

SUGGESTED ANSWERS

TO

QUESTIONS

SET AT THE

INSTITUTE'S EXAMINATIONS

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**PROFESSIONAL EDUCATION
(COURSE - II)**

PAPER – 6 : INFORMATION TECHNOLOGY



**BOARD OF STUDIES
THE INSTITUTE OF CHARTERED ACCOUNTANTS OF INDIA
NOIDA**

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Question 1

Convert the following from one number system to another number system alongwith working notes:

(i)	$(334.625)_{10}$	=	() ₂	(PE – II Nov. 2002)
(ii)	$(1101101.0101)_2$	=	() ₁₀	(PE – II Nov. 2002)
(iii)	$(7523)_8$	=	() ₁₆	(PE – II Nov. 2002)
(iv)	$(15AE)_{16}$	=	() ₁₀	(PE – II Nov. 2002)
(v)	$(238.5)_{10}$	=	() ₈	(PE – II Nov. 2002)
(vi)	$(295.5625)_{10}$	=	() ₂	(PE –II May 2003)
(vii)	$(1011.1011)_2$	=	() ₁₀	(PE –II May 2003)
(viii)	$(592F)_{16}$	=	() ₁₀	(PE –II May 2003)
(ix)	$(436.625)_{10}$	=	() ₈	(PE –II May 2003)
(x)	$(6437)_8$	=	() ₁₆	(PE –II May 2003 & Nov. 2005)
(xi)	$(101101.011)_2$	=	() ₁₀	(PE–II Nov. 2003)
(xii)	$(99.8125)_{10}$	=	() ₂	(PE–II Nov. 2003)
(xiii)	$(B2C)_{16}$	=	() ₁₀	(PE–II Nov. 2003)
(xiv)	$(2E7)_{16}$	=	() ₈	(PE–II Nov. 2003)
(xv)	$(2508)_{10}$	=	() ₈	(PE–II Nov. 2003)
(xvi)	$(246.125)_{10}$	=	() ₂	(PE–II May 2004)
(xvii)	$(101101.1011)_2$	=	() ₁₀	(PE–II May 2004)
(xviii)	$(426.5)_{10}$	=	() ₈	(PE–II May 2004)
(xix)	$(A2B4)_{16}$	=	() ₁₀	(PE–II May 2004)
(xx)	$(7654)_8$	=	() ₁₆	(PE–II May 2004 & Nov 2008)
(xxi)	$(765.625)_{10}$	=	() ₂	(PE–II Nov. 2004)

(xxii)	$(11011010.1101)_2$	=	() ₁₀	(PE–II Nov. 2004)
(xxiii)	$(9876)_{10}$	=	() ₈	(PE–II Nov. 2004)
(xxiv)	$(AD5)_8$	=	() ₁₀	(PE–II Nov. 2004)
(xxv)	$(1267.3125)_{10}$	=	() ₂	(PE–II May 2005)
(xxvi)	$(10110.101)_2$	=	() ₁₀	(PE–II May 2005 & Nov. 2008)
(xxvii)	$(1234)_8$	=	() ₁₆	(PE–II May 2005)
(xxviii)	$(B2C)_{16}$	=	() ₂	(PE–II May 2005)
(xxix)	$(10110111.1)_2$	=	() ₈	(PE–II May 2005)
(xxx)	$(11011101)_2$	=	() ₁₀	(PE–II Nov. 2005)
(xxxi)	$(423.25)_{10}$	=	() ₂	(PE–II Nov. 2005)
(xxxii)	$(CDEF)_{16}$	=	() ₂	(PE–II Nov. 2005)
(xxxiii)	$(11011.11101)_2$	=	() ₁₆	(PE–II Nov. 2005)
(xxxiv)	$(101101.1101)_2$	=	() ₁₀	(PE–II May 2006)
(xxxv)	$(56.57)_8$	=	() ₁₆	(PE–II May 2006)
(xxxvi)	$(36.125)_{10}$	=	() ₂	(PE–II May 2006)
(xxxvii)	$(11001.10)_2$	=	() ₈	(PE–II May 2006)
(xxxviii)	$(426.40)_8$	=	() ₁₀	(PE–II May 2006)
(xxxix)	$(1357)_{10}$	=	() ₂	(PE–II Nov. 2006)
(xl)	$(1463)_{10}$	=	() ₈	(PE–II Nov. 2006)
(xli)	$(101101110)_2$	=	() ₁₆	(PE–II Nov. 2006)
(xlii)	$(573)_8$	=	() ₁₆	(PE–II Nov. 2006)
(xliii)	$(1100100110)_2$	=	() ₈	(PE–II Nov. 2006)
(xliv)	$(3CB . 98)_{16}$	=	() ₂	(PE –II May 2007)
(xlv)	$(AF . 16C)_{16}$ 2007)	=	() ₈	(PE–II May
(xlvi)	$(111.12)_8$ 2007)	=	() ₂	(PE –II May
(xlvii)	$(10101010.101)_2$ 2007)	=	() ₁₀	(PE –II May
(xlviii)	$(123.15)_{10}$ 2007)	=	() ₁₆	(PE –II May
(xlix)	$(2363.75)_{10}$ 2007)	=	() ₁₆	(PE –II Nov.

(I)	$(23D.15)_{16}$ 2007)	=	() ₈	(PE –II Nov.
(II)	$(1E12.12)_{16}$ 2007)	=	() ₂	(PE –II Nov.
(Iii)	$(310.04)_8$ 2007)	=	() ₂	(PE –II Nov.
(Iiii)	$(1111101111.11)_2$ Nov.2007)	=	() ₁₆	(PE –II
(Iiv)	$(65.65)_{10}$ 2008)	=	() ₂	(PE –II May
(Iv)	$(12AE)_{16}$ 2008)	=	() ₁₀	(PE –II May
(Ivi)	$(39.B6)_{16}$ 2008)	=	() ₈	(PE –II May
(Ivii)	$(245)_8$ 2008)	=	() ₁₆	(PE –II May
(Iviii)	$(1011.1101)_2$ 2008)	=	() ₁₀	(PE –II May
(Iix)	$(11.8125)_{10}$ 2008)	=	() ₂	(PE –II Nov.
(Iix)	$(71.554)_3$ 2008)	=	() ₁₆	(PE –II Nov.
(Ixi)	$(ABCD)_{16}$ 2008)	=	() ₁₀	(PE –II Nov.
(Ixii)	$(110101100.01101)_2$ 2008)	=	() ₈	(PE –II Nov.

Answer

(i) $(334.625)_{10} = ()_2$

		Remainder	Fractional Value
2	334	0	
2	167	1	.625 X 2 = 1.25
2	83	1	0.25 X 2 = 0.5
2	41	1	0.5 X 2 = 1.0
2	20	0	
2	10	0	

2	5	1
2	2	0
2	1	1
	0	

$$= (101001110.101)_2$$

$$(ii) \quad (1101101.0101)_2 = (\quad)_{10}$$

$$(1101101.0101)_2 = 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 0 \times 2^{-1} + 1 \times 2^{-2} + 0 \times 2^{-3} + 1 \times 2^{-4}$$

$$= 64 + 32 + 0 + 8 + 4 + 0 + 1 + \frac{1}{4} + 0 + \frac{1}{16}$$

$$= (109.3125)_{10}$$

$$(iii) \quad (7523)_8 = (\quad)_{16}$$

$$(7523)_8 = 111 \quad 101 \quad 010 \quad 011$$

$$= 1111 \quad 0101 \quad 0011$$

$$= (F53)_{16}$$

$$(iv) \quad (15AE)_{16} = (\quad)_{10}$$

$$(15AE)_{16} = 1 \times 16^3 + 5 \times 16^2 + 10 \times 16^1 + 14 \times 16^0$$

$$= 4096 + 1280 + 160 + 14$$

$$= (5550)_{10}$$

$$(v) \quad (238.5)_{10} = (\quad)_8$$

	Remainder
8 238	6
8 29	5
8 3	3
0	

$$0.5 \times 8 = 4.0$$

$$= (356.4)_8$$

$$(vi) \quad (295.5625)_{10} = (\quad)_2$$

$$\begin{array}{r|l} 2 & 295 \quad \text{Remainder} \end{array}$$

2	147	1
2	73	1
2	36	1
2	18	0
2	9	0
2	4	1
2	2	0
2	1	0
	0	1

100100111.1001

.5625	Integral Part
$\times 2$	
0.1250	1
$\times 2$	
0.2500	0
$\times 2$	
0.5000	0
$\times 2$	
0.0000	1

Hence, $(295.5625)_{10} = (100100111.1001)_2$

$$\begin{aligned}
 \text{(vii)} \quad (1011.1011)_2 &= (\quad)_{10} \\
 1011.1011 &= 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} + 1 \times 2^{-4} \\
 &= 8 + 2 + 1 + \frac{1}{2} + \frac{0}{4} + \frac{1}{8} + \frac{1}{16} \\
 &= 11 + 0.5 + 0.125 + 0.0625 \\
 &= 11 + .6875 = 11.6875
 \end{aligned}$$

Hence, $(1011.1011)_2 = (11.6875)_{10}$

$$\begin{aligned}
 \text{(viii)} \quad (592F)_{16} &= (\quad)_{10} \\
 (592F)_{16} &= 5 \times 16^3 + 9 \times 16^2 + 2 \times 16^1 + 15 \times 16^0
 \end{aligned}$$

$$\begin{aligned}
 &= 5 \times 16 \times 256 + 9 \times 256 + 2 \times 16 + 15 \\
 &= 20480 + 2304 + 32 + 15 \\
 &= (22831)_{10}
 \end{aligned}$$

Hence, $(592F)_{16} = (22831)_{10}$

(ix) $(436.625)_{10} = (\quad)_{8}$

8	436	Remainder
8	54	4
8	6	6
0		6

$$= 664$$

$$\begin{aligned}
 &.625 \\
 &\times 8 \\
 &\hline
 &5.000
 \end{aligned}$$

Hence, $(436.625)_{10} = (664.5)_8$

(x) $(6437)_8 = (\quad)_{16}$

To convert the given number from octal to hexadecimal, we will represent each digit of the number by three bit binary number. These binary bits will then be combined in group of four bits adding leading zeros, if required.

$$\begin{aligned}
 (6437)_8 &= (110 \quad 100 \quad 011 \quad 111) \\
 &= (1101 \quad 0001 \quad 1111) \\
 &= (D \quad 1 \quad F)
 \end{aligned}$$

Hence, $(6437)_8 = (D1F)_{16}$

(xi) $(101101.011)_2 = (\quad)_{10}$

$$\begin{aligned}
 (101101.011)_2 &= 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 + 0 \times 2^{-1} \\
 &\quad + 1 \times 2^{-2} + 1 \times 2^{-3} \\
 &= 32 + 0 + 8 + 4 + 0 + 1 + 0 + \frac{1}{4} + \frac{1}{8} = (45.375)_{10}
 \end{aligned}$$

Hence, $(101101.011)_2 = (45.375)_{10}$

(xii) $(99.8125)_{10} = (\quad)_2$

2	99	Remainder
2	49	1
2	24	1
2	12	0

Integral Part	0.8125
	$\times 2$
1	0.625
	$\times 2$

$\uparrow$
 $\downarrow$

2	6	0
2	3	0
2	1	1
	0	1

1	0.25
	$\times 2$
0	0.5
	$\times 2$
1	0

Hence, $(99.8125)_{10} = (1100011.1101)_2$

$$\begin{aligned} \text{(xiii)} \quad (B2C)_{16} &= (\quad)_{10} \\ (B2C)_{16} &= 11 \times 16^2 + 2 \times 16^1 + 12 \times 16^0 \\ &= 11 \times 256 + 2 \times 16 + 12 \times 1 = 2816 + 44 = 2860 \end{aligned}$$

Hence, $(B2C)_{16} = (2860)_{10}$

$$\begin{aligned} \text{(xiv)} \quad (2E7)_{16} &= (\quad)_8 \\ (2E7)_{16} &= \begin{array}{ccc} 2 & E & 7 \\ & 0010 & 1110 & 0111 \end{array} \end{aligned}$$

Rearrange in group of three, adding leading zeros, if required

$$\begin{aligned} &= \begin{array}{ccc} 001 & 011 & 100 & 111 \\ & 1 & 3 & 4 & 7 \end{array} \\ &= \begin{array}{ccc} 1 & 3 & 4 & 7 \end{array} \end{aligned}$$

Hence, $(2E7)_{16} = (1347)_8$

$$\text{(xv)} \quad (2508)_{10} = (\quad)_8$$

8	2508	Remainder
8	313	4
8	39	1
8	4	7
	0	4

Hence, $(2508)_{10} = (4714)_8$

$$\text{(xvi)} \quad (246.125)_{10} = (\quad)_2$$

2	246	Remainder
2	123	0
2	61	1
2	30	1
2	15	0

$$\begin{array}{ll} .125 \times 2 & = 0.250 \\ .25 \times 2 & = 0.50 \\ .5 \times 2 & = 1.0 \end{array}$$

2	7	1
2	3	1
	1	1

Hence, $(246.125)_{10} = (11110110.001)_2$

(xvii) $(101101.1011)_2 = ()_{10}$

$$\begin{aligned}(101101.1011)_2 &= 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} + 1 \times 2^{-3} + 1 \times 2^{-4} \\ &= 32 + 8 + 4 + 1 + .5 + .125 + 0.0625 \\ &= 45.6875\end{aligned}$$

Hence, $(101101.1011)_2 = (45.6875)_{10}$

(xviii) $(426.5)_{10} = ()_8$

8	426	Remainder	$.5 \times 8 = 4.0$
8	53	2	
	6	5	

Hence, $(426.5)_{10} = (652.4)_8$

(xix) $(A2B4)_{16} = ()_{10}$

$$\begin{aligned}(A2B4)_{16} &= 10 \times 16^3 + 2 \times 16^2 + 11 \times 16^1 + 4 \times 16^0 \\ &= 40960 + 512 + 176 + 4 = 41652\end{aligned}$$

Hence, $(A2B4)_{16} = (41652)_{10}$

(xx) $(7654)_8 = ()_{16}$

To convert a number from octal number system to hexadecimal system, each digit of the octal number is represented by its binary equivalent using a group of three bits. These bits are then grouped from right to left by grouping four bits at a time and adding leading zeros if required. Each group of these four bits is then represented by its hexadecimal equivalent.

$$\begin{aligned}(7654)_8 &= 111 \ 110 \ 101 \ 100 \\ &= 1111 \ 1010 \ 1100 \\ &= FAC\end{aligned}$$

Hence, $(7654)_8 = (FAC)_{16}$

(xxi) $(765.625)_{10} = ()_2$

2	765	Remainder
2	382	1
2	191	0

$$\begin{array}{ccc} & \uparrow & \\ 0.625 \times 2 = & 1.250 & \\ 0.250 \times 2 = & 0.50 & \downarrow \end{array}$$

2	95	1	0. 50 x 2=	1.0
2	47	1		
2	23	1		
2	11	1		
2	5	1		
2	2	1		
	1	0		

Thus, $(765.625)_{10} = (1011111101.101)_2$

(xxii) $(11011010.1101)_2 = ()_{10}$

$$\begin{aligned}
 (11011010.1101)_2 &= 1 \times 2^7 + 1 \times 2^6 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^{-2} + 1 \times 2^{-4} \\
 &= 128 + 64 + 16 + 8 + 2 + 0.5 + 0.25 + 0.0625 \\
 &= 218 + 0.8125 = (218.8125)_{10}
 \end{aligned}$$

Thus, $(11011010.1101)_2 = (218.8125)_{10}$

(xxiii) $(9876)_{10} = ()_8$

	9876	Remainder
8	1234	4
8	154	2
8	19	2
	2	3

Thus, $(9876)_{10} = (23224)_8$

(xxiv) $(AD5)_{16} = ()_{10}$

$$\begin{aligned}
 (AD5)_{16} &= A \times 16^2 + D \times 16^1 + 5 \times 16^0 \\
 &= 10 \times 256 + 13 \times 16 + 5 \\
 &= 2560 + 208 + 5 \\
 &= (2773)_{10}
 \end{aligned}$$

Thus, $(AD5)_{16} = (2773)_{10}$

(xxv) $(1267.3125)_{10} = ()_2$

2	1267	Remainder
2	633	1

	0.3125
	×2
0	0.625
	×2
1	0.25
	×2
0	0.50
	×2
1	0

2	316	1
2	158	0
2	79	0
2	39	1
2	19	1
2	9	1
2	4	1
2	2	0
2	1	0
	0	1



Hence $(1267.3125)_{10} = (10011110011.0101)_2$

$$\begin{aligned}
 \text{(xxvi)} \quad (10110.101)_2 &= (\quad)_{10} \\
 (10110.101)_2 &= 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} \\
 &= 16 + 4 + 2 + 0.5 + 0.125 = (22.625)_{10} \\
 \text{Hence, } (10110.101)_2 &= (22.625)_{10}
 \end{aligned}$$

$$\begin{aligned}
 \text{(xxvii)} \quad (1234)_8 &= (\quad)_{16} \\
 (1234)_8 &= 001 \ 010 \ 011 \ 100 \\
 &= \overline{0010} \ \overline{1001} \ \overline{1100} \\
 &= (29C)_{16} \\
 \text{Hence, } (1234)_8 &= (29C)_{16}
 \end{aligned}$$

$$\begin{aligned}
 \text{(xxviii)} \quad (B2C)_{16} &= (\quad)_2 \\
 (B2C)_{16} &= (101100101100)_2
 \end{aligned}$$

$$\text{(xxix)} \quad (10110111.1)_2 = (\quad)_8$$

To convert the given number from binary to octal, we will combine the digit in groups of three adding leading or trailing zeros wherever required.

$$\begin{aligned}
 (10110111.1) &= 010 \ 110 \ 111 \ . \ 100 \\
 &= 2 \ 6 \ 7 \ . \ 4
 \end{aligned}$$

Hence, $(10110111.1)_2 = (267.4)_8$

(xxx) $(11011101)_2 = (\quad)_{10}$
 $(11011101)_2 = 1 \times 2^7 + 1 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$
 $= 128 + 64 + 16 + 8 + 4 + 1$
 $= (221)$

Hence, $(11011101)_2 = (221)_{10}$

(xxxi) $(423.25)_{10} = (\quad)_2$

2	423	Remainder	
2	211	1	.25
2	105	1	$\times 2$
2	52	1	0.50
2	26	0	$\times 2$
2	13	0	1.00
2	6	1	
2	3	0	
2	1	1	
	0	1	

Hence, $(423.25)_{10} = (110100111.01)_2$

(xxxii) $(CDEF)_{16} = (\quad)_2$

To convert the given hexadecimal number to binary, each digit will be represented by a group of four binary bits.

$(CDEF) = (1100 \ 1101 \ 1110 \ 1111)$

Hence, $(CDEF)_{16} = (1100110111101111)_2$

(xxxiii) $(11011.11101)_2 = (\quad)_{16}$

To convert the given number from binary to hexadecimal, we will combine the digits in groups of four, adding leading or trailing zeros wherever required.

$(11011.11101)_2 = (0001 \ 1011 \ 1110 \ 1000)$

$= (1B \cdot E8)$

Hence, $(11011.11101)_2 = (1B \cdot E8)_{16}$

(xxxiv) $(101101.1101)_2 = (\quad)_{10}$

$$\begin{aligned}
 (101101.1101) &= 1 \times 2^5 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} + 1 \times 2^{-4} \\
 &= 32 + 8 + 4 + 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{16} \\
 &= 45 + 0.5 + 0.25 + 0.0625 \\
 &= (45.8125)
 \end{aligned}$$

Hence, $(101101.1101)_2 = (45.8125)_{10}$

(xxxv) $(56.57)_8 = ()_{16}$

$$\begin{aligned}
 (56.57)_8 &= 101 \ 110 \ . \ 101 \ 111 \\
 &= 0010 \ 1110 \ . \ 1011 \ 1100 \\
 &= 2 \ \ \ \ \text{E} \ \ \ \ \ . \ \ \ \ \text{B} \ \ \ \ \text{C}
 \end{aligned}$$

Hence, $(56.57)_8 = (2\text{E} \ . \ \text{BC})_{16}$

(xxxi) $(36.125)_{10} = ()_2$

2	36	Remainder	.125
2	18	0	<u>$\times 2$</u>
2	9	0	0.250
2	4	1	<u>$\times 2$</u>
2	2	0	0.500
2	1	0	<u>$\times 2$</u>
	0	1	1.000

Hence $(36.125)_{10} = (100100.001)_2$

(xxvii) $(11001.10)_2 = ()_8$

$$\begin{aligned}
 (11001.10)_2 &= 011 \ 001 \ . \ 100 \\
 &= 3 \ \ \ \ 1 \ \ \ \ 4
 \end{aligned}$$

Hence, $(11001.10)_2 = (31.4)_8$

(xxviii) $(426.40)_8 = ()_{10}$

8	426	Remainder	0.40
8	53	2	<u>$\times 8$</u>
8	6	5	<u>5.00</u>

0	6
---	---

Hence, $(426.40)_8 = (652.5)_{10}$

(xxxix) $(1357)_{10} = ()_2$

2	1357	Remainder
2	678	1
2	339	0
2	169	1
2	84	1
2	42	0
2	21	0
2	10	1
2	5	0
2	2	1
2	1	0
	0	1



Hence $(1357)_{10} = (10101001101)_2$

(xli) $(1463)_{10} = ()_8$

8	1463	Remainder
8	182	7
8	22	6
8	2	6
2	0	2



Hence, $(1463)_{10} = (2667)_8$

(xlii) $(101101110)_2 = ()_{16}$

To convert the given number from binary to hexadecimal number, we will combine the digits in groups of four, adding leading zeros if required.

$(101101110) = 0001 \ 0110 \ 1110$

$$= 1 \quad 6 \quad E$$

Hence, $(101101110)_2 = (16E)_{16}$

$$\begin{aligned} \text{(xlii)} \quad (573)_8 &= (\quad)_{16} \\ (573) &= 101 \quad 111 \quad 011 \\ &= 0001 \quad 0111 \quad 1011 \\ &\quad 1 \quad 7 \quad B \end{aligned}$$

Hence, $(573)_8 = (17B)_{16}$

$$\text{(xliii)} \quad (1100100110)_2 = (\quad)_8$$

To convert the given number from binary to octal, we will combine the digits in groups of three, adding leading zeros if required.

$$\begin{aligned} (1100100110) &= 001 \quad 100 \quad 100 \quad 110 \\ &= 1 \quad 4 \quad 4 \quad 6 \end{aligned}$$

Hence, $(1100100110)_2 = (1446)_8$

$$\text{(xliv)} \quad (3 \text{ CB.98})_{16} = (\quad)_2$$

To convert the given number from Hexadecimal Number System to Binary Number System, each digit of the number will be represented in Binary form using a group of four bits. Adding or removing leading zeros if required.

$$(3 \text{ CB.98})_{16} = 0011 \quad 1100 \quad 1011 \quad 1001 \quad 1000$$

Hence, $(3 \text{ CB.98})_{16} = (11 \quad 11001011.10011000)_2$

$$\text{(xlv)} \quad (\text{AF.16 C})_{16} = (\quad)_8$$

To convert the given number from Hexadecimal Number System to Octal Number System, each digit of the number will be represented in Binary form using a group of three bits. Adding or removing leading zeros if required.

$$\begin{aligned} (\text{AF.16 C}) &= 1010 \quad 1111 \quad 0001 \quad 0110 \quad 1100 \\ &= 010 \quad 101 \quad 111 \quad 000 \quad 101 \quad 101 \quad 100 \\ &= 2 \quad 5 \quad 7 \quad 0 \quad 5 \quad 5 \quad 4 \end{aligned}$$

Hence, $(\text{AF.16 C})_{16} = (257.0554)_8$

$$\text{(xlv)} \quad (111.12)_8 = (\quad)_2$$

To convert the given number from Octal Number System to Binary Number System, each digit of the number will be represented in Binary form using a group of three bits. Adding or removing leading zeros if required.

$$(111.12) = 001 \quad 001 \quad 001 \quad 001 \quad 010$$

$$\text{Hence, } (111.12)_8 = (1001001.00101)_2$$

(xlvii) $(10101010.101)_2 = (\quad)_{10}$

$$= 2^7 \times 1 + 2^6 \times 0 + 2^5 \times 1 + 2^4 \times 0 + 2^3 \times 1 + 2^2 \times 0 + 2^1 \times 1 + 2^0 \times 0 + 2^{-1} \times 1 + 2^{-2} \times 0 + 2^{-3} \times 1$$

$$= 128 + 0 + 32 + 0 + 8 + 0 + 2 + 0 + \frac{1}{2} + \frac{0}{4} + \frac{1}{8}$$

$$\text{Hence, } (10101010.101)_2 = (170.625)_{10}$$

(xlviii) $(123.15)_{10} = (\quad)_{16}$

Step I

16	123	Remainder	
16	7	11	= B
	0	7	= 7

Step II

$$.15 \times 16 = 2.40 \rightarrow 2$$

$$.40 \times 16 = 6.40 \rightarrow 6$$

Hence,

$$(123.15)_{10} = (7B.26)_{16}$$

(xlix) $(2363.75)_{10} = (\quad)_{16}$

16	2363	Remainder
16	147	11= B
16	9	3
	0	9

$$= 93 \text{ B}$$

$$.75$$

$$\times 16$$

$$12.00 = C$$

$$\text{Hence, } (2363.75)_{10} = (93 \text{ B} . C)_{16}$$

(l) $(23 \text{ D} . 15)_{16} = (\quad)_8$

To convert the given number from hexadecimal number system to octal number system, each digit of the number will be represented in octal form.

$$\begin{aligned}(23D.15)_{16} &= 0010 \ 0011 \ 1101 \ . \ 0001 \ 0101 \\ &= 001 \ 000 \ 111 \ 101 \ 000 \ 101 \ 010 \\ &= 1 \ 0 \ 7 \ 5 \ . \ 0 \ 5 \ 2\end{aligned}$$

$$\text{Hence, } (23D.15)_{16} = (1075.052)_8$$

$$\text{(ii) } (1 \ E12.12)_{16} = (\quad)_2$$

To convert the given number from Hexadecimal number system to Binary number system, each digit of the number will be represented in binary form.

$$= 0001 \ 1110 \ 0001 \ 0010 \ . \ 0001 \ 0010$$

$$\text{Hence, } (1E \ 12 \ .12)_{16} = (0001111000010010.0001001)_2$$

$$\text{(iii) } (310.04)_8 = (\quad)_2$$

To convert the given number from Octal number system to Binary number system, each digit of the number will be represented in binary form.

$$= 011 \ 001 \ 000 \ . \ 000 \ 100_2$$

$$(310.04)_8 = (11001000.0001)_2$$

$$\text{(liii) } (111110 \ 1111 \ . \ 1100)_2 = (\quad)_{16}$$

To convert the given number from Binary number system to Hexadecimal number system, each digit of the number will be represented in binary form using a group of 4 digits.

$$= 0011 \ 1110 \ 1111 \ . \ 1100$$

$$= 3 \ E \ F \ . \ C$$

$$(1111101111 \ . \ 1100)_2 = (3EF.C)_{16}$$

$$\text{(liv) } (65.65)_{10} = (\dots\dots\dots)_2$$

For the Integral Part

=

2	65	
2	32	1
2	16	0
2	8	0
2	4	0
2	2	0
2	1	0
	0	1

$$= (1000001)_2$$

Now, for the Fractional Part

$$\begin{aligned}
 &= 0.65 \times 2 = \underline{1}.30 \\
 &\quad 0.30 \times 2 = \underline{0}.60p \\
 &\quad 0.60 \times 2 = \underline{1}.20 \\
 &\quad 0.20 \times 2 = \underline{0}.40 \\
 &\quad 0.40 \times 2 = \underline{0}.80 \\
 &\quad 0.80 \times 2 = \underline{1}.60 \\
 &\quad 0.60 \times 2 = 1.20 \text{ (Repeat)} \\
 &= (101001\dots)_2
 \end{aligned}$$

So, the complete Binary form of $(65.65)_{10}$ is as follows:

$$(65.65)_{10} = (1000001.101001\dots)_2$$

$$\begin{aligned}
 \text{(iv)} \quad (12AE)_{16} &= (\dots\dots\dots)_{10} \\
 &= 1 \times 16^3 + 2 \times 16^2 + 10 \times 16^1 + 14 \times 16^0 \\
 &= 1 \times 4096 + 2 \times 256 + 10 \times 16 + 14 \times 1 \\
 &= 4096 + 512 + 160 + 14 \\
 &= (4782)_{10}
 \end{aligned}$$

$$\text{(vi)} \quad (39.B6)_{16} = (\dots\dots\dots)_8$$

To convert the given number from Hexadecimal number system to Octal number system, each digit of the number will be represented in Binary form using a group of four bits

$$= \quad 0011 \quad \quad 1001 \quad \quad .1011 \quad 0110$$

Now we need to regroup each 4-bit Binary form into 3-bit Binary form as follows:-

$$\begin{array}{ccccccc}
 & = & 000 & & 111 & & 001 & & .101 \\
 101 & & 100 & & & & & & \\
 & & 0 & & 7 & & 1 & & .5 \\
 5 & & 4 & & & & & & \\
 & & & & & & & & (71.554)_8
 \end{array}$$

$$\text{Hence, } (39.B6)_{16} = (71.554)_8$$

$$\text{(lvii)} \quad (245)_8 = (\dots\dots\dots)_{16}$$

To convert the given number from Octal number system to Hexadecimal number system, each digit of the number will be represented in Binary form using a group of

three bits.

$$= \quad 010 \quad 100 \quad 101$$

Now we need to regroup each 3-bit Binary form into 4-bit Binary form as follows:-

$$\begin{aligned} &= \quad 0000 \quad \quad 1010 \quad \quad 0101 \\ &= \quad 0 \quad \quad A \quad \quad 5 \\ &= \quad (A5)_{16} \end{aligned}$$

$$\text{Hence, } (245)_8 = (A5)_{16}$$

$$\begin{aligned} \text{(lviii)} \quad (1011.1101)_2 &= \quad (\dots\dots\dots)_{10} \\ &= 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} + 0 \times 2^{-3} + 1 \times 2^{-4} \\ &= 1 \times 8 + 0 \times 4 + 1 \times 2 + 1 \times 1 + 1 \times 0.5 + 1 \times 0.25 + 0 \times 0.125 + 1 \times 0.0625 \\ &= 8 + 0 + 2 + 1 + 0.5 + 0.25 + 0 + 0.0625 \\ &= (11.8125)_{10} \end{aligned}$$

$$\text{Hence, } (1011.1101)_2 = (11.8125)_{10}$$

$$\text{(lix)} \quad (11.8125)_{10} = \quad (\dots\dots\dots)_2$$

For the Integral Part

2	11	
2	5	1
2	2	1
2	1	0
	0	1

$$= \quad (1011)_2$$

Now, for the Fractional Part

$$\begin{aligned} &= \quad 0.8125 \times 2 = 1.625 \\ &\quad 0.625 \times 2 = 1.25 \\ &\quad 0.25 \times 2 = 0.5 \\ &\quad 0.5 \times 2 = 1 \\ &= \quad (1101)_2 \end{aligned}$$

So, the complete binary form of $(11.8125)_{10}$ is as follows:

$$(11.8125)_{10} = \quad (1011.1101)_2$$

$$(ix) (71.554)_8 = (\dots\dots\dots)_{16}$$

To convert the given number from Octal number system to Hexademical number system, each digit of the number will be represented in Binary form using a group of three bits.

$$= \quad 111 \quad 001 \quad .101 \quad 101 \quad 100$$

Now we need to regroup each 3-bit Binary form into 4-bit Binary form as follows:-

$$= \quad 0011 \quad 1001 \quad .101101100000$$

$$= \quad 0011 \quad 1001.1011 \quad 0110 \quad 0000$$

$$= \quad 3 \quad 9 \quad .B \quad 6 \quad 0$$

$$= \quad (39.B6)_{16}$$

$$(Ixi) (ABCD)_{16} = (\dots\dots\dots)_{10}$$

$$= \quad 10 \times 16^3 + 11 \times 16^2 + 12 \times 16^1 + 13 \times 16^0$$

$$= \quad 10 \times 4096 + 11 \times 256 + 12 \times 16 + 13 \times 1$$

$$= \quad 40960 + 2816 + 192 + 13$$

$$= \quad (43981)_{10}$$

$$\text{Hence } (ABCD)_{16} = (43981)_{10}$$

$$(Ixi) (110101100.01101)_2 = (\dots\dots\dots)_8$$

To convert the given number from Binary number system to Octal number system, the digits of the number will be grouped into sets of 3 bits.

$$= \quad 110 \quad 101 \quad 100 \quad .011 \quad 010$$

$$= \quad 6 \quad 5 \quad 4 \quad .3 \quad 2$$

$$\text{Hence } (110101100.01101)_2 = (654.32)_8$$

Question 2

Discuss briefly the following term with reference to Information Technology:

(i) ASCII Code (PE- II May 2004)

(ii) Stored Program Concept (PE- II Nov 2006)

(iii) Toggle (PE- II Nov 2006)

(iv) Parity bit (PE- II May 2005)

Answer

- (i) **ASCII Code** – It stands for American standard code for information interchange. It is used to represent data in main memory of computer. It uses the right most seven bits of the 8 bits to represent numbers, letters and special characters.
- (ii) **Stored program concept:** Computers can perform variety of mathematical calculations without error. They can sort data, merge lists, search files, make logical decisions and comparisons. However, computer is devoid of any original thinking. It is provided with a set of instructions. These instructions are stored in primary memory and executed under the command of the control unit of CPU. This is known as stored program concept.
- (iii) **Toggle:** It is a switch or control code that turns an event on or off by repeated action or use. It also means to turn something on or off by repeating the same action.
- (iv) **Parity bit:** It is an additional redundant bit that is used to provide a check on the integrity of a data representation. It helps in detecting any errors that may occur while transmitting a binary data.

Question 3

Give one or two reasons for the following:

- (i) *The presence of parity bit in the Coding system* (PE- II Nov. 2002)
- (ii) *Need of Reference files* (PE- II May 2005)
- (iii) *Parity bit* (PE- II Nov. 2008)

Answer

- (i) **The presence of parity bit in the Coding system** – The parity bit is an additional or redundant bit that is used to provide a check on the integrity of a data representation. It is used as even or odd parity check.
- (ii) **Need of reference file** – These files contain keys of records in other files. In order to retrieve a record from a file, the reference file is first searched to find out in which file a record can be located.
- (iii) **Parity bit:** A bit appended to an array of bits to make the sum of all the 1-bit in the array either always even (even parity) or always odd (odd parity). It is a check that tests whether the number of 1-bits in an array is either even or odd. The parity bit is an additional bit appended to an array of bits to provide a check on the integrity of a data representation. It helps in detecting transmission errors.

Question 4

Write true or false for each of the following:

- (i) *The WINDOWS 95/98 is based on 16 bit architecture.* (PE- II May 2003)
- (ii) *One MB represents 1000KB.* (PE- II May 2004)
- (iii) *A dumb terminal has an inbuilt processing capability.* (PE- II Nov. 2004)

- (iv) Digital computer process data input in a continuous form (PE- II Nov. 2005)
 (v) One GB represents 10,48,567 bytes. (PE- II May 2007)
 (vi) Binary equivalent of a terminating decimal fraction need not be terminating. (PE- II May 2008)

Answer

- | | | |
|------------|------------|-------------|
| (i) False | (ii) False | (iii) False |
| (iv) False | (v) False | (vi) True |

Question 5.

Distinguish between the following:

- (i) Third generation and Fourth generation languages (PE-II May 2005)
 (ii) Fixed length field and Variable length field (with reference to database). (PE-II May 2005)
 (iii) Hardware and software (PE-II May 2006)
 (iv) Analog computer and Digital computer (PE-II Nov. 2006)

Answer

(i) Third Generation and Fourth Generation Languages

Third Generation Languages are called procedural languages and they are procedure oriented. They employ plain English like and mathematical expressions. They are intended for professional programmers, and require specification of how to perform task. Programmes written in third generation languages are also difficult to debug and usually translated through compiler. Code is difficult to learn, understand and maintain. These languages were originally developed for batch operations and are typically file oriented. FORTRAN, COBOL etc. are examples of third generation languages.

Fourth Generation Languages(4GLs), on the other hand, can be used by both programmers and non-programmers. 4GL uses English like instructions, has limited mathematical manipulation capability. It offers automatic report formatting, sequencing and record selection by user given criteria. However, 4GLs are less efficient than third generation languages. They require specification of what task to perform and the system determines how to perform that task. 4GL requires fewer instructions, code is easy to maintain and understand. Many features of 4GLs can be learned quickly. 4GLs are more structured and are data base oriented. Generally, these are available in two types (i) Production Oriented and (ii) User Oriented.

(ii) Fixed Length Fields and Variable Length Fields

Under **Fixed Length Fields** scheme, fields are simply placed in sequence one after another. Thus, while designing physical records, it conserves storage space. In this scheme, a trailing blank pad character field and leading zero pad numeric field is used. Hence, under fixed length field scheme we know the exact location within a file for each of the fields of a physical record.

Variable Length Fields scheme makes the location of a particular field and a particular record irregular. That is, depending on which records exist and the precise values for fields, different records and fields will be in different locations. A common way to handle variable length field is to break the relation into a fixed length physical records containing all fixed length fields and one or more variable length physical records. In personal computers, this is how many DBMS handle a memo field which is a variable-length field.

(iii) Hardware and Software

Hardware	Software
Physical components of a computer system are called hardware.	Collection of programs designed for specific needs is called software.
Input devices, processing unit, output devices and auxiliary storage devices are different categories of hardware.	Software can be divided into three types - application software, system software and general-purpose software.
Keyboard, mouse, printer, CPU, RAM are example of hardware	Financial Accounting software, operating system, MS-WORD etc. are examples of software.
Hardware is manufactured/assembled by hardware manufacturing companies/ hardware vendors. Hardware is independent of software.	Software is developed by software development firms. Software cannot be developed/used without hardware i.e. software is dependent on hardware.
Hardware repair requires hardware engineer.	Software development/modification requires software professionals like application programmer and system programmer.
It is bulky and requires more storage space.	Software can be copied on CD/DVD, which is lightweight and transportable.
Hardware is supported by uninterrupted power supply (UPS).	Software operation requires requisite hardware.
Hardware can be assembled, Indian branded or of MNC brand.	Software can be licensed or pirated.

(iv) Analog computers and Digital computers: Analog computers process data input in a continuous form. Data such as voltage, resistance or temperature and pressure etc. are represented in a computer as a continuous, unbroken flow of information. In engineering and scientific applications where quantities to be processed exist in wave forms or continually rising and falling voltages, pressure and so on, analog computers are very useful.

Digital computers, on the other hand, count and accept letters or numbers through various input devices that convert the data into electric pulses, and perform arithmetic operations on numbers in discrete form. In addition to performing arithmetic operations, they are also capable of storing data for processing, performing logical operations, editing or deleting the input data and printing out the result of its processed routine at high speed.

Question 1

Describe briefly, the following terms with reference to Information Technology:

- (i) *Intelligent terminal* (PE – II Nov. 2002)
- (ii) *BIOS* (PE – II May 2003 & Nov. 2007)
- (iii) *Stored Program Concept* (PE – II Nov. 2003)
- (iv) *Accumulator* (PE – II May 2004)
- (v) *CMOS* (PE – II Nov. 2004)
- (vi) *PCI slots* (PE – II Nov. 2005)
- (vii) *Cursor* (PE – II Nov. 2005)
- (viii) *Flash Memory* (PE – II May 2008)
- (ix) *Clock Speed* (PE – II May 2008)
- (x) *Parallel Ports* (PE – II Nov. 2008)

Answer

- (i) **Intelligent Terminal:** It has an in-built processing capability. It is also user-programmable. In addition to the storage areas, it has a microprocessor, which can be programmed to communicate with and instruct the user who is entering data.
- (ii) **BIOS:** BIOS stands for Basic Input Output system. It is a small chip on the motherboard that includes start up code, the set up program and also loads the hardware settings required to operate various devices like keyboard, monitor, disk drives, etc.
- (iii) **Stored Program Concept:** Computers can perform variety of mathematical calculations millions of times without error. They can sort data, merge lists, search files, make logical decisions and comparisons. However, computer is devoid of any original thinking. Hence, computer is provided with set of instructions. These instructions are stored in primary memory and executed under the command of the control unit of CPU. This is known as 'Stored Program Concept'.

- (iv) **Accumulator:** It refers to a storage area in memory used to accumulate totals of units or of amounts being computed.
- (v) **CMOS (Complementary Metal Oxide Semiconductor) :** Personal computer uses the CMOS memory to store the date, time and system setup parameters. These parameters are loaded every time the computer is started. It is powered by lithium ion battery.
- (vi) **PCI slots:** The PCI (Peripheral Component Interface) slots are used for connecting PCI based devices like sound cards, internal modems and graphics accelerator cards.
- (vii) **Cursor:** A symbol that marks the current position of the mouse on the screen or the point of entry of data is referred to as cursor.
- (viii) **Flash Memory:** Flash Memory is a memory in which the data is recorded permanently and is not wiped out when the power is turned off. Flash memory devices are very fast because they do not have any moving part.
- (ix) **Clock Speed:** Clock Speed is the speed at which the processor executes instructions. It is measured in megahertz (MHz) which is equal to million cycles per second. Higher the clock speed, faster will be the processor and better will be the system's performance.
- (x) **Parallel Ports:** They let the user connect external input / output devices like scanners or printers and provide interface with the computer. The physical interfaces for the ports are located on the outside of the computer, but they are directly or indirectly connected to the motherboard. These ports facilitate the parallel transmission of data, usually one byte at a time. Parallel ports use 25 pin RS232C.

Question 2

Give one or two reasons for each of the following:

- (i) Cache memory in a processor (PE – II May 2003)
- (ii) Use of RS-232C port (PE – II Nov. 2003)
- (iii) Use of USB connectors (PE – II May 2004 & May 2007)
- (iv) Use of Video RAM (PE – II May 2004 & Nov. 2007)
- (v) Use of cache memory (PE – II Nov. 2004)
- (vi) Use of Parallel Ports (PE – II Nov. 2004 & Nov. 2006)
- (vii) Use of cache memory in a processor (PE – II May 2006)
- (viii) Use of RS-232C port (PE – II May 2006)
- (ix) Use of BOIS (PE – II Nov. 2006)
- (x) CMOS (PE – II Nov. 2008)
- (xi) Data Bus (PE – II Nov. 2008)

Answer

- (i) **Cache Memory in a Processor:** Processors incorporate their own internal memory called cache. The cache acts as temporary memory and boosts processing power

significantly. The cache that comes with the processor is called level one or L1 cache. It runs at the processor's clock speed, and therefore is very fast.

- (ii) **Use of RS-232C port:** RS-232C port is a standard parallel port on micro computers that is used to connect external input/ output devices like scanner or printer. It facilitates the parallel transmission of data.
- (iii) **Use of USB connectors:** USB standards for universal serial Bus. These ports provide the user with higher data transfer speeds for different USB devices like keyboards, mouse, scanners or digital cameras.
- (iv) **Use of Video RAM –** Video RAM (VRAM) is used to accelerate the display of graphics on the screen. It does this by using two ports one connected to the CPU and other to the screen. Data flows in one port and get out of the other very smoothly.
- (v) **Use of Cache Memory :** The Cache memory acts as a temporary memory and boosts processing power significantly. The cache that comes with the processor is called level one (L1) cache. This cache runs at the processor's clock speeds, and therefore, is very fast. The L1 cache is divided into two sections-one for data, and other for instructions.
- (vi) **Use of Parallel Ports:** Parallel ports are used to connect external input/output devices like scanners or printers. Parallel ports facilitate the parallel transmission of data, usually one byte at a time. Parallel ports use 25 pin RS 232C.
- (vii) **Use of cache memory in a processor:** Processors incorporate their own internal memory called cache. The cache acts as a temporary memory and boosts the processing power significantly. The cache that comes with the processor is called L1 cache. It runs at the processor's clock speed, and therefore is very fast.
- (viii) **Use of RS-232C port:** It is a parallel port that is used to connect external input/output devices like scanner or printer. It facilitates the parallel transmission of data.
- (ix) **Use of BIOS:** BIOS stands for Basic Input Output System. It is a small chip on the motherboard that loads the hardware settings required to load various devices like keyboard, monitor or disk drives. Most new PCs come with flash BIOS – these BIOS can be software upgraded to support new devices.
- (x) **CMOS:** The PC uses the CMOS (Complementary Metal Oxide Semiconductor) memory to store the date, time and system setup parameters. These parameters are loaded every time the computer is started. A small lithium ion battery located on the motherboard powers the CMOS.
- (xi) **Data Bus:** The Data Bus is an electrical path that connects the CPU, memory, and other hardware devices on the motherboard. Actually, the bus is a group of parallel wires which carries data on high speed. More the number of wires, more the data speed.

Question 3

Write True or False for each of the following:

- (i) Cache memory acts as temporary memory and boosts processing power significantly.

- (PE – II May 2004)
- (ii) The clock speed is the speed at which the processor executes instruction. (PE – II Nov. 2004)
- (iii) Flash memory chips are one form of static RAM chip. (PE – II May 2005)
- (iv) A Personnel Computer based on the Intel 80386 chipset has 32 bit processor. (PE – II May 2005)
- (v) Microcomputers are based on RISC architecture. (PE – II Nov. 2005)
- (vi) Flash memory uses solid-state chips to store data and the data stays recorded only when the power supply is turned on. (PE – II May 2006)
- (vii) The Address BUS is a set of wires that connects the CPU and RAM and carries the memory address. (PE – II Nov. 2006)
- (viii) Bubble Memory is a volatile memory. (PE – II Nov 2007)
- (ix) Contents of PROM can be erased by ultra – violet rays. (PE – II Nov 2007)
- (x) The largest number a computer can store depends on its 'WORD LENGTH'. (PE – II May 2008)
- (xi) Bubble memory can be used for auxiliary storage. (PE – II Nov 2008)

Answer

- (i) True (ii) True (iii) True
- (iv) True (v) False (vi) False
- (vii) True (viii) False (ix) True
- (x) True (xi) False

Question 4

Distinguish between the following:

- (i) Dynamic RAM and Static RAM (PE – II Nov. 2002)
- (ii) Virtual memory and Main memory. (PE – II May 2003)
- (iii) Data Bus and Address Bus (PE – II Nov. 2003)
- (iv) Workstation and Micro -computer (PE – II Nov. 2003)
- (v) PROM and EPROM (PE – II Nov. 2003)
- (vi) Control unit and Arithmetic logic unit (PE – II May 2004 & May 2008)
- (vii) Semi-conductor memory and Bubble memory (PE – II Nov. 2004)

(viii) RAM and ROM

(PE – II May 2005)

(ix) Cache memory and ROM

(PE – II Nov. 2006)

Answer

- (i) **Dynamic RAM and Static RAM** : The memory system constructed with MOS elements that can be changed is called RAM. The purpose of RAM is to hold programs and data while they are in use.

Dynamic RAM is the most common type of main memory. It is dynamic because each memory cell loses its charge so it must be refreshed hundreds of times each second to prevent data from being lost. The most popular DRAM used in desktop systems are Extended Data Out DRAM, Synchronous DRAM and Rambus DRAM. RDRAM sends data down at high-band width channel.

Static RAM, on the other hand, is a lot faster, larger and more expensive. It is static because it need not be continually refreshed. Because of its speed it is mainly used in cache memory.

The static RAM retains the stored data as long as power remains on, whereas in dynamic RAM the stored information is to be recharged before it disappears. The power consumption of dynamic RAM is less than static RAM. In DRAM, the computer does the refreshing process taking time out from other chores every millisecond. Dynamic RAM is the most common type of main memory whereas static RAM is faster, larger and more expensive than DRAM. Static RAM is used mainly in a special area of memory called a cache.

- (ii) **Virtual Memory and Main Memory**: Main memory is a part of the computer hardware, which stores programs, and data that are in active use. Storage locations in main memory are addressed directly by CPU's load and store instructions. Access is slower from main memory than from CPU registers because of large capacity and the fact that it is physically separated from the CPU.

Virtual memory, on the other hand, is a technique that allows the execution of a process, even though the logical address space requirement of the process is greater than the physical available main memory. The technique works by dividing a program on disk into fixed length pages or into logical, variable length segments. Virtual memory thus extends primary memory by treating disk storage as a logical extension of the main memory.

Virtual memory helps in efficient main memory utilization. The programs can be loaded partially in the main memory, so more programs can be run at the same time. Hence, efficient CPU utilization and better throughput is possible by using the concept of virtual memory. Virtual memory makes the task of programming much easier, because the programmer no longer needs to worry about the amount of physical or main memory available.

- (iii) **Data Bus and Address Bus**: **Data Bus** is an electric path or group of parallel wires that connects CPU, memory and other hardware devices on the motherboard for the purpose

of transmission of data. **Address bus**, on the other hand, is a set of wires that connects CPU and RAM and carries the addresses of the memory locations from where data can be retrieved or stored. Number of wires in the bus affects the speed at which data can travel between hardware components. On the data bus, each wire can transfer one bit at a time. Eightwire buses can transfer eight bits simultaneously. Similarly, 16-bit bus can transmit two bytes simultaneously.

Data bus is designed to match the capabilities of the devices attached to it. If a CPU could send and receive only one byte of data at a time, there is no need to connect the CPU to a bus that could transfer more than 8 bits of data at a time. Presently 64-bit data bus is being used for transfer of data from 64-bit CPU.

Number of parallel wires in the address bus determines the maximum number of memory locations the CPU can address. For example, with an eight-bit address bus, CPU can address maximum 256 memory locations. Today CPUs have 32-bit address bus that can address 4×10^9 memory locations.

- (iv) **Workstation and Micro-computer:** A **microcomputer** is a full-fledged computer system that uses a microprocessor as its CPU. These are also called personal computers. Between minicomputer and microcomputer, in terms of processing power, there is a class of computers known as workstation. It looks like a personal computer and is typically used by one person.

Workstations differ significantly from microcomputers in two areas. Internally, workstations are constructed differently than microcomputers. They are based on different architecture of CPU called Reduced Instruction Set Computing (RISC) which results in faster processing of instructions compared to microprocessor based personal computers. Workstations are generally used by scientists and engineers.

Another difference is that most microcomputers can run on DOS, Windows and Windows NT operating system whereas workstations generally run on the Unix operating system or a variation of it.

Although workstations are still more powerful than the average personal computer, the difference in the capabilities of these types of machines are growing smaller.

- (v) **PROM and EPROM: Programmable Read Only Memory (PROM)** is one sort of Read Only Memory which can be programmed as per user requirements. It is non-volatile and allows the user to program the memory chip with a PROM writer. The chip can be programmed only once, thereafter, the contents of the program stored on it can not be altered.

EPROM, on the other hand, stands for Erasable Programmable Read Only Memory. EPROM chip can be electrically programmed with EPROM programmer. Unlike ROM and PROM, EPROM chips can be erased and reprogrammed by the user number of times. Exposing the EPROM chip to ultra violet light erases contents of the EPROM. Due to this facility, EPROM are mostly used for R & D applications.

- (vi) **Control unit and Arithmetic logic unit: Control Unit** supervises the entire operation of

the computer system. It selects the program statements from the storage unit, interprets the statement and sends the appropriate electronic impulses to the ALU and storage unit to cause these units to carry out the operations required. Thus control unit does not perform the actual processing operations on data. Rather, its function is to maintain order and direct the flow of sequence of operations and data within the computer. Control unit also instructs the input devices, when to start and stop transferring data to storage unit and tells the storage unit when to start and stop transferring data to output devices. Hence, it acts as a central nervous system for component parts of the computer.

On the other hand, **Arithmetic Logic Unit** actually performs mathematical calculations, compares numeric and non-numeric values and makes decisions. Data flows between ALU and the storage unit during processing. Specifically, data is transferred as needed from the storage unit to the ALU, manipulated and returned to the storage unit.

(vii) **Semi-conductor memory and Bubble memory:** It is made up of very thin silicon chip which contains a number of small storage cells that can hold data. Instead of being made up of a series of discrete components, these units are constructed as integrated circuits, meaning that a number of transistors are integrated or combined together on a thin silicon wafer to form a complete set of circuits. The faster and more expensive bipolar semi conductor chips are often used in the ALU and high speed buffer storage sections of the CPU, while the slower and less expensive chips that employ metal-oxide semi-conductor technology are used in the main memory section.

On the other hand, **bubble memory** is composed of small magnetic domains formed on a thin single-crystal film of synthetic garnet. These magnetic bubbles, which are actually magnetically charged cylinders, only a few thousandths of a centimeter in size, can be moved across the garnet film by electric charges. The presence or absence of a bubble can be used to indicate whether a bit is 'on' or 'off'. Since data stored in bubble memory is retained when power to the memory is turned off, it can be used for auxiliary storage. Bubble memory has high potential because of its low production costs and its direct access capabilities, thus it may become widely employed as main memory technology. Since it is small, lightweight, and does not use very much power, bubble memory is finding a great deal of use as an auxiliary storage in portable computers.

(viii) **RAM and ROM:** RAM or random access memory is the memory system constructed with metal oxide semi conductor storage elements that can be charged. The purpose of RAM is to hold programs and data while they are in use. It is independent of the address of the word. It is fast but can be quite expensive. ROM or Read only Memory is used for micro programs not available to normal programmers. ROM refers to a storage that cannot be altered by regular program instructions. The information is stored permanently in such memory during manufacture. The information from the memory may be read but fresh information cannot be written into it. ROM BIOS is one such example.

RAM can be further divided according to ways in which the data is stored viz. dynamic RAM and Static RAM. In dynamic RAM, each memory cell quickly loses its charge so it must be refreshed hundred of times each second. Static RAM is larger, faster and more expensive. It is static because it does not require to be continually refreshed. Because of its speed, it is mainly used in cache memory.

ROM on other hand is available in the following three forms:

- PROM - Programmable read only Memory
- EPROM - Erasable Programmable read only memory
- EEPROM – Electrically Erasable Programmable Read Only Memory.

(ix) **Cache Memory and ROM:** Cache memory refers to internal memory on the processor. It is a temporary memory and is used to boost the processing power of the computer significantly. On the other hand, ROM or Read-only memory is used for Micro programs not available to normal users. The term read-only means that the storage cannot be altered by regular program instructions. The information is stored permanently in such memory at the time of manufacturing. One set of instructions found in ROM is called ROM – BIOS which stands for Read-only Memory Basic Input Output system. It is used for performing the basic control and supervisory operations of the computer.

There are two types of cache memory. The cache that comes with the processor is called Level One (L1) cache. This cache runs at the processor's clock speed, and therefore is very fast. The cache is divided into 2 sections – one for data, the other for instructions. Generally, more the L1 cache, faster the processor. Additionally, PCs also include a much slower secondary, or Level Two (L2) cache. This cache resides on the motherboard and delivers slower performance when compared with the L1 cache.

On the other hand, there are various types of ROM available. **PROM** or Programmable Read Only Memory is a non-volatile memory, which allows the user to program the chip with a PROM writer. The chip can be programmed once, thereafter, it cannot be altered.

EPROM or Erasable Programmable Read Only Memory can be electrically programmed. Unlike ROM and PROM chips, EPROM chips can be erased and reprogrammed. Exposing the chip to Ultra-violet light performs erasure.

In **EEPROM** or Electricity Erasable Programmable Read Only Memory, data can be erased by applying electrical charges.

Question 5

Write short note on Virtual Memory.

(PE – II Nov. 2007)

Answer

Virtual Memory : Programmer writes the program with the illusion that there is infinite main memory but main memory is always limited in size. Therefore, when the size of a program exceeds the size of available RAM, then the entire program is stored in secondary memory. Operating system divides the program into number of equal parts, known as pages. Main memory is also considered to be divided into no. of parts having same size as that of page, known as Blocks. Those pages which can be accommodated in available blocks are shifted from secondary memory to main memory and execution starts. When a page which is currently not in main memory is required, then the required page is brought in the main memory after shifting an unwanted page from main memory to secondary memory. This process is known as swapping. In this way, program having size more than the size of

available RAM is executed. Since the size of the main memory is not same as the size of job, hence it gives rise to a concept of virtual memory.

Question 1

Describe briefly, the following term with reference to Information Technology:

- (i) *Intelligent Terminal* (PE – II Nov. 2002)
- (ii) *Drag* (PE – II May 2006)
- (iii) *MICR* (PE – II May 2008)

Answer

- (i) **Intelligent Terminal:** It has an in-built processing capability. It is also user-programmable. In addition to the storage areas, it has a microprocessor, which can be programmed to communicate with and instruct the user who is entering data.
- (ii) **Drag:** It refers to the activity of moving something around the computer monitor with the help of the mouse. Dragging involves holding down one of the mouse buttons while the user moves it.
- (iii) **MICR:** MICR stands for Magnetic Ink Character Recognition. It allows the computer to recognize characters printed using magnetic ink. This technology is used to read electronic numbers printed on the bottom of the cheque.

Question 2

Give one or two reasons for the Integrated circuits are used for primary memory and not for secondary storage. (PE – II Nov. 2002)

Answer

The integrated circuits, also called silicon chips do lose their contents when the computer's power is shut off. These chips provide volatile storage. Due to this reason they are not used for secondary storage since secondary storage serves as a means of permanent storage device.

Question 3

Write True or False for the following:

- (i) A dumb terminal has an inbuilt processing capability (PE – II Nov. 2004)
- (ii) Screen Resolution is measured in terms of Picture elements. (PE – II May 2007)

Answer

- (i) False
- (ii) True

Question 4

Briefly describe the procedure of document imaging. Write the advantages of Image Processing System. (PE-II Nov. 2002 & Nov. 2004)

Answer

Document Image processing captures an electronic image of data so that it can be stored and shared. Imaging system can capture almost anything such as handwritten documents, photographs, flow charts, drawings etc. There are five distinct steps to document imaging. These are as follows:

Step 1: Data capture : The most common means of converting paper documents into electronic images is to scan them. The scanning device converts the text and pictures into digitized electronic code. The scanner can range from a simple hand held device to a high end, high speed scanner capable of scanning more than 2500 pages an hour. Hand-held scanners could transform text or graphical images into machine-readable data. Fax modems are also used to receive electronic images of documents.

Step 2: Indexing : Document images must be stored in a manner that facilitates their retrieval. Therefore, important document information, such as purchase order numbers or vendor numbers, is stored in an index. Great care is needed in designing the indexing scheme, as it affects the ease of subsequent retrieval of information.

Step 3: Storage : Because images require a large amount of storage space, they are usually stored on an optical disk. One 5.25 inch optical platter can store 1.4 GB or about 25,000 pages of documents. A 12-inch removable optical disk stores upto 60,000 pages of documents, and upto 100 optical disks can be stored in devices called jukeboxes.

Step 4: Retrieval : Keying in any information stored in an index can retrieve documents. The index tells the system which optical disk to search and the requested information can be quickly retrieved.

Step 5: Output : An exact replica of the original document is easily produced on the computer's monitor or on paper, or is transmitted electronically to another computer.

Advantages of Image Processing System

The image processing systems provide the following advantages:

- (a) **Accessibility** – Documents can be accessed and reviewed simultaneously by many

people, even from remote locations.

- (b) **Accuracy** – Accuracy is much higher because costly and error-prone manual data-entry processes are eliminated.
- (c) **Capacity** – Large amounts of data can be stored in very little space, which significantly reduces storage and office space.
- (d) **Availability** – There are no more lost or misfiled documents.
- (e) **Cost** – When large volumes of data are stored and processed, the cost per document is quite inexpensive. As a result, the costs to input, file, retrieve, and refine documents are also reduced.
- (f) **Customer satisfaction** – Since the waiting time is significantly reduced, customers can get the information almost immediately. Hence, satisfaction level of the customer increases.
- (g) **Security** – Various levels of passwords and clearances can be assigned to restrict document access.
- (h) **Speed** – Data can be retrieved at high speeds. Stored documents can be indexed using any number of identifying labels, attributes, or keywords.
- (i) **Versatility** – Handwritten or typed text and voice messages can be added to an image. Documents can be added to word processing files; the data can be included in a spreadsheet or database.

Question 5

What do you mean by Direct Data Entry (DDE) system? Give a brief description of Optical Character Reader.
(PE – II Nov. 2004)

Answer

Direct Data Entry (DDE): Direct data entry refers to entry of data directly into the computers through machine-readable source documents. DDE does not require manual transcription of data from original paper documents. These devices can scan source documents magnetically or optically to capture data for direct entry into the computer. Magnetic ink character reader and Optical character reader are examples of such devices.

Optical Character Readers (OCR) employ a set of printing characters with standard font that can be read by both human and machine readers. The machine reading is done by light scanning techniques in which each character is illuminated by a light source and the reflected image of the character is analysed in terms of the light-dark pattern produced. Keyboard devices are used to give the required print quality. OCR has the potential of reading even handwritten documents straightaway. OCRs can read upper and lower case letters, numerals, and certain special characters from handwritten, typed and printed paper documents. The specific characters that can be read and whether the characters must be handwritten, typed or printed depends upon the type of OCR being used. OCR annihilates the time consuming step of transcription. Large volume billing applications (e.g. the bills of utility companies, credit

card organizations, and magazine subscriptions etc.) increasingly are being adapted to OCR methods.

Question 6

Write short note on the following:

- (i) Bar Code Reader (PE – II Nov. 2003 & Nov 2006)
- (ii) Light Pen (PE – II Nov. 2007)
- (iii) Touch Screen (PE – II May 2008)

Answer

- (i) **Bar Code Reader:** It is the most commonly used input device in supermarkets and departmental stores. This device converts the bar code which is a pattern of printed bars on products, into a product code by emitting a laser beam which reflects off the bar code image. A light sensitive detector identifies the bar code image by recognizing special bars at both ends of the image. Once the detector has identified the bar code, it converts the individual bar patterns into numeric digits and feeds that number to the computer, just as though the number had been typed on a key board. The special bars at each end of the image are different, so the reader can tell whether the bar code has been read right side up or upside down. After the bar code reader has converted a bar code image into a number, it feeds that number to the computer for further processing.

Bar code reader provides following advantages:

- improves accuracy of data entry
- better customer service
- faster check out at the point of sale
- greater control and reliability of inventory records
- most widely used input device after the keyboard and mouse.

Bar code readers are also used in industries that must count and track inventory, such as retail, medical libraries, military and other government operations.

- (ii) **Light Pen:** A light pen is a pointing device which can be used to select an option by simply pointing at it, or draw figures directly on the screen and move the figures around. A light pen has a photo-detector at its tip. This detector can detect changes in brightness of the screen. When the pen is pointed at a particular point on the screen, it records the instant change in brightness that occurs and informs the computer about this. The computer can find out the exact spot with the information. Thus, the computer can identify where the user is pointing on the screen. Light pens are useful for menu-based applications. Instead of moving the mouse around or using a keyboard, the user can select an option by pointing at it. A light pen is also useful for drawing graphics in CAD.
- (iii) **Touch Screen:** In touch screen, by pressing a finger against a function or program

displayed on the screen, information / instruction / input is provided to the system. It is a Hewlett Packard innovation and was introduced in 1984. Bank ATMs are a very good example of this technology. Nowadays, this technology is being used at various places, such as, hotels, stock exchanges, railways, flight booking, etc. In this technology, an invisible microwave beam 'matrix' criss-crosses the screen, emanating from holes along the bottom and sides of the display unit. When we touch the screen using finger, the infrared beam is broken at that intersection and the system gets activated.

Question 7

Distinguish between the following:

- | | |
|--|---------------------|
| (i) Dumb Terminal and Intelligent Terminal | (PE – II Nov. 2005) |
| (ii) Key to disk and Key-to-diskette | (PE – II May 2006) |
| (iii) Personal Computing and Network Computing | (PE – II Nov 2007) |

Answer

(i) Dumb Terminal and Intelligent Terminal

Dumb Terminal consists of I/O devices for data entry and obtaining the results but has no processing capability. This terminal cannot process the data at its own level, processing is done by central host computer. In other words, in these types of terminals, entire workload is on the main computer. Thus, if the processing speed of main computer is less, the waiting time of the users working on different terminals will be increased. Further, failure of main computer will result in breakdown of the entire network. Such terminals are generally used in centralised processing.

Intelligent Terminal, on the other hand, consists of a small microprocessor in addition to I/O devices. This microprocessor can process the data upto a certain level. It means that these terminals have processing capabilities in addition to performing Input and Output operations. Using these terminals, workload on the central computer is reduced, hence response to the users is fast. Intelligent terminals can be used in a stand-alone basis, or can be part of a network of terminals.

(ii) Key to disk and Key-to-diskette

Key to -disk system consists of a mini processor, number of keying stations, supervisor console and a magnetic disk. Keying station consists of a keyboard and VDU. Supervisor's console is used to monitor the functioning of different operators working on different keying stations, usage of magnetic disk and status of Input data.

Each keying station is connected to the mini processor and for each keying station, fixed area of main memory in the mini processor is allocated. When the data is entered from a keying station, it is stored in its allocated area. When the allocated area in the mini processor is filled with data, then the data from that area is shifted on the magnetic disk

as a record. Key-to-disk system provides accuracy of input, security and monitoring of progress. However, since all the keying stations are connected with a single mini processor and in case mini processor fails, then all keying stations stop working.

Key-to-diskette stand-alone computers are provided to the different operators for data entry. Data entered by them is stored on the floppy disks. The data recorded on the floppy disks are later transferred to magnetic tapes with the help of data converter. The data converter can handle upto 20 diskettes at a time.

Since all the computers used are stand-alone computers, therefore, if one computer fails, it will not stop the working of others. In addition to this, stand-alone computers can be installed close to the source of data. Key-to-diskette system allows decentralized recording of data and centralized conversion on magnetic tape for processing by a mainframe computer.

(iii) Personal Computing and Network computing

Personal computing: The philosophy behind personal computing is that a computer should be readily available to an individual to perform his/her work at any time. Many tasks are individual by nature. Over the time, the range of tasks that a personal computer can accomplish has steadily increased largely because of the increasing availability of high-quality software. Some smaller businesses rely only on personal computers for all of their accounting, inventory management, customer database and transaction processing operations.

Network Computing: In network computing arrangement, individuals do their own work on personal computers, but are connected to other computers through a telecommunication network that allows them to share information and resources with others. Users in these environments may share databases, memos and other messages, and work in progress. They can also share printers, fax machines and links to external data sources. Providing duplicates of these resources for each of the members of the work group can be very costly for many organizations. Sharing of resources saves lot of cost for the organization.

Question 8

Explain in brief the advantages of Optical Character Reader.

(PE – II Nov. 2005)

Answer

Advantages of Optical Character Reader (OCR)

- (i). It employs a set of printing characters with standard font that can be read by both human and machine readers.
- (ii) OCR eliminates the human effort of transcription. It has the potential of reading even handwritten documents straightway.
- (iii) Paper work explosion can be handled because OCR is economical for a high rate of input.

- (iv) Since documents have only to be typed or handwritten, not very skilled staff is required.
- (v) These input preparation devices are much cheaper than the keypunch or the key-to-tape devices.

Question 9

What is Image processing? Explain the steps required for image processing.

(PE – II May 2007)

Answer

Image Processing: It is the process of entering an image, graph, design, drawing or photograph into the computer with the help of digitizing. Digitizing is a process of converting the graphical information into digital form. Image processing also known as Document Imaging is a step towards paperless office. There are five steps required for document imaging.

- (1) **Data Capture:** Paper documents are entered into the computer with the help of image scanner. Image scanner converts the graphical information into digital form. Printers are available in the market having removable printing head which can be replaced with scanning head, enabling the printer to work as image scanner. There are two types of scanners:
 - (a) **Page Scanner (Flat bed scanner):** This scanner is used to scan the large images by placing the document on a flat surface and giving the command with the help of scanner software using computer.
 - (b) **Hand held scanner:** This scanner is used to scan small images by holding the scanner in hand and moving the scanner on the document.
- (2) **Indexing:** For fast retrieval of the stored documents, scanned images are indexed on the basis of some criteria like Vendor Code or purchase order number.
- (3) **Storage:** Scanned document files are stored on auxiliary storage media for future reference. Since size of the scanned files is more, therefore, compact disk (CD's) or DVD's are used as storage media.
- (4) **Retrieval:** Document management software allows the user to access any required information from the stored files on the basis of various parameters like Indexed key, key word etc. The software can automatically mark the optical disks (CD's) so that when any information is required to be accessed, then software may tell the number of that CD storing the desired information.
- (5) **Output:** Hard copy of the scanned documents can be printed with the help of printers and even can be sent to another person through E-mail.

Question 10

Explain in brief, the floppy disk as an auxiliary device.

(PE – II May 2007)

Answer

Floppy Disk (Diskette): It consists of a circular plate, known as platter made of mylar plastic and coated with magnetic material like Ferrous Oxide on both the surfaces. The platter is enclosed in a protective jacket to avoid scratching on the magnetic surface. The circular plate is divided into number of concentric circles, known as tracks. Each track is divided into number of equal parts, known as sectors. Although different tracks vary in sizes but the volume of data stored on each track is same because the packing density of data goes on increasing as we move from outer to inner tracks. Outer track is called track 0. Any location on the floppy disk i.e. Physical address is identified by Surface number, Track number and Sector number.

Data recorded on the floppy disk is read with the help of a device, known as Floppy Disk Drive (FDD). There are two types of floppies – 5.25" (1.2 MB) and 3.5" (1.44 MB). In both cases, FDD required to read/write the data on floppy disks is different. Sony, IBM, Imation are the reputed manufacturers of floppy disks.

Different portions of the floppy disks are explained below:

- (i) **Spindle hole:** This hole is used to rotate the circular plate at very high speed, usually at the speed of 300 RPM (Rotations/revolutions per minute). Due to the movement of circular plate, each sector of a track comes under the R/W head of FDD.
- (ii) **Read/Write Access position:** This is the position where R/W head of FDD touches the magnetic surface for the purpose of reading/writing. Initially, R/W head is adjusted on the outermost track i.e. track 0 and when this track is completely read or written, then R/W head moves horizontally to adjust itself on the next inner track i.e. Track 1 and so on.
- (iii) **Index Hole:** It is used as a marker of first sector. If an imaginary line passing through the center of spindle hole and Index hole is drawn, then the sector starting from this line in the clockwise direction is called first sector.
- (iv) **Write protect button:** It is used to write-protect the floppy. If floppy is write protected, then nothing can be written on the floppy but contents already stored on the floppy disk can be read.

Question 1

Write True or False for each of the following:

- (i) Thermal printer is an impact printer. (PE – II Nov. 2003)
- (ii) A non-impact printer forms character by chemical or electronic means. (PE – II Nov. 2004)
- (iii) The speed of Dot matrix printer is measured in terms of CPS. (PE – II May 2005)
- (iv) Speed of Non-Impact Printers is measured in LPM. (PE – II Nov. 2005)
- (v) Computer Output Microfilm (COM) is Input as well as Output device. (PE – II May 2007)
- (vi) Laser printers speed is measured in PPM. (PE – II May 2007)
- (vii) 'Duplex Printer' prints on both sides of a sheet of paper at the same time. (PE – II Nov. 2008)

Answer

- (i) False
- (ii) True
- (iii) True
- (iv) False
- (v) False
- (vi) True
- (vii) True

Question 2

Distinguish between the following:

- (i) Voice synthesizer system and Voice recognition system (PE – II Nov. 2002 & Nov 2007)
- (ii) Impact Printers and Non -impact Printers. (PE – II May 2004)

Answer

(i)

Voice Synthesizer System	Voice Recognition System
--------------------------	--------------------------

It is hardware device which is attached to the parallel port of the Computer. It is used to convert text to voice. It is an output device.	It is software based approach of data entry into the computer by speaking using microphone attached with the computer. It is used to convert voice to text It is an input technique of data entry.
It is much helpful for blind persons who can not see the text on VDU.	It is helpful for those persons who find it difficult to use conventional devices like Keyboard, Mouse etc. for entry of data into the computer.
It is a costly device	The problem in the implementation of this system is that the persons are not uniform in their speech modulation which leads to error in data entry.

(ii) Impact Printers and Non-impact Printers: Impact printers use some form of striking device such as revolving print chains, rotary print wheels or wire-matrix printers. Non-impact printers use technology such as xerography or laser to produce output. Impact printers form images when electronic pulses activate printing elements that are pressed against an inked ribbon and form an image on paper. The characters to be printed are formed either by whole alphanumeric images or by dot matrix method, which arranges a series of dots to assume the shape of each character being printed. These printer fall into two categories i.e. serial printers and line printers. Non-impact printers use thermal, chemical, electrical or optical technique to form images. Thermal printers, ink jet printers and laser printers fall under this category.

Non-impact printers are much faster than impact printers because they involve less physical movements of parts. A speed of 3800 lpm (lines per minute) is very fast for an impact printer but speeds of upto 21,000 lpm are offered with some non-impact printers. Non-impact printers are capable of a wide range of fonts and quality approaching that of multilith book printing. However, only one copy of the document can be printed at a time. These printers are generally too expensive and give high-speed, high quality printing in comparison with impact printers. Impact printers, on the other hand are capable of printing multiple copies of a document, these are less costly and are mostly used where draft quality print is required.

Question 3

Write a short note on the following:

- (i) Computer Output MicroFilm (COM) (PE – II Nov. 2004)
- (ii) Smart Card Systems (PE – II May 2006)
- (iii) Voice Recognition (PE – II May 2008)

Answer

- (i) **Computer Output MicroFilm (COM):** It is an output technique that records output from a computer as microscopic images on roll or sheet film. The images stored on COM are the same images, which would be printed on paper. It reduces characters 24, 42, or 48 times smaller than normal size. The information is then recorded on 16 mm, 35 mm or 105 mm Microfilm.

The data to be recorded is displayed on CRT and a camera takes a picture of it and places it on the film. The film is then processed either in the recorder unit or separately. After it is processed, it can be retrieved and viewed by the user. It has the following advantages:

- Data can be recorded at a speed of 30,000 lines/minute.
- Cost of recording is very less compared to printed output.
- Huge size data can be recorded.
- Recording space requirement is less.

It provides easy access to data, using indexing techniques.

- (ii) **Smart Card Systems:** Smart cards are similar to credit card in size and shape but have small microprocessor chip and memory to store the details of the card holder.

So far, smart cards are used mostly for E-commerce and EFT (Electronic fund transfer). However, these days smart cards are being used to store the complete details of the card holder such as holders particulars, identity, address, insurance data, relatives' details, medical background and even finger prints of the holders. These cards can help the doctors to provide immediate treatment in case the cardholder is disabled by an accident or illness. It can serve as an identity card at various security checkpoints, the stored fingerprints could be compared to fingerprints of people who are authorized to enter a secured area.

Data from Smart cards is read with the help of a device known as Smart Card Reader. Smart cards are going to replace the need of multiple documents to be retained by a person like Ration card, Driving license, Passport, Identity card, Voter card etc.

- (iii) **Voice Recognition:** Voice Recognition is a process in which the voice is translated into text and stored in a digital form. Using this process, one can speak to the computer rather than having to type. The user can also control the computer with oral commands, such as, 'Shut Down' or 'Print Report'. Voice Recognition software takes the smallest individual sounds in a language, called phonemes, and translates them into text. Two major challenges in the area of voice recognition is, first, a sound can have different meanings that makes reliability of translation difficult and second, distinguishing between meaningful sound from the background noise.

Question 4

Give one or two reasons for each of the following:

- | | |
|-----------------------------|--------------------|
| (i) Use of Serial Interface | (PE – II May 2005) |
| (ii) Use of Graph Plotter | (PE – II Nov 2005) |

(iii) *Use of drivers*

(PE – II May 2006)

Answer

- (i) **Use of Serial Interface:** A serial interface is used to connect a printer to the input device, either a computer or word processor. It allows the printer to accept transmission of data, which is sent serially, or one character at a time.
- (ii) **Use of Graph Plotters:** It is an output device which is used to print graphs, designs, drawings and maps on the paper. It is used particularly in applications like computer-aided design (CAD).
- (iii) **Use of drivers:** Drivers are small programs that translate the program's generic instructions into instructions for a specific piece of hardware. When a new hardware is introduced, the programmer of an operating system just writes a driver for it. Operating system has a library of device drivers, one for each specific hardware item.

Question 5

Describe briefly, the following terms with reference to Information Technology:

(i) *Digitization*

(PE - II Nov 2005)

(ii) *Bidirectional Printing*

(PE - II May 2006)

(iii) *Duplex Printing*

(PE – II May 2007)

(iv) *Computer Output Microfilm (COM)*

(PE – II Nov 2008)

Answer

- (i) **Digitization:** The process of converting the graphical information such as lines, pictures and graphs etc. to digital form with the help of Image Scanner is called digitizing.
- (ii) **Bi-directional Printing:** Under bi-directional printing, a printer types the first line from left to right and the second line from right to left and so on through out the page. This speeds up the printing sequences.
- (iii) **Duplex Printing:** Printing on both sides of a paper at the same time is called Duplex Printing.
- (iv) **Computer Output Microfilm (COM):** Computer output microfilm (COM) is an output technique that records output from a computer as microscopic images on roll or sheet film. The images stored on COM are the same as the images, which would be printed on paper. The COM recording process reduces characters to 24, 42, or 48 times smaller than would be produced from a printer. The information is recorded on sheet film called 16 mm, 35 mm microfilm or 105 mm microfiche.

Question 1

Describe briefly, the following terms with reference to Information Technology :

- (i) Overlay (PE – II Nov. 2002)
- (ii) File Allocation Table (PE – II May 2003 & Nov. 2007)
- (iii) Access time (PE – II Nov. 2004)
- (iv) Buffer (PE – II Nov. 2004)
- (v) Formatting (PE – II May 2006)
- (vi) Rotational Delay time (PE – II Nov. 2007)
- (vii) Seek Time (PE – II May 2008)

Answer

- (i) **Overlay** : It is a technique which makes it possible to execute programs which are too large to fit into the computer's internal storage at one time. The program is segmented and two or more segments occupy the same internal storage location at different times during execution of the program.
- (ii) **File Allocation Table** : It is a log that records the location of each file and the status of each sector. When a file is written to a disk, the operating system checks the FAT for an open area, stores the file and then identifies the file and its location in the FAT. The FAT solves common filing problems with respect to updation of the files on the disk.
- (iii) **Access Time** : It refers to the time interval between the instant when a computer or control unit calls for transfer of data to or from a storage device and the instant when its operation is completed. Thus, access time is the sum of the waiting time and transfer time.
- (iv) **Buffer** : It refers to a storage device used to compensate for differences in the rates of flow of data or in the times of occurrence of events when transmitting data from one device to another.

- (v) **Formatting** : The process of creating tracks and sectors on the storage media is called formatting. By this process, each location of the storage media is assigned a physical address for reading/writing the data.
- (vi) **Rotational delay Time**: After adjusting the Read/Write head of the disk on the desired track, it is the time taken by Read/Write head to find the desired sector. It is considered as half of the time required in one revolution of the platter.
- (vii) **Seek Time**: Seek time is the time required to position a movable read-write head over the recording track to be used. If the read-write head is fixed, then seek time will be zero.

Question 2

Give one or two reasons for each of the following:

- (i) Disk formatting (PE – II Nov. 2002 & May 2008)
- (ii) Need for Boot record (PE – II Nov. 2003 & May 2008)
- (iii) Need of FAT (PE – II May 2004)
- (iv) Need of auxiliary storage devices (PE – II Nov. 2007)

Answer

- (i) **Disk Formatting**: A new diskette is nothing more than simple coated disk encased in plastic. Before the computer can use it to store data, it must be magnetically mapped into tracks and sectors called formatting so that the computer can go directly to a specific point on the diskette without searching through data.
- (ii) **Need for Boot record**: Boot record contains a small program that runs when the computer system is switched on. This program determines whether the disk has the basic components, which are necessary to run the operating system successfully. If it determines that the required files are present, it transfers control to one of the files of the operating system that continues the process of starting the computer system. Boot record also describes the disc characteristics such as number of sectors/ track and number of bytes / sector.
- (iii) **Need of FAT**: File Allocation Table (FAT) is a log that records the location of each file and the status of each sector. When a file is written to a disk, the Operating System checks the FAT for an open area, stores the file and then identifies the file and its location in the FAT. The FAT solves a common filing problem. For storing larger files, free space at different locations is used and pointers are added in the FAT.
- (iv) **Need of Auxiliary storage devices**: When user enters the data/program using input device, those are stored in RAM. RAM is a Volatile memory which means that all the contents of RAM are erased when the power is switched-off. Therefore, in order to store the entered data permanently for future reference, auxiliary memory is required. Auxiliary

storage devices like Floppy disk, Magnetic disk and Magnetic tape have auxiliary memory.

Question 3

Write True or False for each of the following:

- (i) In CD ROM drive, the read/ write head touches the surface of the disk. (PE – II Nov. 2002)
- (ii) Time required to position the movable read/ write head over the desired track is termed as seek time. (PE – II Nov. 2003)
- (iii) A sequential access file can reside only on a magnetic tape. (PE-II May 2005)
- (iv) Each side of DVD can hold upto 4.7 GB data. (PE – II Nov. 2005)
- (v) Magnetic tape supports random file organization. (PE-II May 2006)
- (vi) Optical laser disks use mechanical Read/write head for the purpose of reading and writing the data. (PE – II Nov. 2007)

Answer

- | | | |
|-----------|-----------|-------------|
| (i) False | (ii) True | (iii) False |
| (iv) True | (v) False | (vi) False |

Question 4

A moving arm disk-storage device has the following specifications:

- | | |
|-------------------------------------|-----------------------|
| No. of tracks per recording surface | = 200 |
| Track storage capacity | = 62,500 bits |
| Disk rotation speed | = 2,400 rev. / minute |

Estimate the average latency and the data transfer rate of this device. (PE – II Nov. 2002)

Answer

$$\text{No. of revolution per second} = \frac{2400}{60} = 40$$

$$(i) \text{ Average latency} = \frac{1}{2 \times 40} = \frac{1}{80} \text{ Sec.}$$

$$\begin{aligned}
 \text{(ii) Data Transfer rate} &= 62500 \times 40 \text{ bits/sec.} \\
 &= 2500000 \\
 &= 2.5 \times 10^6 \text{ bits per sec.}
 \end{aligned}$$

Question 5

Describe the various factors which determine the storage capacity of a magnetic disk.

(PE – II May 2004)

Answer

Diskette Storage capacity depends upon the following factors:

- (i) **Number of sides of the diskette used**: Earlier disks and drives were designed so that data could be recorded only on one side of the diskette. Now -a -days disk drives are manufactured so that data can be read/written on both sides of the diskette. Such drives are called 'Double Sided Drives'. The use of double sided drives and diskette approximately doubles the number of characters that can be stored on the diskette.
- (ii) **The recording density of the bits in the track**: Recording density refers to the number of bits that can be recorded on a disk in one inch circumference of the innermost track on the diskette. This measurement is referred to as bits per inch (bpi). For the user, the diskette is identified as being either single density or double density. A single density drive can store 2768 bits per inch.
- (iii) **The number of tracks on the diskette**: Number of tracks depends upon the drive being used. Many drives record 40 tracks on the surface of the diskette. Other drives, however, can record 80 tracks on the diskette.

In case of hard disk the storage capacity depends on the number of platters that are stacked on the top of one another, the number of tracks per platter and the number of sectors per track. Hard disks generally have 6 platters, i.e. 12 faces out of which eleven faces can be used. Each side may have 200 or more tracks, each track having 54, 63 or even more sectors per track and hard disk generally store 512 bytes of data in a sector. Data on magnetic disc is stored in cylinders where the nth track of each face vertically above and below each other constitutes cylinder n.

Thus, the storage capacity of hard disk is calculated as

$$= \text{No. of cylinders} \times \text{no. of usable sides} \times \text{No. of sectors / track} \times \text{no. of bytes / sector.}$$

Question 6

Write short notes on the WORM Disks.

(PE-II Nov. 2006)

Answer

WORM Disks: It stands for write once, read many optical laser disks, or WORM disks. These are used by end user companies to store their own proprietary information. Once the data have been written to the medium, they only can be read, not updated or changed. The PC version of a WORM disks cartridge, which looks like a 5¼ inch version of the 3½ inch diskette, has a capacity of 200 MB. Access times for CD-ROM and WORM drives tend to be quite slow by hard disk drive standards, ranging from 100 to 300 milliseconds. The WORM disks cartridge is a feasible alternative to magnetic tape for archival storage; for example, a company might wish to keep a permanent record of all financial transactions during the last year. Another popular application of WORM disks is an information system that requires the merging of text and images which do not change for a period of time.

Question 7

Distinguish between CD-ROM and ROM-BIOS.

(PE – II May 2008)

Answer

CD-ROM and ROM-BIOS: **CD-ROM** stands for Compact Disc - Read Only Memory. It is an auxiliary storage device which is used to store large volumes of data and text. CD-ROMs are often used for the distribution of computer programs / softwares and user manuals. Using CD-ROM, the content can be read into primary storage for processing or display. However, the data on the disk are fixed, they cannot be altered.

ROM-BIOS stands for Read Only Memory – Basic Input Output System. It contains a set of instructions which perform the basic control and supervisory operations for the computer. These instructions are needed frequently by the computer system (to provide basic input/output services) and are not available in the computer circuitry.

Question 1

Give one or two reasons for each of the following:

- | | |
|--|--------------------------------|
| (i) Use of Spooling software | (PE – II May 2003 & May 2005) |
| (ii) Boot strap loader | (PE – II May 2003) |
| (iii) Importance of Firmware | (PE – II Nov. 2003) |
| (iv) Need of Diagnostic Routine in System software | (PE – II Nov. 2004) |
| (v) Use of Subroutine | (PE – II Nov. 2005) |
| (vi) Use of Operating System | (PE – II Nov. 2005 & Nov 2007) |
| (vii) Use of Dynamic Processing | (PE – II May 2006) |
| (viii) Need of language translators | (PE – II Nov. 2007) |
| (ix) GUI | (PE – II May 2008) |

Answer

- (i) **Use of Spooling software:** The purpose of spooling is to compensate for the speed difference between the computer and its peripheral devices. These programs take the results of computer program and move them from primary memory to disk. The area on the disk where the program results are sent is commonly called the output spooling area. Thus, the output device can be left to interact primarily with the disk unit, not the CPU. It can also be used on the input side.
- (ii) **Boot strap loader:** When a computer is first turned on or restarted, a special type of absolute loader called a bootstrap loader is executed. This bootstrap loads the first program to be run by the computer – usually an operating system. Since no program can be executed without OS, hence bootstrap loader is the most essential system software without which the computer cannot be started.
- (iii) **Importance of Firmware:** The firmware refers to a series of special programs which deal with very low-level machine operations and thus essentially substitutes for additional hardware requirement.

- (iv) **Need of Diagnostic Routine in System software:** These programs are written and provided by computer manufacturers. These assist in tracing the processing of the program being debugged. They are also used to find hardware details. Diagnostic routines are often treated as a category of the utility or service programs.
- (v) **Use of subroutine:** It is a small independent program which is included in the main program to perform a specific function again and again with different values of data.
- (vi) **Use of operating system:** It is a system software which acts as an interface between the user and the computer system. It is used to managed the system resources like memory, processor, I/O devices and data.
- (vii) **Use of Dynamic Processing:** This technique is used for swapping jobs in and out of computer memory according to their priorities and the number of time slices allocated to each task. It helps in increasing the processing speed of various tasks.
- (viii) **Need of language translator:** Computer understands only binary language or machine language. Therefore, in order to convert assembly language program or source program to object program, language translator is required. Assembler, Interpreter and compiler are known as language translators.
- (ix) **GUI :** GUI stands for Graphical User Interface. It provides a user-friendly graphics oriented environment. Using GUI, the user can interact with operating system and other software packages by selecting options from menus that are temporarily super-imposed over whatever is currently on the screen. Mouse is used to position the graphics cursor over the appropriate icons. GUI has effectively eliminated the need for users to memorize and enter cumbersome commands.

Question 2

Write True or False for each of the following:

- (i) DOS based software cannot be executed on WINDOWS 95/98. (PE – II Nov. 2002)
- (ii) Multiprocessing refers to the use of two or more central processing units to perform coordinated work simultaneously. (PE – II May 2003)
- (iii) A spooling software is used to compensate the speed difference between the computer and its peripheral devices. (PE – II May 2004 & Nov 2006)
- (iv) Multitasking refers to the use of two or more CPU to perform coordinated work simultaneously. (PE – II Nov. 2004)
- (v) MS-Windows is a multi tasking operating system. (PE – II May 2006)
- (vi) Compiler is one of the hardware devices in a computer. (PE – II Nov. 2006)
- (vii) Financial accounting software is a system software. (PE – II Nov. 2007)
- (viii) Computer system may function a bit faster if certain of program's window are closed on the system running too many applications simultaneously. (PE – II May 2008)

(ix) MS DOS is a 32 bit operating system.

(PE – II Nov. 2008)

Answer

(i)	False	(ii)	True	(iii)	True
(iv)	False	(v)	True	(vi)	False
(vii)	False	(viii)	True	(ix)	False

Question 3

Distinguish between the following :

- | | | |
|-------|--|--------------------------------|
| (i) | Multiprogramming and Multitasking systems | (PE – II May 2003 & May 2008) |
| (ii) | Compiler and Interpreter | (PE – II May 2004) |
| (iii) | System Software and Application Software | (PE – II May 2004 & Nov. 2008) |
| (iv) | Multiprogramming and Multiprocessing | (PE – II May 2005) |
| (v) | Third generation language and Fourth generation language | (PE – II Nov. 2008) |

Answer

- (i) **Multi-programming and Multi-tasking systems:** Multiprogramming is a processing mode in which several partially completed programs are processed concurrently. At any given moment, only one program or job is actually being executed, but within a larger time span of several minutes, the computer is processing several jobs or programs, alternating between actually executing, and performing input/ output activities. Several jobs may be in memory but only one is being executed. When one job needs to do input/ output, another can begin (that is resume) execution. Thus two or more independent programs are executed in the same time span by interleaving their execution.

The advantage of multiprogramming is that overall performance of the system can be enhanced. The great speed of the central processing unit can be used and delays in waiting for input or output operations (a condition that is called, being input/ output bound) can be avoided.

Main frames and mini computers work in multi-user multiprogramming environment.

Multitasking is a logical extension of multiprogramming. Personal computers generally work in multitasking environment. It refers to the operating system's ability to execute two or more of a single user's task concurrently. Multiple tasks are executed by the CPU switching between them. The CPU scheduler selects a task from the ready queue and switches the CPU to that task. When time slot expires, the CPU switches from this task to another task. In this method, the CPU time is shared by different processes.

The main advantage of multitasking is efficient CPU utilization. It provides single user with multiprogramming capabilities.

- (ii) **Compiler and Interpreter:** An interpreter is a language processor and is similar to the compiler in the sense that like compiler it also translates the source program written in a high level language to machine level language. However, there are certain basic differences between an interpreter and a compiler:

The compilation process consists of first loading the computer with the compiler and then inputting the source program via floppy disk or magnetic tape/disk. As output, the compiler produces an object program on a floppy disk or magnetic tape/disk, and also a print out of the program instructions along with the syntax errors indicated in the aforesaid print out. However, the object program is generated by the compiler only when the entire program is error free. On the other hand, in case of interpreter, when the command "run" is keyed in, each statement in the program is interpreted and if any statement does not conform to the rules of grammar of the language, then a syntax error is displayed. If the statement is error free, then the interpreter executes it before translating the next statement. This process slows down the execution of the program until the errors are removed.

In case of interpreter, each statement is interpreted whenever the program is executed, whereas with compiler, it is necessary to translate the program once during the compilation run, and the compiled program or the executable codes are stored on the storage medium. Thereafter, only these executable codes are loaded whenever there is a need to run the program. As each statement is not required to be translated at "run time", the program runs faster than an interpreted program.

Interpreters are usually used by personal or small business computers, whereas compilers are basically utilized by mainframes.

An interpreter is more "firmware" than "software" as it is stored on a ROM chip which is a part of the electronics of the computer, whereas a compiler forms a part of the system software which is stored on backing storage.

- (iii) **System Software and Application Software:** System Software comprises those programs that direct the computer in performing tasks that are basic to proper functioning of the computer system or commonly needed by system users. It includes (i) assemblers and compilers, (ii) diagnostic routines, (iii) utility programs, (iv) supervisory programs, and (v) library of subroutines. The system software of one computer system may differ in many ways from that of another.

Application software directs the computer in performing specific user-related data processing tasks. Application programs fall in two categories viz., cross industry i.e. programs that perform tasks common to many industries or organisations and industry specific i.e. programs that perform tasks unique to a particular industry or organisation. The most popular application programs are used by individuals to improve the speed and quality of their work. Examples of such programs are payroll, general accounting, sales statistics, and inventory control etc.

Systems software is traditionally written in low-level languages. A detailed knowledge of system hardware is needed to write such programs. Hence, systems software are generally provided by the computer manufacturers or software development firms that specializes in writing systems program.

Application programs are either written by individual users in high-level language or written and marketed by service companies as generalised applications packages on modular design which can be tailor-made to cater to the needs of different users.

(iv) Multiprogramming and Multiprocessing

Multiprogramming is defined as execution of two or more programs that all reside in primary storage. Since CPU can execute only one instruction at a time, it cannot simultaneously execute instructions from two or more programs. However, it can execute instruction from one program then from second program and so on. This type of processing is referred to as concurrent execution. It is very useful as most of time CPU remains idle waiting for I/O devices to complete their job, as I/O devices are very slow. When I/O devices are working for one program, CPU executes instructions of second program. Thus, multiprogramming is a technique which helps in utilising a computer system more effectively. It is a module, which is available in an operating system.

Multiprocessing, on other hand, refers to the use of two or more central processing units linked together to perform coordinated work simultaneously. Instructions are executed simultaneously because the available CPUs can execute different instructions of the same program or of different programs at any give time. It is also called parallel processing and job can be processed more rapidly than on a single machine. Multiprocessing offers data processing capabilities that are not available when only one CPU is used. Many complex operations can be performed at the same time. Multiprocessing is used for nation's control applications such as rail, road control, airways and traffic control etc.

(v) Third Generation Language and Fourth Generation Language:

	Third Generation Languages	Fourth Generation Languages
1.	Intended to be used by professional programmers.	May be used by a non-programming end user as well as a professional programmer.
2.	Require specification of how to perform task.	Require specification of what task to perform (system determines how to perform the task).
3.	Require large number of procedural instructions.	Require far fewer instructions.
4.	Code may be difficult to read, understand and maintain.	Code is easy to understand and maintain.
5.	Largely developed for batch operation.	Language is developed primarily for on-line use.

6.	Difficult to debug.	Easier to debug.
----	---------------------	------------------

7.	Typically file-oriented.	Typically database oriented.
8.	Require that all alternatives be specified.	Have default alternatives built in; end user need not specify.
9.	Can be difficult to learn.	Many features can be learned quickly.

Question 4

Define Graphical User Interface (GUI). Why is it mostly used these days? Explain.

(PE-II May 2003 & Nov. 2004)

Answer

Graphical user interface (GUI) is an user-friendly graphics oriented environment. Through the 1980s, microcomputer's operating system was strictly text based, command driven software. The users were required to issue commands to the operating system by entering them on the key board. The commands were syntax sensitive, hence the user had to follow the terms for constructing the command, otherwise error was displayed on the monitor. The trend now-a-day is away from command driven interface to graphical user interface. GUI provides an alternative to cryptic text commands. With the GUI, the user can interact with operating system and other software packages by selecting options from menus that are temporarily super-imposed over whatever is currently on the screen by using mouse to position the graphics cursors over the appropriate icons. GUI have effectively eliminated the need for users to memorize and enter cumbersome commands.

In PCs like 386 & 486, complex graphic displays are used, hence GUI became necessary for almost all applications. Microsoft MSWindows introduced in 1983 provided an effected GUI cover for MS-DOS. In today's environment, almost all the software are based on GUI.

Question 5

Define an Operating System and discuss its various functions by it.

(PE – II Nov. 2003, May 2007 & May 2008)

Answer

Operating systems are devised to optimize the man-machine capabilities. An operating system is defined as an integrated system of programmes which supervises the operation of CPU, controls the input/ output functions of computer system and provides various support services. Without loading the operating system into the memory of the computer system, the computer cannot be used. The operating systems are usually the creation of the computer

manufacturers who design these to suit the capabilities of the particular computer. MS-DOS, UNIX, Windows-98/XP and OS/L are some of the popular operating systems.

There are six basic functions that an operating system can perform:

- (i) **Job scheduling:** Operating system decides the sequence in which different jobs are executed, using priorities established by the organisations.
- (ii) **Manage hardware and software resources:** Operating system helps in loading the application program into the primary memory and then causes the various hardware units to perform as specified in the application program.
- (iii) **Maintain system security:** Operating system identifies the authorized users by recognizing the password entered by the user and authorizes the user to have access to the system.
- (iv) **Enable multiple user resource sharing:** Operating system can handle the scheduling and execution of the application programs for many users at the same time, a feature called multiprogramming.
- (v) **Handle interrupts:** An interrupt is a technique used by the operating system to temporarily suspend the processing of the program in order to allow other programs to be executed. Interrupts are issued when a program requests an operation that does not require the CPU i.e. Input/ output devices or when the program exceeds the predefined time limit.
- (vi) **Maintains usage records:** Operating system can keep track of the amount of the time used by each user for each resource – processor, memory, input/output devices. Such information is usually maintained for the purpose of charging users' departments for the use of the organization's computing resources.

Question 6

What do you mean by object-oriented programming? Explain its advantages.

(PE – II May 2004 & Nov. 2006)

Answer

Object oriented programming: With traditional programming approaches, developing a new program means writing entirely new codes which may take years to complete, yet not meeting the desired quality standards. The solution of this problem is a new way of developing programs using an object-oriented language.

An object is a predefined set of program codes that, after having been written and tested, will always behave the same way so that it can be used for other applications. All programs consist of specific tasks such as saving or retrieving data and calculation. In object oriented programming, an object is written for each specific task and saved in the library so that anyone can use it.

In OOP, objects are selected by pointing to a representative icon, small amount of code necessary for finishing the program is written and then linking these objects together creates a new program.

OOP offers the following advantages:

- ease of use;
- allows graphical user interface;
- faster development of programmes;
- programs produced are more reliable; and
- when an object is updated, all programs using that object are updated automatically.

However, initial cost of development using OOPs and time consumed is very large. Large programs produced by OOPs are slower and use more memory and other computer resources.

Question 7

Write a short note on the following:

- | | |
|-----------------------------------|--|
| (i) Microsoft Windows | (PE - II May 2003, May 2004, May 2005 & Nov. 2008) |
| (ii) Firmware | (PE - II May 2005 & Nov. 2007) |
| (iii) Parallel Processing | (PE - II Nov. 2005) |
| (iv) Language Translators | (PE - II May 2006) |
| (v) Diagnostic Routines. | (PE - II May 2007) |
| (vi) Spooling Software | (PE - II Nov. 2008) |
| (vii) Object Oriented Programming | (PE - II Nov. 2008) |

Answer

- (i) **Microsoft Windows:** The first version of the Microsoft Windows OS was launched in 1983. Microsoft allowed developers to produce software applications to run on their Windows OS without the need to notify them and hence encouraged the whole industry to work with their product. Though the original version of Windows was not very successful, MS-Windows-3 became the world's best selling 16-bit GUI operating systems.

Windows 95/98 and Windows NT are the most popular Microsoft Windows operating systems.

We have explained two of these operating systems:

Windows 95: It is a 32 bit OS which was released in August, 1995. It was designed to have certain critical features. These included:

- (a) A 32-bit architecture which provides for a multi tasking environment.
- (b) A friendly interface fitted with 'one click' access.
- (c) Windows 95 is network ready i.e. it is designed for easy access to network resources.
- (d) It is backwardly compatible with most Windows 3.1 / DOS applications.

Window NT: Window NT represents an industry standard mission critical operating system. It is 32 bit operating system and represents the preferred platform for the Intel's more powerful Pentium range of processors. Although not exactly the same, Windows NT 4.0 is very similar in appearance to Windows 95. Critical features that allow the program to context the commercial OS market include:

- (i) Stable multitasking environment
- (ii) Enhanced security features
- (iii) Increased memory
- (iv) Network utilities
- (v) Portability

Windows NT is more expensive than other Windows OS and makes greater processing demands, but due to its features it is recognized as a competent and useful OS.

Later Microsoft brought various versions Windows Vista being the latest one. This OS has various features:

- It has a 32/64 bit architecture which provides an environment for multitasking; allowing the user to run multiple programs or execute multiple tasks concurrently. This architecture also enables faster data/file access as well as an improvement in printing delivery.
- A friendlier interface fitted with 'one click' access. One click access refers to the fact that user did not have to double click on the mouse every time that they want to activate an application. Other congenial attributes include the ability to employ long file names, easy navigation routes, and plug and play technology enabling user to connect various peripheral devices or add-ons with minimum effort.
- It is designed for easy access to network resources.
- The OS also facilitates gateways to e-mail, voice recognition, fax facilities and access to the internet via Microsoft network.
- The OS is backwardly compatible to migrate from previous system .
- It has enhanced security features.

- (ii) **Firmware:** Firmware or micro programs refer to a series of special program instructions. The most basic operations such as addition, multiplication etc, in a computer are carried out by hardwired circuits. These fundamental tasks are then combined in the form of

micro programs to produce higher level operations such as move data, make comparison etc. These micro programs are called firmware because they deal with very low level machine operations and thus essentially substitute for additional hardware. Firmware are held in the CPU in a special control storage device.

- (iii) **Parallel Processing:** It is also called Multiprocessing. It requires use of two or more CPUs, linked together to perform coordinated work simultaneously. Instructions are executed simultaneously because the available CPUs can execute different instructions of the same program or of different programs at any given time.

In case of parallel processing, there may be multiprogramming or there may not be multiprogramming. If there is no multiprogramming, then different CPU execute different programs, thereby reducing the overall execution time. Parallel processing systems provide those data processing capabilities, which are not found in those systems that have single processor. Many complex operations can be performed at the same time. CPUs can function on complementary units to provide data and control for one another. Parallel processing is used in Air Traffic control systems, and Traffic lights control system etc. Super Computers, which have multiple CPU's, perform parallel processing.

- (iv) **Language Translators:** It is a general term used for any assembler, compiler or other routines that accept statements in one language and produce equivalent statements in another language.

There are three types of translators:

- (a) **Compiler:** It is system software, which is used to translate source codes to object codes. It scans the complete source program to find the syntax errors of the program and declares all those errors at the end of the compilation run. Once the user corrects all the errors, it then generates executable codes.
 - (b) **Interpreter:** It is a system software, which is also used to translate source codes to object codes. It scans the lines of source program one by one. If there is an error in a line of source program, then it declares that error before proceeding to the next line. Therefore, it becomes necessary for the user to correct that error before finding errors in the remaining program, if any.
 - (c) **Assembler:** It is a system software which is used to translate assembly language program to object code.
- (v) **Diagnostic Routines:** It is a system software which is usually a part of operating system and is provided by the computer manufacturer. These are those programs which help the user in debugging of program as well as to find out the details of various equipments used in the computer, like:
- 1. What type of Processor is installed in the computer like P-III or P-IV and its speed?
 - 2. What is total amount of main memory like 128MB/256MB?
 - 3. What type of keyboard is attached with the computer like 101 Keys/104 keys/Multimedia Keyboard?

4. What is display type like VGA/SVGA?
5. What type of mouse is attached with computer like 2 buttons/3buttons/scroll mouse/Mechanical Mouse/Optical Mouse?
6. Is separate math coprocessor present in computer?
7. Where is BIOS (Basic I/O) manufacture like AWARD BIOS or ANI BIOS?

(vi) Spooling Software: The purpose of spooling software is to compensate for the speed differences between the computer and its peripheral devices. Spooling software is usually encountered in large system and network computing environments.

To preclude the computer from being slowed down by input and output devices, many computer systems employ spooling software. These programs take the results of computer programs and move them from primary memory to disk. This area on the disk is called the output spooling area. Thus the output device can be left to interact primarily with the disk unit, not the CPU. Spooling utilities can also be used on the input side, so that programs and data to be processed are temporarily stored in an input spooling area on disk.

(vii) Object oriented programming: With traditional programming may approach, developing a new program means writing entirely new codes which may take years to complete, yet not meeting the desired quality standards. Since each program is written from scratch, quality is often poor, productivity of programmers is low, and programs are usually behind schedule. When program modifications are needed, the code must be rewritten and tested. As programs become longer and more complex, achieving a reasonable quality level becomes a formidable task.

The solution to this problem is a new way of developing software using an object oriented language.

An object is a predefined set of program code that, after having been written and tested, will always behave the same way, so that it can be used for other applications. All programs consist of specific task such as saving or retrieving data and calculating tools. In object-oriented programming, an object is written for each specific task and saved in a library so that anyone can use it.

In OOP, object are selected by pointing to a representative icon. A small amount of code necessary for finishing the program is written and then linking these objects together creates a new program. Object can be modified, reused, copied, or created. When an object is updated, all programs using that object can be automatically updated as well. OOP offers the following advantages:

- Allows graphical user interface.
- Ease of use.
- Faster program development.
- Enhanced programmer productivity.
- More reliability and contains fewer errors.

- When an object is updated, all programs using that object updated automatically.

However, large programs produced using OOP are slower and expensive since they require more computer resources.

Question 8

Describe briefly, the following terms with reference to Information Technology:

- | | |
|----------------------------|---------------------|
| (i) Subroutine | (PE - II May 2005) |
| (ii) Interpreter | (PE - II Nov. 2006) |
| (iii) Object Program | (PE - II Nov. 2006) |
| (vi) Compiler | (PE - II Nov. 2005) |
| (v) Debug | (PE - II Nov. 2005) |
| (vi) Concurrent Processing | (PE – II Nov. 2007) |
| (vii) Security Software | (PE – II Nov. 2008) |

Answer

- (i) **Subroutine** – It is a subset of instructions that appears over and again in the program or finds applications in several programs. It is economical to write it once and for all. This saves time for writing and debugging and can be used repeatedly in the same program.
- (ii) **Interpreter**: It refers to a language translator that converts source program written in high level language to machine code and executes it immediately statement by statement.
- (iii) **Object program**: It refers to a program expressed in a machine language, which can be directly executed by a particular computer. A compiler takes source program as an input and produces the object code/program.
- (iv) **Compiler**: It is a software which converts source programs written in a high level language into machine level language. It is an important part of systems software for most computers.
- (v) **Debug**: Error in a programme is called a bug and the process of finding and correcting the errors in a source programme is called debug.
- (vi) **Concurrent processing**: It refers to the capability of a computer system to share memory among several programs and to execute the instructions, provided by each during the same time frame.

(vii) **Security software:** DBMS contains a security software package which provides a variety of tools to shield the database from unauthorized access. Security consideration should include means of controlling physical access to hardware and software while ensuring that authorized person can add, delete and update the database.

DATA STORAGE AND RETRIEVAL

Question 1

Distinguish between the following:

- (i) Master File and Transaction File (PE – II Nov. 2003 & May 2007)
- (ii) Sequential File Organization and Random File Organization (PE – II Nov. 2005 & May 2007)

Answer

(i)

No.	Master File	Transaction File
1.	This file stores the permanent records of an organization which show the current status.	This file stores daily transactions of an organization.
2.	This file consists of static data and is less volatile in nature.	This file is frequently changed to store current transaction i.e. this file is highly volatile.
3.	Master file is updated on the basis of transaction file.	Transaction file is used to update Master file.
4.	It is necessary to take the backup of Master files for security purpose.	Transaction files are no longer required after updation and transaction entries can be deleted after updation. Therefore, it is not essential to take the backup of these files.
5.	Records in master file are stored in ascending order of primary key.	Transaction file stores the entries in the order in which they arrive.
6.	Master file stores one record corresponding to each primary key.	There can be more than one entry for a particular master record.
7.	Examples of Master files are Item file,	Sales file, Day Book, deductions file etc.

Customer file, Employee file etc.	are example of transaction files.
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(ii) Sequential File Organization and Random File Organization

Sequential File Organization	Direct File Organization
1. There exists a definite relationship among adjacent records.	No relationship exists among adjacent records, as records are stored randomly.
2. Desired record is searched by sequential access. Hence, more time is required to find the desired record.	Desired record is accessed by direct access, hence desired record is searched quickly.
3. Updation of Master file on the basis of Transaction file takes place by Brought-forward Carried-forward file method, in which original master file is retained.	Updation of Master file on the basis of Transaction file takes place by Overlaying in disk, in which original master file is overwritten by updated master records.
4. Tape devices support sequential file organization.	Direct Access Storage Devices (DASD) like Magnetic disk, Floppy disk, Optical Laser disk support Direct File Organization.
5. This file organization is suitable for batch processing like payroll application and is not used for on-line queries like Banking System, Railway/Airlines Reservation system.	This file organization is suitable for on-line applications like Banking System, Railway/Airlines Reservation System where immediate response is required.

Question 2

Describe various factors which determine the best file organization for an application.

(PE – II May 2003, Nov 2006 & Nov. 2008)

Answer

Best File Organization: The selection of best file organization for a particular application depends upon the following factors:

- (i) **File Volatility:** It refers to the number of additions and deletion to the file in a given period of time. Applications which require large number of addition/deletion are called high volatile. An ISAM file would not be a good choice in such situation, since addition would have to be placed in the overflow area. Sequential file organization would be appropriate if there were no interrogation requirements.
- (ii) **File Activity:** It is the proportion of master file records that are actually used or accessed in a given processing run. At one extreme is the real-time file where each transaction is processed immediately and hence at a time only one master record is accessed. Direct access organization is best suited here. At another extreme, for a payroll master file

where almost every record is accessed when the weekly payroll is processed. A sequential master file would be more efficient in this case.

- (iii) **File Interrogation:** It refers to the retrieval of information from a file. If the retrieval of records must be fast to support a real time operation then direct organization is more efficient. If the requirements for data can be delayed, then all the individual requests can be batched and run in a single processing run with a sequential file organization. Large files that require many individual references to records must be organized under some type of direct access method. However, in small files, it may be more efficient to search the entire file sequentially or with a more efficient binary search, to find an individual record than to maintain complex indexes or direct addressing scheme.
- (iv) **File Size:** Large files that require many individual references to records with immediate response must be organized under some type of direct access method. But, with small files, it may be more efficient to search the entire file sequentially or with more efficient binary search, to find an individual record than to maintain complex indexes or complex direct addressing scheme.

Question 3

Write short note on File Management system.

(PE – II May 2007)

Answer

File Management System: In this system, different users work on their independent computers and maintain their own data files. Each user has its own application software according to the requirements which was either developed in-house or got developed from external software agency according to the requirements. Instead of getting integrated software developed, different users have independent modules for data processing. Such system of maintaining files creates many problems as discussed below:

- (a) **Data redundancy:** When same data files are stored at different locations, then it is called data redundancy. It causes problem when the data has to be updated. Different users may use same data as to occur inconsistency among different files.
- (b) **Lack of Data integration:** Data files of different users are not integrated with each other, therefore changes made by one user are not made in each file automatically. It is an expensive and time consuming process for an organization.
- (c) **Data inconsistency:** Lack of Data integration create data inconsistency. When at a particular time, data stored in different files does not reconcile with each other, then it is called data inconsistency.
- (d) **Program-data dependence:** Software modules being used by different users are developed in high level programming languages like BASIC, COBOL etc. These high level languages use different file formats. Therefore, when program written in one programming language is required to be changed in another language, then it becomes essential to change the format of data files also.

Question 4

Explain the various advantages and disadvantages of direct access storage.

(PE – II Nov. 2007)

Answer

Advantages of direct access storage:

- (i) Magnetic rigid disk is a direct access storage (DAS) medium; therefore, individual records can be retrieved without searching through the entire file.
- (ii) The costs of DAS are steadily declining.
- (iii) For real-time systems where direct access is required, disks are currently the only practical means of file storage.
- (iv) Records can be readily updated by writing the new information over the area where the old information was stored.
- (v) With removable disk packs, a single disk drive can store large quantities of data, although all but one of the disks is offline at any given point in time.
- (vi) Interrelated files stored on magnetic disk can allow a single transaction to be processed against all of these files simultaneously.

Disadvantages: Updating a master file stored in DAS destroys the old information. Therefore, it does not provide an automatic audit trail. When disk is used, backup and audit trail require that each old master file records be copied to another medium prior to update.

Question 5

Describe briefly, the term "File Volatility" with reference to Information Technology

(PE – II May 2008)

Answer

File Volatility: File Volatility refers to the number of additions and deletions performed in a file in a given period of time. An example of a volatile file is a "Payroll" file where employees' roster continuously changes.

Question 1

Describe briefly, the following terms with reference to Information Technology:

- (i) *Data Independence* (PE – II May 2004)
- (ii) *Object oriented Database* (PE – II May 2005)
- (iii) *Structured Query Language (SQL)* (PE – II May 2006)

Answer

- (i) **Data Independence:** Database system keeps description of data separate from applications that use the data. Thus, changes in the data definition can occur without necessarily requiring changes in every application programs that uses the data. The result could be substantial reduction in program maintenance cost i.e. the cost to upgrade application program in response to changes in the file structure.
- (ii) **Object oriented database or OODB:** It provides a repository of reusable objects that only need to be created once. This allows new applications to be put together by appropriately arranging the objects stored in the OODB.
- (iii) **Structured Query Language (SQL):** It refers to a set of commands for creating, updating and accessing data from a data base. It also aids the manager to make ad hoc queries from the database.

Question 2

Give one or two reasons for each of the following:

- (i) *Preference of relational database model with comparison to hierarchical database model.* (PE – II Nov. 2002)
- (ii) *Use of File pointer.* (PE – II May 2004)
- (iii) *SQL* (PE – II May 2008)

Answer

- (i) A relational database is structured into a series of two dimensional tables. It allows

flexibility in conducting database queries and creating reports. The link between data elements need not to be made explicit at the time the database is created. It is more flexible and provides managers with rich opportunity for ad-hoc reports and queries. In case of hierarchical data base, hierarchy of records must be determined and implemented before a search can be conducted.

- (ii) **Use of File Pointer:** File pointers establish linkage between records and are a basic part of the file organization of all the database models except the relational model. A pointer is the address of another related record that is "pointed to". The pointer directs the computer to that related record. It is placed in the last field of a record, if more than one pointer is used, then in the last fields.
- (iii) **SQL:** SQL stands for Structured Query Language. It is a query language having a set of easy to use commands for creating, updating, deleting, and accessing data from a database. It allows end users to perform ad hoc queries on the database interactively without the aid of programmers.

Question 3

Explain Database Management Systems (DBMS). Why is it being preferred in comparison to Traditional File Processing Systems?
(PE – II Nov. 2002)

Answer

A database management system software (DBMS) is the tool that computers use to achieve the processing and orderly storage of data. A database is a repository for related data. A database might contain information about customers, vendors, employees, sales and inventory. Each piece of information can be added to a database and extracted later in a meaningful way. DBMS is the collection of programs that allows users to access and work with a database.

Earlier information systems had a file processing orientation. Therefore, data needed for each user application was stored in independent data files. Processing consisted of using separate computer programs that updated these independent data files and used them to produce the documents and reports required by each separate user application. This file processing approach has several problems such as data duplication, lack of data integration and dependence of programs on data structure etc., that limit its efficiency and effectiveness for end- users.

The DBMS offers following distinct advantages which makes it preferable to traditional file processing systems:

- (i) **Data sharing:** The data from the entire company is at the disposal of users who need them.
- (ii) **Reduced data redundancy:** A database minimizes duplication of data from file to file.
- (iii) **Improved data integrity:** Since data redundancy is minimized, data inconsistency and the threat to data integrity are substantially reduced.
- (iv) **Data independence:** A database system keeps descriptions of data separate from the

applications that use the data. Thus, changes in the data definitions can occur without requiring changes in every application program that uses the data.

- (v) **Increased application programmer and user productivity:** Most DBMS offer application program development tools that help application programmers to write program code. Users can also increase their productivity when query languages and report generators allow them to produce reports from the database with little technical knowledge and without any help from data processing.
- (vi) **Improved data administration and control:** A department devoted to the supervision of data permits better enforcement of standards for defining data elements and data relationships.
- (vii) **Increased emphasis on data as a resource:** Establishing a database administration (DBA) and deploying a DBMS acts as an advocate for the concept of information as a corporate resource, to aid in managerial decision-making and long-range planning.

Question 4

Describe the main functions performed by the Database Administrator.

(PE – II Nov. 2003 & May 2006)

Answer

The database administrator is a database professional who actually creates and maintains the database, and carries out the policies developed by the data administrator. He performs the following main functions:

- (i) Determines and maintains the physical structure of the database.
- (ii) Provides for updating and changing the database, including the deletion of inactive records.
- (iii) Creates and maintains edit controls over changes and additions to the database.
- (iv) Allows only specified users to access certain paths into the database and thus prevents unauthorized access.
- (v) Also prepares documentation which includes recording the procedures, standards, guidelines and data descriptions necessary for the efficient and continued use of the database environment.
- (vi) Ensures that operating staff performs its database processing related responsibilities which include loading the database, following maintenance and security procedures, taking backups, scheduling the database for use, etc.
- (vii) Ensures that standards for database performance are met and the accuracy, integrity and security of data is being maintained. He also sets up procedures for identifying and correcting violation of standards documents and corrects errors.

- (viii) He is responsible for incorporating any enhancement into the database environment which may include new utility programs or new system releases and changes into internal procedures for using database etc.

Question 5

What do you mean by Structured Query Language (SQL)? Explain its utility in database management. (PE – II Nov. 2004)

Answer

SQL is a query language - a set of commands for creating, updating and accessing data from database. It allows programmers, managers and other users to ask adhoc questions of the database interactively without the aid of programmers. It is a set of about 30 English like commands such as Select.....From.....Where.

SQL has following features:

- Simple English like command;
- Command syntax are easy;
- Can be used by non-programmers;
- Can be used for different type of database management systems;
- Allows user to create, update database;
- Allows retrieving data from data base without having detailed information about structure of the records and without being concerned about the processes the DBMS uses to retrieve the data;
- Has become standard practice for DBMS.

Since SQL is used in many database management systems, managers who understand SQL syntax are able to use the same set of commands regardless of the DBMS software that they may use. Thus learning SQL provides managers with access to data in many database management systems.

Question 6

Write short notes on the following:

- (i) *Data Dictionary* (PE – II May 2003 & May 2005)
(ii) *Distributed Database.* (PE – II Nov. 2004 & Nov. 2007)

Answer

- (i) **Data Dictionary:** Data dictionary is a centralized depository of information, in a computerized form, about the data in the database. The data dictionary contains the

scheme of the database i.e. the name of each item in the database and a description and definition of its attributes along with the names of the programs that use them, and who is responsible for the data; authorization tables that specify users and the data and programs authorized for their use. These descriptions and definitions are covered under data dictionary.

The data dictionary is helpful in the following ways:

- If a data field is to be altered in any way or eliminated from the database, the dictionary can identify all programs that might require some modification.
- It is also helpful in protecting the integrity of database data.
- It helps programmer to quickly locate blocks of code that can be reused in new applications.
- It also ensures that all design or coding actions performed by an analyst are internally consistent with the application.

Thus, the data dictionary informs users or programmers of what data is available in the database and how it is used.

- (ii) **Distributed database:** Distributed data processing refers to a system in which computer intelligence is located at more than one site and the actual running of application programs and processing of data are completed at more than one site. Distributed data processing may save a lot of time and money for an Organisation. When processing is distributed, the data to be processed usually must be located at the processing site. This means that the data base, or parts of the data base must be distributed. There are two ways to distribute a database. The first one is to provide duplicates of all data at all sites. This approach is called a **replicated database**. Another means of distributing the database is to partition it. The data base may be divided into segments that are appropriate for certain locations and these segments distributed only to those locations. This approach is called a **partitioned database**. Distributed database systems usually reduce costs for an organization because they reduce transfer of data between remote site and the organization's headquarters. Distributed database systems may also provide organizations with faster response times for filling orders, answering customer requests, or providing managers with information.

Question 7

Describe briefly, why a file processing system reduces effectiveness of the end user applications ?
(PE-II May 2005)

Answer

The file processing system is still being used, but it has several problems that limit its efficiency and effectiveness for end user applications. These are stated below:

1. **Data Duplication:** Independent data files include a lot of duplicated data; the same data such as customer's name and address is recorded and stored in several files. This data

redundancy causes problems when data has to be updated, since separate file maintenance programs have to be developed and coordinated to ensure that each file is properly updated.

2. **Lack of Data Integration:** Having data in independent files makes it difficult to provide end users with information for ad hoc requests that require accessing data stored in several different files. Special computer programs have to be written to retrieve data from each independent file. This is difficult, time consuming and expensive for the organization.
3. **Data Dependence:** In file processing system, major components of a system i.e. the organization of files, their physical location on storage, hardware and the application software used to access those files depend on one another in a significant way. Application programs typically contain references to the specific format of data stored in the various files they use. Thus, if changes are made in the format and structure of data and records in a file, changes have to be made in all programs that use this file. This program maintenance effort is a major burden of file processing system.
4. **Other Problems:** Data elements such as stock numbers and customer address are generally defined differently by different end users and applications. This causes serious inconsistency in the development of programs, which access such data. In addition, integrity of the data is suspected because there is no control over their use and maintenance by authorized end users.

Question 8

Describe the salient features of Hierarchical database.

(PE-II May 2005 & Nov. 2008)

Answer

Features of Hierarchical Database

- Hierarchically structured database are less flexible than other database structures because the hierarchy of records must be determined and implemented before a search can be conducted. In other words, the relationships between records are relatively fixed by the structure.
- Ad hoc queries made by managers that require different relationships other than that are already implemented in the database may be difficult or time consuming to accomplish.
- Managerial use of query language to solve the problem may require multiple searches and prove to very time consuming. Thus, analysis and planning activities, which frequently involve ad hoc management queries of the database, may not be supported as effectively by a hierarchical DBMS as they are by other database structures.
- On the plus side, a hierarchical database management system usually processes structured, day-to-day operational data rapidly. In fact, the hierarchy of records is usually specifically organized to maximize the speed with which large batch operations such as payroll or sales invoices are processed.
- Records are logically structured in inverted tree pattern.

- Each record or node in hierarchy is related to other records in a parent-child relationship.
- It implements one-to-one and one-to-many relationship.
- Processing with group records of natural relations can be done faster.
- Child to many parents type logical structure finds difficulty in processing.

Question 9

Distinguish between DDL and DML.

(PE-II Nov 2005 & Nov. 2008)

Answer

Data Definition Language (DDL) is used to create a link between logical and physical structure of database file. Logical refers to the way the user views the data and physical refers to the way the data is stored on the storage media. Overall logical view of the data is called Schema and particular application view is called Subschema.

Functions performed by DDL include the following:

- Describes the Schema and Subschema.
- Describes the field name and data type of each field.
- Indicates the keys of record i.e. defines Primary, Secondary and Foreign key.
- Defines for data security restrictions i.e. defines the passwords and access rights of various users.
- Provides for logical and Physical data independence.
- Provides means for associating the related records of different files.

On the other hand, **Data Manipulation Language (DML)** provides the techniques for processing the data stored in database files.

Functions performed by DML include the following:

- Provides the techniques for data manipulation such as insertion, deletion and updation of records.
- Enables the user and application programmes to process the data on logical basis rather than physical location basis.
- Provides for programming languages independence. A DML must support various high level programming languages like COBOL, PL/1, C++ etc.
- Allows the user and application programmers to be independent of physical data structure and physical data structure maintenance.
- Provides for use of record relationship which is defined using DDL.

Question 10

Define Database. Explain in brief different types of databases.

(PE-II May 2006)

Answer

Data base: A data base is a repository for related collection of data. It is a computer file system that uses a particular file organization to facilitate rapid updating of individual records, simultaneous updating of related records, easy access of information by all applications programs and rapid access to all stored data which must be brought together for a particular routine report or inquiry or a special purpose report or enquiry.

The main types of databases are discussed below:

- (i) **Operational data bases:** These data bases store detailed data needed to support the operations of the entire organization. These are also called subject area data bases, transaction data bases and production data bases.
- (ii) **Management data bases:** These data bases store data and information extracted from selected operational and external data base. They consist of summarized information mostly needed by the top management and other end users as part of their decision support systems and executive information systems to support managerial decision-making.
- (iii) **Information warehouse data bases:** It stores data from current and previous years. It contains data that has been extracted from the various operational and management databases of an organization. It is a central source of data that has been standardized and integrated so that it can be used by different levels of management in an organization.
- (iv) **Distributed data bases:** These are data bases of local work groups and departments at regional offices, branch offices, manufacturing plants and other work sites.
- (v) **End user data bases:** These data bases consist of data files developed by end users at their workstations. For example, users may have their own electronic copies of documents they have generated with word processing package or received by electronic mail.
- (vi) **External data bases:** Access to external, privately owned online data bases or data banks is available for a fee, to the end users and organizations from commercial information services.
- (vii) **Text data bases:** Text data bases are natural outgrowth of the use of computers to create and store documents electronically. Thus, online data base services store bibliographic information such as publications in larger text data bases. They are also available on CDROM or optical disks.
- (viii) **Image data Base:** A wide variety of images can also be stored electronically in image data bases. For example, electronic encyclopedia is available on CD-ROM. It can be used in document image processing. Thousands of pages of business documents can be optically scanned and stored as document images on a single optical disk. Workers can view and modify documents at their own workstations and electronically transfer them to the workstations of other end users in the organization.

Question 11

Write True or False for each of the following statements:

- (i) DML describes the data type and name of each field. (PE-II Nov. 2006)
(ii) Network database structure can be used to answer ad hoc queries. (PE – II May 2007)
(iii) Relational Database model specifies the relationship among data elements in advance. (PE – II Nov. 2008)

Answer

- (i) False (ii) False (iii) False

Question 12

What is database structure? Explain relational database structure. (PE – II May 2007)

Answer

The approach used to organize records and their relationships logically, is called Database Structure.

The three traditional data base structures are:

- (i) Hierarchical database structure.
- (ii) Network database structure.
- (iii) Relational database structure.

Relational database structure: In this database structures, records are stored in the form of two dimensional tables. The table is a file, in which each row represents one record and each column represents a field. In this database structure, relationships between the records need not to be specified in advance. Relational databases provide the flexibility in performing database queries and creating reports from more than one file by establishing the relationship among them on the basis of primary key. This relationship among the files can be created at any time according to the requirement and need not to be specified at the time of creation of database files.

The relational database structure is more flexible than hierarchical or network database structures in providing answers of ad hoc reports but it does not process the large batch applications with the speed of hierarchical or network databases. Examples of Relational Database Management Systems (RDBMS) include Oracle, IBM DB2, SQL Server, MSAccess etc.

Question 13

Mention the advantages of DBMS. (PE – II May 2008)

Answer

Advantages of DBMS (Database Management System) are as follows:

1. **Data Sharing:** The data from the entire company is available at one place and at the disposal of the users who need them, which helps them to analyze a large store of information.
2. **Reduced Data Redundancy:** A database minimizes duplication of data from file to file.
3. **Improved Data Integrity:** Because data redundancy is minimized, data inconsistency and the threat to data integrity are substantially reduced.
4. **Data Independence:** A database system keeps descriptions of data separate from the applications that use that data. Thus, changes in the data definitions can occur without changing the application program that uses the data.
5. **Increased Application Programmer and User productivity:** An Application program development tool offered by DBMS improves the programmer's productivity. The users can also increase their productivity by using query languages and report generators that allow them to produce reports from the database with little technical knowledge.
6. **Improved Data Administration and Control:** Since the responsibility of database is at one person's hand, it permits better enforcement of standards for defining data elements and data relationships. Moreover, access to data, privacy of data, updates and deletions of data become much easier to control.
7. **Increased Emphasis on Data as a Resource:** Establishing database administration and deploying a database management system results in greater corporate attention to information systems and aids to managerial decision making and long-range planning using the database as the basic information resource.

Question 14

Discuss various issues related to data management.

(PE – II May 2008)

Answer

All issues regarding the effective management of data fall into at least one of the following categories:

- (1) **Content:** What data should the organization collect in future? What data are being currently collected by the organization?
- (2) **Access:** In what ways should organized users access the data in order to effectively perform their jobs? This issue involves the timing required to get data to the users when they need it, and also the issues of which users have a right to which data.
- (3) **Organization:** In what ways should the data be logically and physically organized to the key types of data accesses required by the users?
- (4) **Accuracy:** Which validation, editing and auditing procedures are necessary in every stage of the input - processing - output cycle to ensure that data and information generated from the data are correct?

- (5) **Integrity:** What controls are necessary in each stage of the input-processing-output-storage cycle to ensure that data are up-to-date and that changes to specific occurrences of data are made everywhere in the system?
- (6) **Security:** How will data be protected from such possible events as unauthorized access, unauthorized modification, outright theft, and malicious or unintentional destruction?
- (7) **Privacy:** How will data be safeguarded to protect the rights of individuals to privacy?
- (8) **Cost:** How should data-related costs be controlled? To which sets of data and information needs should scarce resources be allocated?

SOME ADVANCED SYSTEMS

Question 1

Write True or False for the following statement

The decision support system is useful for structured problems. (PE – II May 2003)

Answer

False

Question 2

Distinguish between the following:

(i) Online system and Real time system (PE – II Nov. 2004 & Nov. 2007)

(ii) Computer Aided Design (CAD)/Computer Aided Manufacturing (CAM)

(PE – II Nov. 2005)

(iii) On line system and Batch processing

(PE-II Nov 2006)

Answer**1. Online System and Real Time System**

Online Systems: Online system refers to processing of individual transactions as they occur from their point of origin as opposed to accumulating them into batches. This is made possible by such direct access devices as magnetic disk and number of terminals connected to, and controlled by a central processor. In this way, various departments in a company can be connected to the processor by cable. If operating companies are a number of miles away from the processor then they are linked by means of telegraph, telephone lines or even through satellite. This type of processing provides multi-access to information files by terminal users and also enables them to update files with transaction data. Some examples where online applications are being used are electricity and gas boards, banking system, tour operators, stock exchanges and for stock control.

Real Time systems: The term **real time system** refers to the technique of updating files with transaction data immediately after the event to which it relates occurs. Real time system is basically on-line system with one specialty in inquiry processing. The response of system to the inquiry itself is used to control the activity. Real time systems usually

operate in multi programming and multi processing. This increases both availability and reliability of the system. CPU's in real time systems should possess capability of what is known as program interrupts.

Some of the leading areas for real-time applications are sales order processing, transport and travel reservation, manufacturing control system, and airline reservation system.

(ii) Computer Aided Design (CAD)/Computer Aided Manufacturing (CAM)

Computer-Aided Design (CAD) refers to use of a wide range of computer-based tools that assist engineers, architects and other design professionals in their design activities. It involves both software and sometime special-purpose hardware. CAD is sometimes translated as "computer-assisted" or "computer-aided drafting". First commercial applications of CAD were in large companies in automotive and aerospace industry, as well as in electronics. As computers became more affordable, the application area gradually expanded.

When the field was initially established it was typically limited to producing drawings similar to hand-drafted drawings. Advances in computer technology have allowed more skillful application of computers in design activities. Today CAD is not limited to drafting, it ventures into more "intellectual" areas of designer's expertise.

On the other hand, CAM stands for **computer-aided manufacturing**. CAM with computer-aided design systems produces quicker and more efficient manufacturing processes. This methodology is applied in different manufacturing areas. CAM can be used for following applications:

- Verification of the data
- Panelization of the design to fit the raw material.
- Ability to edit
- Ability to add manufacturing information

CAM has great usage in mechanical engineering. In electronic design automation, CAM tools prepare printed circuit board (PCB) and integrated circuit design data for manufacturing.

(iii) On-line systems and Batch processing: *Online systems* refer to processing of individual transactions as they occur from their point of origin as opposed to accumulating them into batches. Aside from transaction processing and file updating, inquiries can also be handled by the online processing systems.

On-line Systems are in use in various organizations for applications such as Electricity and Gas Boards, Banking industry, Tour operators and Stock exchanges.

On-line systems offer following benefits:

- (a) Integration of clerical staff with the computer.
- (b) Elimination of tedious tasks.
- (c) Reduction in paper work.

- (d) Improved accuracy.
- (e) Improved file updating.
- (f) Management information more readily available.
- (g) Improved customer services.
- (h) Reduced data preparation cost.

Batch Processing, on the other hand is used in those business applications that consist of high volume of input transactions. In this, batches of transactions are accumulated in a file sorted by the key field and processed against the master file to update the latter and produce the desired results. This job is done periodically and scheduled at a non-peak time depending upon the workload. Under batch processing, the files can be stored on sequential media also.

Question 3

What is Decision Support System (DSS)? Explain its various components.

(PE – II May 2004 & May 2006)

Answer

Decision Support Systems: These are information processing systems which help the managers in decision making process. Advancement in hardware technology, interactive computing design graphics capabilities and programming languages has helped in the development of decision supports systems. These systems support management decision making process by solving relatively unstructured problems. A friendly computer interface eases the communication between the user and the decision support system.

A decision support system has four basic components - (i) the user, (ii) one or more databases, (iii) a planning language, and (iv) the model base. These are briefly discussed below:

- (i) **The user:** The user of a decision support system is usually a manager with an unstructured or semi-structured problem to solve. The manager may be at any level of authority in the organization (e.g., either top management or operating management). Typically, users do not need a computer background to use a decision support system for problem solving. The most important knowledge is a thorough understanding of the problem and the factors to be considered in finding a solution. A user does not need extensive education in computer programming since he has to concentrate on what should be accomplished rather than on how the computer should perform each step.
- (ii) **Databases:** Decision support systems include one or more databases. These databases contain both routine and non-routine data from both internal and external sources. The data from external sources include data about the operating environment surrounding an organization – for example, data about economic conditions, market demand for the organization's goods or services, and industry competition.

Decision support system users may construct additional databases themselves. Some of the data may come from internal sources. An organization often generates this type of data in the normal course of operations. The database may also capture data from other subsystems such as marketing, production, and personnel.

- (iii) **Planning languages:** Two types of planning languages that are commonly used in decision support systems are: (1) general –purpose planning languages and (2) special-purpose planning languages. General-purpose planning languages e.g. languages in most electronic spreadsheets allow users to perform many routine tasks such as retrieving various data from a database or performing statistical analyses. Special-purpose planning languages are more limited in what they can do, but they usually do certain jobs better than the general-purpose planning languages. Some statistical languages, such as SAS, SPSS, and Minitab, are examples of special purpose planning languages.
- (iv) **Model base:** The planning language in a decision support system allows the user to maintain a dialogue with the model base. The model base is the “brain” of the decision support system because it performs data manipulations and computations with the data provided to it by the user and the database. The analysis provided by the routines in the model base is the key to supporting the user's decision. The model base may dictate the type of data included in the database and the type of data provided by the user. Even where the quantitative analysis is simple, a system that requires users to concentrate on certain kinds of data can improve the effectiveness of decision making.

Question 4

What is an expert system? Explain the various elements of an expert system. Also write its advantages. (PE – II May 2004 & Nov. 2005)

Or

What is an expert system? Explain its various components. (PE - II Nov. 2007)

Answer

An expert system is a computerized information system that allows non-experts to make decisions comparable to those of an expert. Expert systems are used for complex or ill – structured tasks that require experience and specialized knowledge in narrow and specific subject areas.

Various elements of an expert system are briefly discussed below:

- (i) **Knowledge base:** This includes the data, knowledge relationships , rules of thumb (heuristics), and decision rules used by experts to solve a particular type of problem. A knowledge base is the computer equivalent of all the knowledge and insight that an expert or a group of experts develop through years of experience in their field.
- (ii) **Inference engine:** This program contains the logic and reasoning mechanisms that simulate the expert logic process and deliver advice. It uses data obtained from both the knowledge base and the user to make associations and inferences, form its conclusions, and recommend a course of action.

- (iii) **User interface:** This program allows the user to design, create, update, use and communicate with the expert system.
- (iv) **Explanation facility:** This facility provides the user with an explanation of the logic the expert system used to arrive at its conclusion.
- (v) **Knowledge acquisition facility:** Building a knowledge base, referred to as knowledge engineering, involves both a human expert and a knowledge engineer. The knowledge engineer is responsible for extracting an individual's expertise and using the knowledge acquisition facility to enter it into the knowledge base.

Advantages offered by expert system are:

- They provide a cost effective alternative to human experts.
- They can outperform a single expert because their knowledge is representative of numerous experts. They are faster and more consistent and do not get distracted, overworked or stressed out.
- They produce better quality and more consistent decisions. Expert systems assist users in identifying potential decision making problems, which increases the probability that sound decisions will be made.
- They can increase productivity.
- They preserve the expertise of an expert leaving the organization.

Question 5

Write a short note on Expert Systems.

(PE – II Nov. 2002)

Answer

Expert System: An expert system is a computerized information system that allows non-experts to make decisions comparable to those of an expert. Expert systems are used for complex or ill structured tasks that require experience and specialized knowledge in narrow, specific subject area. An expert system typically contains the following components:

- (i) Knowledge base
- (ii) Inference engine
- (iii) User interface
- (iv) Explanation facility, and
- (v) Knowledge acquisition facility.

Expert systems can be example-based, rule-based or frame-based.

In example-based system, the example is converted into decision tree that is used to match the case at hand and those previously entered in the knowledge base.

The rule-based systems are created by storing data and decision rules as if – then - else rules. These systems are useful when history of cases is unavailable or when a body of knowledge can be structured.

Frame-based systems organize all the information into linked records in a data file called frame. Rules are then applied to extract relevant information.

Advantages

- (i) It provides cost-effective alternative to human expert.
- (ii) It gives faster, consistent and good quality decisions.
- (iii) It increases productivity and preserves the expertise of an expert leaving the organization.

Question 6

What do you mean by Artificial Intelligence ? Describe any two types of artificial intelligence used in Information Technology. (PE-II May 2005)

Or

What do you mean by Artificial intelligence ? Describe four types of Artificial Intelligence used in Information Technology. (PE – II Nov. 2008)

Answer

Artificial Intelligence

Artificial Intelligence is a software that tries to emulate aspects of human behavior, such as, reasoning, communicating, seeing and hearing. AI software can use its accumulated knowledge to reason and, in some instances, learn from experience and thereby modify its subsequent reasoning. There are several types of AI, as discussed below:

- (i) **Neural Networks (NN):** These are computing systems structured to emulate the brain's learning process. Like the brain, NN use interconnected processors that perform many operations simultaneously and interact dynamically to learn from data as it is processed. Although NN do not handle unexpected event very well, they are very good at recognizing patterns that humans overlook and at uncovering emerging trends. Like humans, NN learn by fine-tuning their accumulated knowledge using the facts present in each new case.
- (ii) **Voice Recognition System (VRS):** VRS present the user with a hand-free voice-interactive computer interface. In other words, the users can discard conventional input devices such as keyboard or mouse, and access the computer system by simply talking to it. This technology is yet to come to mainstream as it is still in process of development. To date, most speech systems are used for text dictation or for single command voice menu options.
- (iii) **Voice Synthesizers:** These are also known as voice output devices or audio-response units. These convert data in main storage to vocalized sounds understandable to humans. They can be relatively expensive and connect to almost every computer multimedia systems, which incorporate multi-media presentation and voice output, are popular amongst consumers. Available in various uses, such as children education software, voice output serves as an excellent media for communicating information and

especially for blind people. It seems from the present trends that voice output will soon become one of the dominant methods of output.

- (iv) **Natural Language:** The most attractive means of entering data into the computer could be by natural language. Those unable to remember a command or lost in hierarchy of menus, may long for a computer which is able to understand instructions expressed in everyday words. However, due to the ambiguity of natural language (i.e., sentence structure and meaning), it is difficult for the computer to understand and execute instructions accurately. Therefore it is unlikely that such an interface would be available for sometime. Though research is continuing in this direction.

Question 7

Describe briefly various benefits provided by online systems.

(PE-II May 2006)

Answer

Benefits provided by Online Systems - Online systems provide a number of benefits all of which assist in improving administrative efficiency which is essential in today's competitive business environment. Some of the benefits are out-lined below:

1. **Integration of clerical staff with the computer:** Online systems assist in harnessing activities of clerical staff to the computer by the use of terminals. They can have access to information which is required for the efficient performance of their jobs in dealing with customer inquiries and order processing.
2. **Elimination of tedious tasks:** Routine clerical tasks are replaced by terminal operations providing a greater degree of job interest, operating efficiency and job satisfaction.
3. **Reduction in paper work :** Volume of paper work generated by normal clerical system and batch processing system is relatively high. Online systems reduce the volume of print-out required for management reports since the information can be displayed on terminal screen on demand.
4. **Improved accuracy:** As terminal messages are checked for accuracy before being transmitted to the computer by data validation programs, the quality of information in a system increases as the input errors are reduced. Hence, information is more reliable.
5. **File updating improved :** Master files are more easily updated by terminal key board with regard to transaction data, since special runs are not required to be set up as is the case with batch processing applications.
6. **Management information more readily available:** Management information becomes more readily available by direct access facilities which enables managers to obtain a greater degree of control to the operations for which they are responsible.

7. **Improved customer services:** Improvements in the level of customers service can be expected in those systems which are concerned with appliances sales, booking systems and account inquiries.
8. **Reduced data preparation cost:** On-line systems dispense with the need to convert human sensible data into machine sensible data thereby eliminating punching and verifying operations. This saves time and the cost associated with such operations.

Question 1

Describe briefly, the following terms with reference to Information Technology:

- | | |
|---------------------------------|---------------------------------|
| (i) Packet switching | (PE – II Nov. 2002) |
| (ii) Routers | (PE – II May 2003 & Nov. 2006) |
| (iii) Asynchronous Transmission | (PE – II Nov. 2003) |
| (iv) Bandwidth | (PE – II Nov. 2003 & Nov. 2007) |
| (v) Client | (PE – II May 2004) |
| (vi) Multiplexer. | (PE – II Nov. 2004) |
| (vii) Object program | (PE – II Nov. 2006) |
| (viii) Gateways | (PE – II May 2007) |
| (ix) Domain Name | (PE – II Nov. 2008) |
| (x) Bridge | (PE – II Nov. 2008) |

Answer

- (i) **Packet Switching:** It is a sophisticated means of data transmission capacity of networks. In packet switching, all the data coming out of a machine is broken up into chunks. Each chunk has the address of the location it came from and also the address of the destination. This technique is used to move data around on the Internet.
- (ii) **Routers:** Routers are hardware devices used to direct messages across a network. They also help to administer the data flow by such means as redirecting data traffic to various peripheral devices or other computers by selecting appropriate routes in the event of possible network malfunctions or excessive use.
- (iii) **Asynchronous Transmission:** In Asynchronous mode of transmission, each character (1byte) to be transmitted is preceded by a start bit and terminated by one or more stop bits. The function of start bit is to tell the receiver where the new character starts and that of stop bit is to tell the receiver that the character has ended. This mode of transmission is designed for a situation where the characters are transmitted intermittently. This mode

is inefficient as the extra start and stop bits slow down the process of data transmission when there is huge volume of data to be transmitted.

- (iv) **Bandwidth :** Bandwidth represents the difference between the highest and lowest frequencies that can be used to transmit data. In other words, it refers to a channel's information carrying capacity. It is usually measured in bits per second (bps).
- (v) **Client:** It is a software that is used to contact and obtain data from a server software program on another computer, often across a great distance. Each client program is designed to work with one or more specific kinds of server programs. A web browser is a specific kind of client.
- (vi) **Multiplexer :** This device enables several devices to share one communicator line. It scans each device to collect and transmit data on a single line to the CPU. It also communicates transmission from the CPU to the appropriate terminal linked to the multiplexer.
- (vii) **Object program:** It refers to a program expressed in a machine language, which can be directly executed by a particular computer. A compiler takes source program as an input and produces the object code/program.
- (viii) **Gateways:** It is used to connect two dissimilar networks but do not possess network management facilities. They are used to connect LANs of different topologies e.g. Bus and Ring Network.
- (ix) **Domain Name:** It refers to the unique name that identifies an internet site. Domain name always have two or more parts, separated by dots. The part on the left is the most specific and the part on the right is most general. A given machine may have more than one domain name but a given domain name points to only one machine. E.g. icai.org; exam.icai.org.
- (x) **Bridge:** The main task of a bridge computer is to receive and pass data from one LAN to another. In order to transmit this data successfully, the bridge magnifies the data transmission signal. This means that bridge can act as a repeater as well as a link.

Question 2

Give one or two reasons for each of the following:

- | | |
|--|--------------------------------|
| (i) Use of multiplexer in data communication | (PE – II Nov. 2002 & May 2007) |
| (ii) Need of modem in data communication | (PE – II May 2003 & Nov. 2005) |
| (iii) Need of hub in a network | (PE – II May 2004) |
| (iv) Use of Gateway in computer network | (PE – II Nov. 2004) |
| (v) Need of Repeaters in the network | (PE – II May 2005 & Nov. 2006) |
| (vi) Need of Protocol Converters | (PE – II Nov. 2005) |
| (vii) Use of Bridges in the Network | (PE – II May 2006) |

(viii) *Use of Router*

(PE – II May 2007)

(ix) *Protocol Translator*

(PE – II Nov. 2008)

Answer

- (i) **Multiplexer** enables several devices to share one communication line. It scans each device to collect and transmit data on a single line to the CPU.
- (ii) **Need of Modem in data communication:** Modem stands for modulator/demodulator. It is a device that converts a digital computer signal into analog telephone signal or vice versa. Modems are required to tele-communicate computer data with ordinary telephone lines because computer data is in digital form but telephone lines are analog.
- (iii) **Need of hub in a network:** A hub is a hardware device that provides a common wiring point in a LAN. Each node is connected to the hub by means of simple twisted pair wires. The hub then provides a connection over a higher speed link to other LANs, the company's WAN or the Internet.
- (iv) **Use of Gateway in computer network:** Gateways are usually used to link LANs of different topologies, e.g., Ethernet and Token ring for enabling the exchange of data. They do not possess the management facilities of routers but like routers they can translate data from one protocol to another.
- (v) **Need of Repeaters in the network** – Repeaters are devices that solve the snag of signal degradation which results as data is transmitted along the cables. It boosts the signal before passing it through to the next location.
- (vi) **Need of Protocol Converters:** Protocols are the standard set of rules which govern the flow of data on a communication network. To enable diverse system components to communicate with one another and to operate as functional unit, protocol conversion is needed. It can be accomplished via hardware, software, or a combination of hardware and software.
- (vii) **Use of Bridges in the Network:** The main task of a bridge computer is to receive and pass data from one LAN to another. In order to transmit this data successfully, the bridge magnifies the data transmission signals. It can act as a repeater as well as a link.
- (viii) **Use of Router:** Router is a special purpose computer or software package that handles the connection between two or more networks. Routers spend all their time looking at the destination addresses of the packets passing through them and deciding on which route the packets should be sent.
- (ix) **Protocol translator:** It is a peripheral device which converts the communication protocol of one system into the protocol of another system so that the two systems are compatible enabling data to be transferred between them.

Question 3

Write True or False for each of the following:

- (i) Two dissimilar devices in a network can communicate with each other using bridges. (PE – II May 2003)
- (ii) A modem provides the connection between server and work station. (PE – II May 2004)
- (iii) Bridge is used to connect two similar networks. (PE – II Nov. 2007)
- (iv) Protocol is geometric arrangement of computer resources. (PE – II May 2008)

Answer

- (i) False (ii) False
- (iii) True (iv) False

Question 4

Distinguish between the following:

- (i) Local area network and Wide area network (PE – II Nov. 2002, Nov. 2005 & Nov. 2008)
- (ii) Distributed system and Computer network (PE – II May 2003)
- (iii) Synchronous and Asynchronous Data Transmission (PE – II May 2003, May 2005 & Nov. 2007)
- (iv) Centralized Processing and Distributed Processing (PE – II Nov. 2003 & May 2006)
- (v) Client-Server Architecture and Peer-to-Peer architecture (PE – II Nov. 2004)
- (vi) Ring network and Star network (PE – II Nov. 2004 & Nov. 2006)
- (vii) Serial transmission and Parallel transmission (PE – II May 2006 & Nov. 2008)
- (viii) Ring Network and Mesh Network (PE – II May 2006)
- (ix) Network-attached storage and Direct-attached storage (PE – II Nov. 2006)
- (x) Client-Server Model and Peer-to-Peer Model (PE – II May 2007)
- (xi) MODEM and Multiplexer (PE – II May 2008)

Answer

(i) Local Area Network and Wide Area Network

Following are the salient features of LAN :

- Multiple user computers are connected together.
- Computers are spread over a small geographic region.
- Communication channels between the computers are usually privately owned.

- Channels are relatively high capacity and error-free.
- LAN enables multiple users to share software, data, devices and physical media.

On the other hand, the salient features of **WAN** are as stated below:

- Multiple user computers connected together.
- Computers are spread over a wide geographic region.
- Communication channels such as long distance telephone service, satellite transmission etc. are provided by third party.
- Channels are relatively low capacity and error-prone.
- WAN operates at lower link speed, usually 1Mbps.
- WAN does not allow sharing of resources.

(ii) **Distributed system and Computer network:** A **computer network** is a collection of computers and terminal devices connected together by a communication system. The computers may include large-scale computers, minicomputers, terminals, workstations and miscellaneous devices. Two computers are said to be inter-connected if they are capable of exchanging information. The connection need not be via a copper wire; but lasers, u-waves and earth satellites can also be used. Computer networks increase the reliability of computer resources and facilitate overall system development. They also satisfy the prime objective of resource sharing which includes device sharing, file sharing, program sharing and program segmentation.

A **distributed system** is one in which the computing functions are dispersed among several physical computing elements. Computer systems are arranged in a computer network, with each system connected to one or more other systems. A distributed system is both a technological and organizational concept. Its premise is that information processing can be more effective if computer hardware, data, software and in some cases, personnel are moved physically closer to the people who use these resources. In distributed system, users have greater control over their computing environment.

Network may or may not be a distributed system, depending on how it is used.

(iii) **Synchronous and Asynchronous Data Transmission:** Under Synchronous Transmission bits are transmitted at fixed rate. The transmitter and receiver both use the same clock signals for synchronization. Synchronous transmission allows characters to be sent down the line without start-stop bits. It allows data to be sent as a multi-word blocks. It uses a group of synchronization bits, which is placed at the beginning and at the end of each block to maintain synchronization. Timing is determined by a modem.

It is faster way of data transmission and many data words can be transmitted per second. However, the synchronous device is more expensive as it must be smart enough to differentiate between the actual data and the special synchronous characters.

On the other hand, in **asynchronous transmission**, each data is accompanied by stop (1) and start (0) bits that identify the beginning and ending of the word. When no

information is being transmitted i.e. sender device is idle, the communication line is usually high i.e. there is continuous stream of 1. Asynchronous transmission is a reliable transmission system as the extra start and stop bits ensure that the sender and receiver remain in step with one another.

It does not require smart device to differentiate between actual data and start/stop bit.

However, it is inefficient as the transmission speed is slowed down when there is huge volume of information to be transmitted.

(iv) Centralized Processing and Distributed Processing

Centralized Processing	Distributed Processing
Complete data is processed by central host computer.	Data is processed locally at the user workstation but stored in the central host computer for sharing of data among various users.
All the database files are stored on the central host computer, hence security of data is of major consideration which requires regular backup.	Database files are physically distributed among various users as Partitioned database or Replicated database. Backup of data is taken by individual user.
Dumb Terminals/Intelligent Terminals are used.	Intelligent Terminals are used.
Central host computer is required to be of high speed, usually mini or mainframe computer, as entire workload is on the main CPU.	Central host computer known as Server can be even a microcomputer since data is processed by user workstations.
Waiting time of a user can be high, as main CPU may be busy in processing the data of other users. Terminals are connected with central host computer using high-speed communication link, which communicate with host computer frequently to access/process the data. Hence, communication expenditure is more.	Data is processed immediately; hence waiting time of users is less. Communication expenditure is less, as terminals called nodes communicate with server occasionally for data access.
Failure of Central host computer will paralyze the entire network.	Failure of server will not completely breakdown the entire network.

(v) Client-Server Architecture and Peer- to -Peer architecture: In **Client-Server architecture**, the network has certain machines and devices called servers that are specially dedicated to provide various services to the other computers called clients.

Different types of specialized servers include file, fax, printer, modem, email and database server. The most common type of client server arrangement is a LAN composed of microcomputers connected to a network server, which serves to all the clients (users) of the LAN. A client program running on one of the microcomputers can request specific data from the server. The server program retrieves the requested data from its databases and returns it to the client. This way, a LAN permits all the computers connected to it to share hardware, software and data.

On the other hand, in **Peer-to-Peer architecture**, there are no dedicated services. All computers are equal, and therefore, are termed as peer. Normally, each of these machines functions both as a client and a server. This arrangement is suitable for environments with a limited number of users. Moreover, the users are located in the same area and security is not an important issue while the network is envisaged to have a limited growth. At the same time, users need to freely access data and programs that reside on other computers across the network. The basic advantage of this architecture is simplicity of design and maintenance. Since there is no server, all nodes on the network are fully employed. Further, the network is not totally reliant on a particular computer and linking computers in a peer-to-peer network is more straightforward.

- (vi) **Ring network and Star network:** In Ring network, the network cable passes from one node to another until all nodes are connected in the form of a loop or ring. There is a direct point-to-point link between two neighboring nodes. These links are unidirectional which ensures that transmission by a node traverses the whole ring and comes back to the node, which made the transmission. Ring networks offer high performance for a small number of workstations or for larger networks where each station has a similar workload. These networks can span longer distances than other types of networks and are easily extendable.

The **Star network structure**, on the other hand, is very popular for LANs. In this topology, the network is characterized by communication channels emanating from centralized computer system. That is, processing nodes in a star network interconnect directly with a central system. Each terminal, small computer, or large mainframe can communicate only with the central site and not with other nodes in the network. If it is desired to transmit information from one node to another, it can be done only by sending the details to the central node, which in turn sends them to the destination. A star network is particularly appropriate for organizations that require a centralized data base or a centralized processing facility. In a Star network, it is easy to add new nodes and also remove nodes. A node failure does not bring down the entire network. It is easier to diagnose network problem through a central hub.

- (vii) **Serial transmission and Parallel transmission**

Serial Transmission: Under **Serial transmission**, one bit of data is transferred at a time. A serial port which facilitates serial transmission data is used for the installation of Mouse/Modem. It is a cheap mode of data transfer. Data can be transferred to long distances. However, in serial transmission, data transfer is slow.

Parallel Transmission: Under **parallel transmission**, a complete byte of data is transferred at a time. Centronic and IEEE are examples of Parallel ports used to connect Printer/Scanner. In parallel transmission data transfer is fast. However, it is an expensive mode of data transfer. Also, data cannot be transferred to long distances.

(viii) Ring network and mesh network

In a **ring network**, the network cable passes from one node to another until all nodes are connected in the form of a loop or ring. There is a direct point-to-point link between two neighboring nodes. These links are unidirectional which ensures that transmission by a node traverses the whole ring and comes back to the node, which made the transmission.

Mesh network is a random connection of nodes using communication links. Network lines are expensive to install and maintain. The links are planned to minimize cost and maintain reliable and efficient traffic movement. A mesh network may be fully connected or connected with only partial links. Each node is connected with a dedicated point-to-point link to every node. The reliability is very high as there are always alternate paths available if direct link between two nodes is down or dysfunctional.

(ix) Network-attached storage and directattached storage: Network-attached storage

(NAS) is a dedicated shared storage solution that attaches to a network topology, becoming immediately and transparently available as a network resource for all clients. NAS is platform and operating system independent. It can be attached without powering down the network, and requires no changes to the existing file servers. A NAS device is typically a stand alone, high performance, single-purpose system or component. It serves specific storage needs with its own operating system and integrated hardware and software. NAS devices are well suited to serve heterogeneous networks. They enable file and data sharing among different types of clients.

Direct attached storage (DAS), on the other hand, is a storage device that connects directly to a single server. Network workstations access the server to connect to this storage. Because the server may be handling distributed applications such as e-mail or databases, the performance of DAS is typically not as high as that of networked storage. DAS uses the security features of the server's network operating system.

(x)

	Client-Server model	Peer-to-Peer model
1.	In this model, number of computers, known as clients are connected to a single host computer known as server.	In this model, all the computers are interconnected with each other. There is no concept of server and clients. All computers behave as server as well as clients.
2.	It uses a dedicated server which provides various services to clients like hardware, software and data access.	It uses non-dedicated server. Non-dedicated server can also be used as a node for data entry, processing

	Different types of servers can be File, Fax, Print or Database server.	and output operations.
3.	Clients can share disk storage and printers attached with the server.	All computers can share the data/resources of each other.
4.	It is suitable for large organization having large number of nodes.	It is suitable in small organization having less number of nodes upto ten.
5.	Data transfer speed is more.	Data transfer speed is less which decreases even further with the increase in number of computers.
6.	Failure of server results in break-down of entire network.	Failure of one computer will not affect the working of other, only the data stored on the faulty computer will not be accessible to other computers.
7.	Server can not be used for data entry/result purposes, hence it can be said that all the computers are not fully employed.	All the computers are fully employed.
8.	Clients are required to be connected with server in a particular structure like Star Network.	Computers can be connected at any convenient point in the network like Ring Network.
9.	Clients can be dumb terminal or Intelligent terminals.	All computers are intelligent terminals.
10.	This architecture is employed where data security is of prime importance.	This architecture is used when security is not a bigger issue.

(xi) **MODEM and Multiplexer:** **Modem** stands for Modulator/Demodulator. It is a device that converts a digital computer signal into an analog telephone signal (i.e. it modulates the signal) and converts an analog telephone signal into a digital computer signal (i.e. it demodulates the signal) in a data communication system. Modems are required to telecommunicate computer data with ordinary telephone lines because computer data is in digital form but telephone lines are analog. Modems can be categorized into internal and external modems.

Multiplexer is a device that enables several devices to share one communication line. A number of devices are connected to the multiplexer. Multiplexer scans each device to collect and transmit data on a single line to the CPU. It also communicates transmission from the CPU to the appropriate terminal linked to the multiplexer. Devices connected to the multiplexer are polled and periodically asked whether there is any data to transmit. Data collected from all terminals are transmitted on same communication line.

Question 5

What is a Computer network? Describe the various networking architectures.

(PE – II Nov. 2002)

Answer

A computer network is a collection of computers and terminal devices connected together by a communication system. The set of computers may include large- scale computers, medium - scale computers, mini -computers and micro processors. The set of terminal devices may include intelligent terminals, dumb terminals, work stations and communication hardware.

Networking Architecture: The way in which individual computers, called nodes on a network interact with other computers on the network depends on how they are organized. The scheme of organizing network is called networking architecture. There are two basic types of architecture:

- (i) **Client – Server:** This type of network has certain machines and devices, called servers, that are specially dedicated to provide various services to other computers (called clients). The most common type of client-server arrangement is LAN composed of microcomputers connected to a network server, which serves to all the clients. A client program running on one of the microcomputers can request specific data from the server. The server program retrieves the requested data from its databases and returns it to the client. LAN permits all clients to share hardware, software and data including storage devices and printer.
- (ii) **Peer-to-Peer:** In peer -to -peer architecture, there are no dedicated servers. All computers are equal, and are termed as peer. Normally each of these machines functions both as a client and server. This arrangement is suitable for environment with a limited number of users. Moreover, the users are located in the same area and security is not a critical issue while the network is envisaged to have a limited growth.
 - Architecture is simple in design and maintenance.
 - Network is not totally reliant on a particular computer.
 - Linking of computer in peer- to -peer is simple and straight -forward.

Question 6

Explain the term Network structure. Describe various types of network structures and discuss their suitability.

(PE – II May 2003)

Answer

Network Structures: The geometric arrangement of computer resources, remote devices and communication facilities is known as network structure or network topology. A computer network is comprised of nodes and links. A node is the end point of any branch in a computer whereas a link is a communication path between two nodes.

A network structure determines which elements in a computer network can communicate with each other. Four basic network structures are commonly used.

- (i) **Star Network:** This is most common structure characterized by communication channels emanating from centralized computer system. The processing nodes interconnect directly with a central computer system. Each node can communicate only with the central server and not with other nodes in the network. If it is desired to transmit information from one node to another, it can be done only by sending the details to the central computer, which in turn sends them to the destination.

A star network is particularly appropriate for those organisations which require a centralized data base or a centralized processing facility. For example, a star network may be used in banking for centralized record keeping in an on-line branch office environment. Features of a star network are:

- It is easy to add or remove nodes.
- A node failure does not bring down the entire network.
- It is easier to diagnose network problems through a central hub, however central hub is a critical element and its failure may bring down the entire network.
- It costs more to cable a star configuration than other topologies.

- (ii) **Bus Network:** This structure is very popular for local area networks. In this structure, a single network cable runs in the building and all nodes are linked along with this communication line with two end points called the bus or backbone. Two ends of the cable are terminated with terminators.

- This structure is easy to use and understand and also reliable where network is small.
- It requires least amount of cable to connect the computers together and therefore less expensive.
- It is easy to extend by joining cable with connector or repeater.
- Heavy network traffic can slow a bus considerably. Since any computer can transmit data any time, computers interrupting each other can use a lot of bandwidth.
- Trouble shooting is difficult. A cable break or malfunctioning computer is difficult to detect, hence it can cause the whole network to stop functioning.

- (iii) **Ring Network:** In this network structure the network cable passes from one node to another until all nodes are connected in the form of a loop or ring. There is direct point-to-point link between two neighboring nodes. These links are unidirectional which ensures that transmission by a node traverse the whole ring and comes back to the node which made the transmission.

- It offers high performance for a small number of workstations or for larger networks where each station has a similar workload.
- Network can span longer distances than other types of networks.
- It is easily extendable.

- It is relatively expensive and difficult to install.
- Failure of one node can affect the entire network.
- Trouble shooting is difficult.
- Addition or removal of node can disrupt the entire network.

(iv) Mesh Network: In this network structure, there is random connection of nodes using communication links. In real life, network connections are not made randomly. Network lines are expensive to install and maintain. This network may be fully connected or connected with only partial links. In fully inter connected topology, each node is connected by a dedicated point to point link to every node. This means that there is no need for any routing function. The reliability is very high. However, fully connected networks are not very common because of the high cost, only military installations, which need high degree of redundancy may have such networks. In partially connected mesh topology, computer nodes are widely scattered. The function of routing information from one node to another is done using routing protocols.

- Mesh Network problems are easier to diagnose.
- Yields greatest amount of redundancy in the event that one of the nodes fails where network traffic can be redirected to another node.
- The cost of installation and maintenance is high.

Question 7

Describe the various factors which have contributed to the growth of Local Area Network (LAN). (PE – II Nov. 2003)

Answer

The following factors contributed to the growth of Local Area Network (LAN):

- (i) Security:** Security for programs and data can be achieved using servers that are locked through both software and by physical means. Diskless nodes also offer security by not allowing users to download important data on floppies or upload unwanted software or virus.
- (ii) Expanded PC usage through inexpensive workstation :** Once a LAN has been set up, it actually costs less to automate additional employees through diskless PCs. Existing PCs can be easily converted into nodes by adding network interface cards.
- (iii) Distributed processing:** Many companies operate as if they had distributed system in place. If numerous PCs are installed around the office, these machines represent the basic platform for a LAN with inter-user communication and information exchange.
- (iv) Electronic mail and Message Broadcasting:** Electronic mail allows users to communicate more easily among themselves. Each user can be assigned a mail-box on the server. Messages to other users can then be dropped into the mail-box and read by them when they log into the network.

- (v) **Organizational Benefits:** Benefits of LANs are numerous. These include reduced costs in computer hardware, software and peripherals, and a drastic reduction in the time and cost of training or re-training manpower to use the systems. In addition, the fact that you are networked helps managers and executive to communicate with each other more easily and faster, without any logistical constraints. Information flow too becomes a lot smoother with various departments having the ability to access or request for information and data pertinent to them.
- (vi) **Data management benefits:** Since data is located centrally on the server, it becomes much easier to manage it, as well as back it up. No file is transferred between users through floppies.
- (vii) **Software cost and upgradation:** If the organization is concerned about using licensed software, purchasing a network version can save a lot of money, since there would be no need to buy multiple copies of the same software for every machine in the organization. Therefore, software upgrades are much easier as any given package is stored centrally on the server.

Question 8

Communication software is an essential requirement of Data Communication system. Explain the various functions of this Data Communication Software. (PE – II Nov. 2003)

Answer

Communication software manages the flow of data across a network. They are written to work with a wide variety of protocols which are rules and procedures of exchanging data. Following functions are performed by the communication software:

(i) **Access Control:**

- Linking and disconnecting different devices
- Automatic dialing and answering telephones
- Restricting access to authorized users only
- Establishing parameters like speed, mode and direction of transmission.

(ii) **Network Management:**

- Polling devices to see whether they are ready to send or receive data
- Queuing input and output
- Determining system priorities
- Routing messages
- Logging network activity, use and errors.

(iii) **Data and File Transmission:** Controlling the transfer of data, files and messages among the various devices.

(iv) **Error Detection & Control:** Ensuring that the data sent is indeed the data received.

(v) **Data Security:** Protecting data during transmission from unauthorized access.

Question 9

Explain the concept of communication protocols.

(PE – II Nov. 2003, Nov. 2007)

Answer

Communication protocols are sets of rules or conventions that must be adhered to by both the communicating parties to ensure that the information being exchanged between them is received and interpreted correctly. A protocol defines the following three aspects of digital communication.

- (i) **Syntax** – The format of data being exchanged, character set used, type of error correction used, type of encoding scheme being used.
- (ii) **Semantics** – Type and order of messages used to ensure reliable and error-free information transfer.
- (iii) **Timing** – Define data rate selection and correct timing for various events during data transfer.

Communication protocols are defined in layers, the first of which is the physical layer or the manner in which node in a network are connected to one another. Both the network software and network interface card have to adhere to a network protocol. The RS232 C connector is the standard for some communication protocols. Subsequent layers, the number of which vary between protocols, describe how messages are packaged for transmission, how messages are routed through network, security procedures and the manner in which messages are displayed.

A number of different protocol codes are in use. For example, X.12 is the standard for electronic data interchange (EDI) X.75 is used for interconnection between networks of different countries, and XMODEM is used for uploading and downloading files. The set of most common protocols used on the Internet is called TCP/IP.

Question 10

Discuss the various data transmission techniques used in a computer network.

(PE – II May 2004)

Answer

Data transmission techniques: There are three basic types of data transmission techniques as discussed below:

- (i) **Circuit switching:** Circuit switching is what most of us encounter on our home phones. We place a call and either get our destination party or, in case we encounter a busy signal, we cannot transmit any message. A single circuit is used for the duration of the call.
- (ii) **Message switching:** Some organizations with a heavy volume of data to transmit use a special computer for the purpose of data message switching. The computer receives all transmitted data; stores it; and when an outgoing communication line is available, forwards it to the receiving point.
- (iii) **Packet switching:** It is a sophisticated means of maximizing transmission capacity of networks. This is accomplished by breaking a message into transmission units, called packets and routing them individually through the network depending on the availability of a channel for each packet. Passwords and all types of data can be included within the packet and the transmission cost is by packet and not by message, routes or distance. Sophisticated error and flow control procedures are applied on each link by the network.

Question 11

What do you understand by Local Area Network? Describe its basic components.

(PE – II May 2004 & May 2005)

Answer

Computer network is a collection of computers and technical devices connected together by a communication system. A local area network (LAN) is primarily a data transmission system intended to link computers and associated devices within a restricted geographical area such as an office building or several adjacent buildings. The linked computers and related equipments may be anything from full-scale mainframe computing systems to small desktop office workstations, terminals and peripherals etc. The key characteristic of a local area network is the fact that the whole of the network, confined to one site, is completely under the control of one organization. Organizations use LANs because they enable multiple users to share software, data and devices. LANs use a shared physical media, which is routed in the whole campus to connect various systems. LAN uses high-speed media (1Mbps to 30 Mbps or more) and are mostly privately owned and operated.

Local area network has following five components:

- (i) **File Server:** A network file server is a computer system used for the purpose of managing the file system, servicing the network printers, handling network communications, and other functions. A server may be dedicated in which case all of its processing power is allocated to network functions, or it may be non-dedicated which means that a part of the servers functions may be allocated as a workstation or DOS-based system.
- (ii) **The network operating system:** It is loaded into the server's hard disk along with the system management tools and user utilities. When the system is restarted, NetWare boots and the server comes under its control.

- (iii) **Workstations:** Workstations are attached to the server through the network interface card and the cabling. Workstations are normally intelligent systems, such as the IBM PC. The concept of distributed processing relies on the fact that personal computers attached to the networks perform their own processing after loading programs and data from the server. Hence, a workstation is called an Active Device on the network. After processing, files are stored back on the server where they can be used by other workstations.
- (iv) **Network interface card:** Every device connected to a LAN needs a Network interface card (NIC) to plug into the LAN. For example, a PC may have an Ethernet card installed in it to connect to an Ethernet LAN.
- (v) **Network Cabling:** Once the server, workstations and network interface cards are in place, network cabling is used to connect everything together. The most popular type of network cable is the shielded twisted-pair, co-axial and fiber optic cabling.

Question 12

Briefly explain various types of communication services used to transmit data in a network.

(PE – II Nov. 2004)

Answer

An organization that wishes to transmit data uses one of the common carrier services to carry the messages from station to station. Some of the common types of communication services used to transmit data in a network are briefly discussed below:

- (i) **Narrow band Service :** It is used where data volume is relatively low; the transmission rates usually range from 45 to 3000 bits per second. Examples of this service are telephone companies, typewriters exchange service (TWX) and telex service.
- (ii) **Voice band Service :** Voice band services use ordinary telephone lines to send data messages. Transmission rates vary from 300 to 4,800 bits per second, and higher.
- (iii) **Wide band Service :** It provides data transmission rates from several thousands to several million bits per second. These services are limited to high-volume users. Such services generally use coaxial cable or microwave communication. Space satellites have been deployed to rapidly transmit data from any part of the world to another part of the world.
- (iv) **Communication Services** may be either leased or dial up. A leased communication channel, which gives the user exclusive use of channel, is used where there are continuing data transmission needs. The dial up variety requires the person to dial the computer. This alternative is appropriate when there are periodic data to be transmitted.

Question 13

Write short notes on the following:

- (i) *Storage Area Network (SAN)*
- (ii) *Neural Networks*

(PE – II Nov. 2002 & May 2005)

(PE – II May 2004)

(iii) *Network Attached Storage (NAS)*

(PE-II May 2006 & Nov. 2008)

(iv) *Wireless Networks*

(PE – II May 2007)

Answer

(i) **Storage Area Network (SAN):** A storage area network is a dedicated, centrally managed, secure information infrastructure which enables any - to- any interconnections of servers and storage system. A SAN has following salient features:

- Facilitates universal access and sharing of resources.
- Supports unpredictable, explosive information technology growth.
- Provides continuous service.
- Improves information protection and disaster tolerance.
- Enhances security and data integrity of new computing architecture.

Move to SAN has been motivated by following factors:

- **E-business** – securely transforming internal business processes and improving business relationships to expedite the buying and selling.
- **Globalization** – the extension of IT systems across international boundaries.
- **Zero latency** – the need to exchange information immediately for competitive advantage.
- **Transformation** – the ability to continually adapt, while immediately accessing and processing information to drive successful business decisions.

Benefits of SAN include :

- Increase in overall system efficiency
- Improved system administration
- Improved availability of resources at lowest cost an
- Increased business flexibility.

(ii) **Neural Networks:** Neural networks are computing systems structured to emulate the brain's learning process. Like the brain, which uses a massively parallel network of interconnected neurons, the neural network uses interconnected processors that perform many operations simultaneously and interact dynamically to learn from data as it is processed. Although neural networks do not handle unexpected or one of a kind event very well, they are very good at recognizing patterns that humans overlook and at uncovering emerging trends. Like humans, neural networks learn by fine-tuning their accumulated knowledge using the facts present in each new case. For example, developing a neural network that detects fraudulent credit card transactions requires showing it enough examples of both valid and fraudulent transactions until it can reliably

tell them apart. Developing a sufficiently large database of examples is the most difficult and costly part of training a neural network.

- (iii) **Network-Attached Storage (NAS):** It is a dedicated shared storage solution connected to a network, allowing the file and data sharing among different clients of the network. It is platform and operating system independent. It can be attached with the network without switching off the network and requires no changes to the existing file servers.

A NAS device is a stand-alone, single-purpose and high performance system. It is used to satisfy the storage requirement of different users with its own operating system, integrated hardware and software. NAS devices are suitable for heterogeneous networks. NAS is a totally integrated network system with SCSI hard disk drives and is basically a modular file server. It runs independently and provides excellent services to all the users. It functions even if the network server is down.

Benefits

- (a) High performance and fast connectivity.
- (b) Simpler and less expensive due to consolidation and centralization.
- (c) Additional cost savings due to simplified installation process and ease of administration.
- (d) Common storage from various platforms.
- (e) Platform independence.
- (f) Scalability due to modular design.
- (g) Remote connectivity to storage.

Considerations

- (a) Dependent on network bandwidth.
- (b) Single point of failure i.e. NAS system failure will result in halting the working of all the clients.

- (iv) **Wireless Networks:** People on the road often want to use their portable computers like Laptop or Notebook computers to send and receive electronic mails, read remote files from the server of their office and to surf the Internet from anywhere on land, sea or air. Since a wired network is impossible in cars and aeroplanes, hence it resulted in the development of wireless network. WAP (Wireless Application Protocol) is the protocol used in Wireless communication. Laptop computers with wireless card are available in the market. Wireless technology known as Bluetooth allows the user to transfer the data between computer and Mobile Phone/Digital Camera. Airports and some Indian Universities have been converted to Wireless fidelity (Wi-Fi) zones which are allowing users to use Internet services anywhere within the premises of Airport.

Wireless networks are of great use for those persons who remain away from their home/office for most of the time. Another use of wireless network is for the rescue

workers at the disaster sites like fires, floods or earthquake sites where telephone system gets destroyed.

Question 14

- (i) Explain the various functions of communications software. (PE-II Nov 2005 & Nov. 2008)
- (ii) Explain any five communication interface devices. (PE-II Nov. 2005)

Answer

- (i) Communications software manages the flow of data across a network. It performs the following functions:
 - (a) **Access control:** Linking and disconnecting the different devices, automatically dialing and answering telephones; restricting access to authorized users; and establishing parameters such as speed, mode and direction of transmission.
 - (b) **Network management:** Polling devices to see whether they are ready to send or receive data; queuing input and output; determining system priorities; routing messages, and logging network activity, use and errors etc.
 - (c) **Data and file transmission:** Controlling the transfer of data, files and messages among the various devices.
 - (d) **Error detection and control:** Ensuring that the data sent was indeed the data received.
 - (e) **Data security:** Protecting data during transmission from unauthorized access.
- (ii) Five commonly used communication interface devices are briefly discussed below:
 - (a) **Network Interface Card (NIC):** It is an electronic card which is installed in server as well as in all the nodes for interconnection of nodes with server. Network Interface card provides a connector on its back for connection of nodes and server using network cable. NIC has buffer for storing incoming and outgoing packets, thus improving the network throughput. NIC uses Linear bus topology, according to which only one node can access the data from the server at a time. NIC is installed in one of the available PCI/ISA slot on the motherboard.
 - (b) **Modem (Modulator/Demodulator):** It is an electronic device which is used to convert digital signals to analog telephone signals (modulation) and analog signals to digital data (demodulation) in a data communication system. Modem allows the communication among computers through telephone lines. Motorola, GVC, O-Link, AOCOM are some of the manufacturers of Modems. Modems can be categorized on the basis of speed, price and other features. But, most commonly people classify them as internal or external. Internal modem looks like the sound cards and video cards that fit inside the computer. External modem connects to the serial port of the computer. Speed of modem can be 28.8Kbps (Kilo bits per second) or 56.6 Kbps. Modem installed in Laptop computers is similar to credit card size, known as

PCMCIA (Personal Computer Memory Card International Association) modem.

- (c) **Multiplexer (MUX):** It is an electronic device which allows number of devices to share a single communication line. Multiplexer continuously scans the nodes and server to find out whether any of them wants to send data to other nodes or not. This process of continuously scanning by multiplexer is called Polling. Multiplexer may perform Time division multiplexing (TDM) or Frequency division multiplexing (FDM).
- (d) **Front-end communication processor:** In case of high volume data transfer, a separate computer, known as front-end communication processor is used for sending and receiving data, code conversions, editing and verification of data, terminal recognition and control of transmission lines thus relieving the main computer for data processing tasks rather than data transmission.
- (e) **Protocol Converter:** Protocols are the standard sets of rules which govern the flow of data on a communication network. Dissimilar devices, which follow different protocols, can not communicate with each other without protocol conversion. For example, one computer representing data in ASCII code can not communicate with another computer using EBCDIC code for data representation without protocol conversion. Protocol converter is an electronic device which is used for protocol conversion. However, protocol conversion can also take place through software.

Question 15

Describe the various types of data communication modes.

(PE – II Nov. 2006)

Answer

There are three different types of data communication modes:

- **Simplex:** A simplex communication mode permits data to flow in only one direction. A terminal connected to such a line is either a send-only or a receive – only device. Simplex mode is seldom used because a return path is generally needed to send acknowledgements, control or error signals.
- **Half duplex:** In this mode, data can be transmitted back and fourth between two stations, but data can only go in one of the two directions at any given point of time.
- **Full duplex:** A full duplex connection can simultaneously transmit and receive data between two stations. It is most commonly used communication mode. A full duplex line is faster, since it avoids the delay that occur in a half-duplex mode each time the direction of transmission is changed.

Question 16

Describe the benefits of SAN.

(PE – II May 2007)

Answer

A Storage Area Network (SAN) is a dedicated, centrally managed, secure information infrastructure, which enables any-to-any interconnection of servers and storage systems. Following are the benefits of SAN:

- (i) **Removes data traffic:** Like back up processes, from the production network giving IT managers a strategic way to improve system performance and application availability.
- (ii) **Improves data access:** Using fiber Channel connections, SAN provides high speed network communication and distance needed by remote workstations and servers to easily access shared data storage pools.
- (iii) **Centralized Management of Data:** IT managers can more easily centralize the management of their storage systems and consolidate backups, increasing overall system efficiency. The increased distances provided by Fiber Channel Technology makes it easier to deploy remote disaster recovery sites. Fiber Channel and switched fabric technology eliminate single point of failure on the network.
- (iv) **Unlimited network expansion:** Unlimited expansion is possible with hubs and switches. Nodes can be removed or added with minimal disruption to the network

Question 17

Explain five components of Local area Network (LAN).

(PE – II Nov. 2007)

Answer

Components of a LAN: There are five components of a LAN:-

- (i) **File Server:** The server stores all the programs and data required by different users. It allows different users to share data and system resources namely hard disk, printer etc. There are two types of file servers:
 - Dedicated Server:** This server is only used to manage the data as well as programs and can not be used as a node, therefore, this server is called passive device.
 - Non-dedicated server:** This server can be used as a node for data entry and obtaining the results as well as server, therefore, it is called active device.
- (ii) **Workstations or Nodes:** These computers are used by different users for data entry and obtaining the results. Nodes are connected with file server using Network Interface card and network cabling. These terminals are usually intelligent terminals which process the data after accessing the data and programs from file server. After processing, files are stored on the server for sharing by the other workstations.
- (iii) **Network Operating system:** This operating system is used to manage different nodes as well as various I/O devices. Commonly used network operating systems are Novell Netware, Windows NT, Sun Solaris etc.
- (iv) **Network Interface card:** It is an electronic card which is installed in all the nodes and server to allow communication between them. Commonly used NIC in LAN is called Ethernet card which uses Linear bus topology.

(v) **Cabling:** There are three types of cables which can be used in LAN:-

- **Co-axial cable:** This is the same cable which is used in domestic homes for watching satellite channels. It has a rigid aluminium wire having spiral wire around. It is not a reliable cable and breaks on the way. In addition to this, data can not travel to long distance due to high resistance. Data transfer speed is also not high.
- **UTP (Unshielded twisted pair) cable:** This cable is similar to telephone cable used in domestic phones but instead of having two wires, it has 4 pairs of different color wires. RJ 45 (Registered Jack) connector is attached in front of this cable for connecting the cable to the NIC. CAT5 and CAT6 are commonly used UTP cables. It is inexpensive and easy to install. These cables are more reliable and result in faster data transfer. These are used in structured cabling of Local area network (LAN).
- **Optical Fiber cable (OFC):** These cables are very reliable and are used for higher data transfer speed but are expensive. Data passed through these cables remain unaffected by electromagnetic interference. OFC uses rapidly turned on and off light to create on and off bits on the communication channel. Data is more secure in fiber optic network.

Question 18

Describe 'Ring Network' as a network topology. Also mention its advantages and disadvantages.

(PE – II May 2008)

Answer

In Ring network, the network cable passes from one node to another until all nodes are connected in the form of a loop or ring. There is a direct point-to-point link between two neighbouring nodes. These links are unidirectional which ensures that transmission by a node traverses the whole ring and comes back to the node, which made the transmission.

Advantages

- (1) Ring network offers high performance for a small number of workstations.
- (2) It can span longer distances compared to other types of networks.
- (3) These networks are easily extendable.

Disadvantages

- (1) Ring network is relatively expensive and difficult to install.
- (2) Failure of one computer on the network can affect the whole network.
- (3) It is difficult to trouble shoot a ring network.
- (4) Adding or removing computers can disrupt the network.

Question 1

Describe briefly, the following terms with reference to Information Technology:

- | | |
|---------------------------------------|--|
| (i) FTP | (PE – II Nov. 2002, May 2005 & May 2007) |
| (ii) Uniform Resource Locators (URL) | (PE – II May 2003 & May 2008) |
| (iii) Secure System | (PE – II Nov. 2003) |
| (iv) Web browser | (PE – II Nov. 2003) |
| (v) PPP (Point-to-Point Protocol) | (PE – II May 2004) |
| (vi) HTML (Hypertext Markup Language) | (PE – II Nov. 2004) |
| (vii) Internet Service Provider (ISP) | (PE – II May 2006) |

Answer

- (i) **FTP:** FTP refers to File Transfer protocol. It is a common method of moving files between two Internet sites. There are many publicly accessible sites from where information can be obtained using FTP.
- (ii) **Uniform Resource Locators:** Uniform Resource Locators are used by Web Browsers to address and access individual web pages, web sites and Internet resources. The format of a URL is as given below:
Protocol/Internet address/web page address
Example : <http://www.icai.org/seminars.html>
- (iii) **Secure System:** It refers to a system in which the computer hardware, software and procedures are:
- reasonably secure from unauthorized access and misuse.
 - provide a reasonable level of reliability and correct operation.
 - reasonably suited to perform the intended functions.
 - adhere to generally accepted security procedures.

- (iv) **Web browser** : A special client software package which is used to review web pages on Internet is called web browser. Netscape and Internet Explorer are commonly used web browsers.
- (v) **PPP (Point-to-Point Protocol)** – It is most well known protocol that allows a computer to use a regular telephone line and a modem to make TCP/IP Internet connection and thus be really on the Internet.
- (vi) **HTML (Hypertext Markup Language)**: This coding language is used to create Hypertext documents for use on the World Wide Web. It allows the creator of the web page to specify how text will be displayed and how to link it to other web pages, files and Internet services.
- (vii) **Internet Service Provider (ISP)**: An institution that provides access to the Internet subscriber on a charge basis is referred to as Internet Service Provider. For example, in India VSNL (Videsh Sanchar Nigam Limited) is one of the Internet Service Providers.

Question 2

Give one or two reasons for the following:

- (i) Use of Firewall in the system. (PE – II Nov. 2003, May 2005 & May 2007)
- (ii) Use of Web browser (PE – II Nov. 2006 & Nov. 2008)
- (iii) Use of Intranet (PE – II Nov. 2007)

Answer

- (i) **Use of Firewall in the system:** Firewalls are hardware and software systems that control the flow of traffic between the Internet and organization's Local Area Network and systems. These are set up to enforce specific desired security policies of the organizations. Firewall is an effective means of protecting the firm's internal resources from unwanted intrusion.
- (ii) **Use of Web Browser:** It is a client program (software) that is used to look at various kinds of Internet resources. Mosaic, Netscape Navigator and Internet Explorer are some of the commonly used web Browsers
- (iii) **Use of Intranet** Intranet is a means of intra-office communication. It facilitates communication within the organization and connects people together with Internet technology in a single view. Through the Intranet, access to all information, applications and data can be made available through the same browser.

Question 3

Distinguish between the following:

- (i) The Internet and the Intranet (PE – II Nov. 2002)
- (ii) Intranet and Extranet (PE – II Nov. 2004 & May 2007)
- (iii) Audio Conferencing and Video Conferencing (PE – II May 2007)
- (iv) Internet and World Wide Web. (PE – II May 2008)

Answer

- (i) **The Internet and the Intranet:** The **Internet** is a global network of computer networks that was initiated in the year 1960's by a team of scientists under a U.S. Government contract. There are approximately 1,40,000 small networks in more than 200 countries connected through Internet. These networks are formed by various educational, commercial, Government, non-profit and military organizations. These networks are individually owned and operated that are all interconnected.

Internet is a combination of number of computers, linked together, sharing same resources. There are thousands of databases containing information of all sorts in addition to the facilities like e-mail, chatting, games, message boards and free software.

Networks comprise addressable devices or nodes (computers) connected by communication channels. Any node can transmit a message to any other node, along with communication channels, via the intermediate nodes. Internet uses are many; some of them are given below:

- (a) **Communication** – It could be on-line or off-line.
- (b) **Data Retrieval** – As large number of databases exists on Internet, one can make use of data according to his/her requirements.
- (c) **Data Publishing** – Data publishing is a new opportunity that Internet has made possible. The information can be forwarded to any one.

The **intranet**, on the other hand, is a type of information system that facilitates communication within the organization, among widely dispersed departments, divisions and regional locations. Intranet connects people together with Internet technology using Web Browsers, Web Servers and Data Warehouses in a single view. Within an Intranet, access to all information, applications and data can be made available through the same browser. We can perform the following works:

- Easily accessible information.
- Reduced information searching time.
- Share and reuse of tools and information.
- Reduced set up and update time.
- Reduced documentation cost etc.

Several applications of Intranet include :

- Supplier management.
- Inventory management.
- Distribution management.
- Channel management.

- (ii) **Intranet and Extranet:** **Intranet** is a type of information system that facilitates communication within the organization, among widely dispersed departments, divisions

and regional locations. Intranets connect people together with Internet technology, using web browsers, web servers and data warehouses in a single view. With an Intranet, access to all information, applications and data can be made available through the same browser. The objective is to organise each individual's desktop with minimal cost, time and effort to be more productive, cost efficient, timely and competitive.

An **Extranet** is an extension of an Intranet that makes the latter accessible to outside companies or individuals with or without an Intranet. It is also defined as a collaborative Internet connection with other companies and business partners. Parts of an Intranet are made available to customers or business partners for specific applications. The Extranet is thus an extended Intranet, which isolates business communication from the Internet through secure solutions. Extranets provide the privacy and security of an Intranet while retaining the global reach of the Internet. An Extranet extends the Intranet from one location to another across the Internet by securing data flows using cryptography and authorization procedures, to another Intranet of a business partner.

(iii) **Audio Conferencing:** It is the use of audio communication equipments which allow the user to communicate with geographically dispersed persons. Audio conferencing does not require a computer but requires a two way audio communication facility.

Guidelines to make Audio conferencing more efficient are as stated below:

- (a) All the participants must have an opportunity to speak.
- (b) Number of participants must be kept to manageable size.
- (c) Copy of conferencing agenda must be sent to all the participants in advance through FAX.
- (d) Participants must identify themselves.
- (e) Conferencing discussion must be recorded.
- (f) Hard copy of the discussion must be prepared and should be sent to all the participants for approval.

Video Conferencing: It is the use of television equipment which allow the user to communicate with geographically dispersed persons. The equipment provides both sound and picture. The participant can see and hear each other and it does not required computers. Participants gather in specially equipped rooms having audio and video facility.

There are three types of Video Conferencing:

- (a) **One way Video and Audio:** In this case, audio and video is traveled only in one direction e.g. Television.
- (b) **One way Video and Two way Audio:** In this case, audio is transferred in both directions but video is transferred in one direction e.g. Discussion of News Reader with field correspondent.

- (c) **Two way Video and Audio:** In this case, audio and video is transferred in both directions between sender and receiver e.g. Discussion of persons between different studios of a News Channel.
- (iv) **Internet and World Wide Web:** **Internet** is a global network of computer networks formed by various educational, commercial, Government, non-profit and military organizations linked together, sharing same resources. They exchange data and information by packet switching and using the standard 'Internet Protocol' (IP). Besides data exchange, it also provides the facilities like e-mail, chatting, games, message boards, etc.

World Wide Web (WWW) is a component of the Internet that provides access to large amounts of information located on many different servers. It also provides access to many of the services available on the Internet. It contains collection of interconnected documents and other resources which are linked through hyperlinks and URLs.

Question 4

Explain briefly various Disaster Recovery (DR) plans for eliminating Down time.

(PE-II May 2006)

Answer

Data centers must have proper disaster recovery systems that minimize downtime for its customers. Downtime can be eliminated by proper disaster recovery plans for mission-critical data. The different types of Disaster recovery plans (DRP) are:

- (i) **Cold Site:** It is an alternative facility that is devoid of any resources or equipments, except air conditioning and raised flooring. In this DRP, equivalent hardware is installed at Disaster site immediately but lost data can not be restored.
- (ii) **Warm site:** It is an alternative processing site that is only partially equipped. In this DRP, organization data is copied on another site in periodic intervals so that in case of disaster, data can be restored from another site but the changes made in the data by the organization between the last backup time and current time is lost. Therefore, after the restoration of data, updation is required in the data to make it live data.
- (iii) **Hot site:** It is an alternative facility that has the equipments and resources to recover business functions that are affected by a disaster. In this DRP, mirror image of data is stored simultaneously at the alternate site with the storage of data at current location. Therefore, data can be restored immediately in case of any disaster and downtime is avoided.

Question 5

Discuss the role of Internet in the development of Ecommerce. Describe the benefits of E-commerce.
(PE – II Nov. 2002)

Answer

Electronic commerce is the process of doing business electronically. It involves the automation of a variety of business- to -business and business –to- customer transactions through reliable and secure connections.

It is a composite of technologies, processes and business strategy that foster the instant exchange of information within and between organizations. It strengthens relationship with buyers, makes it easier to attract new customers, improves customer responsiveness and opens new markets on global scale.

Today, the Internet provides an inexpensive and information- rich, shared, multimedia network technologies interconnecting more than 100 million users and 50 million servers in more than 150 countries. When compared to the enormous cost of a private network and the associated limits in terms of access to consumers, electronic commerce on the Internet seems to be very attractive. There are atleast six reasons for the Internet's dramatic impact on the scope of E-commerce. They are:

- (a) **Universality:** Any business using the Internet can interact with any other business using the Internet.
- (b) **Reach:** The Internet is everywhere: large cities and small towns throughout the modern and developing world.
- (c) **Performance:** The Internet provides its users with a high-function window to the world, in addition to handling everyday networking tasks such as electronic mail; and visual images, audio clips and other large electronic objects.
- (d) **Reliability:** Internet technology is highly robust and reliable as the design concepts for it came out of the U.S. Department of Defence.
- (e) **Cost:** Internet costs are lower as compared to the alternative networking technologies.
- (f) **Momentum:** Tens of millions of individuals are already connected to the Internet and business use is increasing at a dramatic rate.

Benefits of E-Commerce

- (a) **Reduced costs to buyers and suppliers by accessing on-line databases** - Costs to buyers have reduced due to increased competition in procurement as more suppliers are able to compete in an electronically open market place. Even suppliers can electronically access on-line databases of bid opportunities, on-line abilities to submit bids, and on-line review of rewards, thereby reducing their costs.
- (b) **Reduced time to complete business transactions** – Since each and every transaction, from delivery to payment, can be done electronically; the time taken to complete these transactions has reduced substantially.

- (c) **Creation of new markets through the ability to reach potential customers** – As tens of millions of people are currently using Internet and the number is increasing day -by- day, business via Internet has opened the door to new markets and easy-to-reach potential customers.
- (d) **Reduced errors, time and overhead costs in information processing** – By eliminating the requirements for reentering data in processing of information, the overhead costs, errors and time has reduced.
- (e) **Better quality of goods** as specifications are standardized and competition has increased, and improved variety of goods through expanded markets and the ability to produce customized goods exist.
- (f) **Reduced inventories and reduction of risk of obsolete inventories** – As the demand for goods and services is electronically linked through just-in-time inventory and integrated manufacturing techniques, the holding and ordering costs of inventories has also gone down.
- (g) **Ability to undertake major global programs** in which the cost and personnel needed to manage a non-automated system would be unreasonable or prohibitive.
- (h) **Improved market intelligence and strategic planning** – Business via Internet serves as a useful tool to search for information about competitors, customers and suppliers. This information helps in managerial decision-making and strategic planning.
- (i) **Equal access to market for all categories of businessmen** – The use of a public network – based infrastructure can “level the playing field” for both small and large businesses. This allows companies of all sizes to extend their reach to a broad customer basis.
- (j) **Reduced overhead costs through uniformity**, automation and large scale integration of management processes.
- (k) **Reduced delivery cost** – Especially for goods that can also be delivered electronically, the cost of delivery has reduced.
- (l) **Reduced design and manufacturing cost** – With the use of CAD and CAM technology, better products can be designed faster and manufactured at lower costs.
- (m) **Reduced advertising cost** – Products and services can now be advertised on the home pages of the organizations. Even queries can be attended to by advising the potential customers to access the information on the web site of the organization, rather than responding them with brochures and literature.

Question 6

What tools are available to protect the information in network against or misuse ? Discuss.

(PE – II Nov. 2002, May 2005 & May 2007)

Answer

The following tools are available to protect the information in a network against intrusion or misuse :

- (a) **Firewalls:** Firewalls are systems that control the flow of traffic between the Internet and the firm's internal LANs and systems. They are usually packaged as turnkey hardware/software packages and are set up to enforce the specific security policies that are desired. A firewall is a proven and effective means of protecting the firm's internal resources from unwanted intrusion.

To accomplish this:

- All traffic between the outside network and the organization's intranet must pass through the firewall.
- Only authorized traffic between the organization and the outside, as specified by formal security policy, is allowed to pass through the firewall.
- The firewall must be immune to penetration from both outside and inside the organization.

- (b) **Encryption:** Encryption allows information to transit the Internet while being protected from interception by eavesdroppers. There are two approaches to encryption:

- (i) *Hardware encryption devices* – If the Internet is being used to exchange information among branch offices, for instance, use of hardware encryption can ensure that all traffic between these offices is secure.
- (ii) *Software encryption* is employed in conjunction with specific application. For example, certain electronic mail packages provide the facility of encryption and decryption for message security.

- (c) **Message Authentication:** It makes sure that message is really from whom it purports to be and that it has not been tampered with. Regardless of a company's individual needs, clearly defined Internet security policies and procedures should always be part of any corporate Internet security strategy.

- (d) **Site Blocking:** It is a software-based approach that prohibits access to certain websites that are deemed inappropriate by management. In addition to blocking sites, companies can also log activities and determine the amount of time spent on the Internet and identify the sites visited.

Question 7

Explain in brief, the concept of voice messaging.

(PE–II May 2003 & Nov. 2003)

Answer

Voice messaging is a new communication approach, which is similar to the electronic mail except that it is audio message rather than text messages that are processed. A sender speaks into a telephone rather than typing, giving the name of recipient and the message and the sender's voice signal is then digitized and stored. The system can then either deliver the message at a specified time in the future or it can be retrieved from a database by the recipient. The message is reconverted into its analog format when it is delivered or retrieved so that the recipient hears it as the original sender's voice on a telephone.

Voice messaging requires a computer with an ability to store the audio messages in digital form and then convert them back in audio form upon retrieval. Each user has a voice mail box in secondary storage, and special equipment converts the audio message to and from the digital form. The main advantage of voice messaging over electronic mail is that the sender does not have to type the message. Voice mail also makes it easy to include people in the firms environment in a communication network.

Question 8

Explain the term World Wide Web. What do you understand by Internet Surfing? Explain.

(PE – II May 2003)

Answer

The World Wide Web (WWW) is a component of the Internet that provides access to large amount of information located on many different servers. The web also provides access to many of the services available on the Internet.

The fundamental unit of the web is the web page. The web page is a text document that contains links to other web pages, graphic and audio files, and other Internet services. Web pages reside on servers. Tens of thousands of web servers are currently connected to the Internet. A user can directly access any web page on any of these servers and then follow the links to other pages. This process creates a web of links around the world and thus the name World Wide Web.

Web pages are created by using hypertext Markup Language (HTML). Hypertext links are links to other web pages, files and Internet services. To view a web page, the user must use a special client software package called a web browser.

Surfing: Many of the servers on the Internet provide information, specializing on a topic or subject. When a user is looking for some information, it may be necessary for him to look for such information from more than one server. WWW links the computers on the Internet, like a spider web, facilitating users to go from one computer to another directly. When a user keeps hopping from one computer to another, it is called "surfing".

Question 9

Explain various features offered by e-mail software.

(PE – II Nov. 2003)

Answer

Features offered by e-mail software: Electronic mail (email) on the Internet provides quick, cost effective transfer of messages to other e-mail users worldwide. The email software comprises of many important and useful features. Some of them are as follows:

- (i) **Composing messages:** With the help of Internet Browser, it is possible to compose messages in an attractive way with the help of various fonts. It is also possible to spell-check the message before finalizing it.
- (ii) **Replying to mails received:** It is possible to reply to any mail received by merely using the 'Reply' facility available on the Internet Browser. This facility also allows one to send the same reply to all the recipients of the original message. This helps in saving lot of time in terms of remembering addresses and also in typing the subject matter.
- (iii) **Address book:** This is an electronic form of address book wherein the following features can be saved: Name, full address, email address, organization and designation of person etc.

When one has to send the email, by merely typing the first name, it would be possible to recall the email address of the recipient. It is also possible to store addresses on the basis of categories.

- (iv) **Printing of messages:** It is possible to print messages received as well as messages sent. As a result, hard copy of any message can also be kept.
- (v) **Offline Editing / Composing/ Reading:** One does not have to be connected to the Internet all the time to be able to read/ edit/ compose messages. Ideally, one should log on to the Internet, download all the messages on to one's own hard disk and then get disconnected from the Internet. Once user is offline, he should read all the messages that have been received. Even composing messages can be done offline. This saves Internet time as well as helps in keeping the telephone line free.
- (vi) **Forwarding of messages:** It is possible to forward any messages received from one user to another user without retyping the message.
- (vii) **Transfer of data files:** Data files can also be sent / received to / from the client. This helps in saving of considerable amount of time, energy and money.
- (viii) **Greeting Cards:** On the Internet, there are several sites which offer free greeting cards for thousands of occasions. One has to visit that site, select the card and by typing the email address, card can be sent to different users.

Question 10

Explain Electronic Data Interchange (EDI) and its advantages. (PE-II May 2003 & Nov. 2003)

Answer

Electronic Data Interchange (EDI) is the transmission, in the standard syntax, of unambiguous information of business or strategic significance between computers of independent organizations. The users of EDI do not have to change their internal databases. However, users must translate this information to or from their own computer system format, but this translation software has to be prepared only once.

In simple terms, Electronic Data Interchange (EDI) is computer-to-computer communication using a standard data format to exchange business information electronically between independent organizations.

EDI does not aid in transmitting documents but dynamically moves data between companies computer systems. Computer-to-computer transfer can be direct, between two companies using an agreed upon data protocol, or it can be performed by a third party, service – vendor. Users can transmit business documents like quotes, shipping notices and even payment orders electronically to customers and suppliers. Design documents, electronic fund transfers and database transactions also come under EDI umbrella.

The following advantages are observed for use of EDI:

- (i) **Issue and receive orders faster** – Since most purchasing transactions are routine, they can be handled automatically, utilizing the staff for more demanding and less routine tasks.
- (ii) **Make sales more easily** – Quotes, estimates, order entry and invoicing will proceed more smoothly and efficiently. Orders received electronically ensure that information is available immediately, so that an organization can respond faster and be more competitive.
- (iii) **Get paid sooner** – Invoices received electronically can be reconciled automatically, which means they are earmarked for payment in one's trading partner's accounting department sooner and in turn, one's own purchasing department is in a position to negotiate for better terms including faster payment.
- (iv) **Minimize capital tied up in inventory** – For manufacturing organizations with a just-in-time strategy, the right balance is crucial but every organization stands to benefit from reducing order lead times.
- (v) **Reduce letters and memos** – Letters and memos do not follow rigid rules for formatting. They can be handled by an electronic mail system.
- (vi) **Decrease enquiries** – Customers or suppliers can make direct on-line enquiries on product availability, or other non-sensitive information instead of consuming staff's previous time.
- (vii) **Make bulk updates of catalogues and part listings** – One can provide updates of data files, such as catalogues to customers or part listings to franchisees.

Question 11

Explain the different types of payment systems in E-commerce.

(PE – II Nov. 2004)

Answer

Payment Systems in ECommerce: There are dozens of electronic payment systems proposed or already in practice for Ecommerce. But they can be grouped into three categories, based on what information is being transferred on-line.

The first type uses a trusted third party that maintains all sensitive information (such as bank account and credit card numbers) for its clients, which include both buyers and sellers. When there is a transaction, order information is transmitted along with information about payment confirmation and clearing, all of which do not include sensitive information. In effect, no real financial transaction is done on-line. One example of this type of payment system is First Virtual. In this system, the information need not be encrypted since financial transactions are done off-line.

The second type is an extension of the conventional notational fund transfer. In credit card or cheque transactions, sensitive information is exchanged online, hence the information is encrypted for security. This type is becoming the mainstay of online payment methods because consumers are familiar with this system and current payers have vested interest in extending that system to the Internet. Cyber cash and VISA/MasterCard's SET – based transactions are examples of this type of system.

The third type includes variations of digital cash, electronic money and coins. What distinguishes these systems from the other two is not simply the anonymity they afford, but the fact that what is being transferred is value or money itself. With the second type, some one can commit fraud by lifting the message (e.g. credit card number) by running up the charge on the user's account. With digital currency, intercepting a message is an outright theft of user's property, not just information.

Question 12

Explain the chief uses of Internet.

(PE – II Nov. 2004 & Nov. 2008)

Answer

The chief uses of the Internet can be classified into three primary types namely, communication, data retrieval and data publishing.

- (i) **Communication:** Communication on the Internet can be online or offline. When some users connect to a single server or an on-line service at the same time, they can communicate in an on-line chat. This can be truly many-to-many as in a room full of people talking to each other on peer to peer basis. Alternatively, the users send e-mail to each other which can be read by the receiver at a later time. This is off-line communication but "one-to-one" or "one-to-many". It is also possible for the users to get together electronically with those sharing common interests in "Usenet" for the groups.
- (ii) **Data retrieval:** For meaningful data retrieval, availability of data that has been compiled from various sources and put together in a usable form is an essential prerequisite. On

the internet, a large number of databases exist. These have been put together by commercially run data providers as well as individuals or groups with special interest in particular areas. To retrieve such data, any user needs to know the addresses of such Internet services. Then depending on the depth of information being sought, different databases have to be searched and required information compiled.

- (iii) **Data publishing:** Data publishing is a new opportunity that Internet has made possible. Information that needs to be made available to others can be either forwarded to specific addresses, posted in a Usenet site or kept on display in a special site. Internet discourages by social pressure, sending of unsolicited E-mail.

Question 13

Explain the working principle of Electronic Data Interchange (EDI). (PE-II May 2005)

Or

What is Electronic Data Interchange (EDI)? How it works? (PE – II Nov. 2007)

Answer

Electronic Data Interchange (EDI): EDI is the transmission of business information in standard format between computers of independent organizations. There is no need to change the database structure by the companies for implementation of EDI. However, EDI software is required to be developed for translating the format used by one organization to the format being used by another organizations. So EDI is computer-to-computer communication using a standard data format to exchange business information electronically between independent organizations.

Working Principle of EDI – EDI is the electronic exchange of business documents such as invoices, purchase orders, shipping notices etc. EDI is a three step process :-

1. First of all, sender data is converted into standard format as defined by EDI translation software.
2. Data in standard format is transferred to the receiver using communication lines.
3. Finally, standard format data is converted according to the format of receiver data base files.

EDI consists of three components:

- (i) **Communication** - To make EDI work, one needs communication software, translation software and access to standards. Communication software moves data from one point to another, flags the start and end of the document. Translation software helps the user to build a map and shows him how the data fields from his application corresponds to the elements of EDI standards. It also converts data back and forth between the application format and the EDI format.
- (ii) **Mapping** - To build a map, the user first selects the EDI standard for the kind of data he wants to transmit. Usually the trading partner tells about the kind of standards to be

used. Next, he edits out parts of the standards, which do not apply, to his application. Next, he imports a file that defines the fields in his application, and finally he makes the map to show where the data required by the EDI standards

is located in his application. Once the map is built, the translator will refer to it during EDI processing every time a transaction of that type is sent or received.

- (iii) **Profile** - The last step is to write a partner profile that tells the system where to send each transaction and how to handle errors or exceptions. Whereas the user needs a unique map for every kind of documents he exchanges with a partner, he should only have to define partner information once.

Question 14

Describe the various services provided by a Data centre. (PE-II May 2005 & May 2007)

Answer

Services Provided by Data Centre: Some of the value added services that data centres provide are:

- (i) **Database Monitoring:** This is done via a database agent, which enables the high availability of the database through comprehensive automated management.
- (ii) **Web Monitoring:** Assess and monitor website performance, availability, response and integrity from a visitor's perspective.
Report on HTTP, FTP service status, monitor URL availability, verify web content accuracy and changes.
- (iii) **Backup and restore:** Provide centralized multi-system management capabilities
Provide comprehensive integral management solution to data storage using backup agent for the operating systems, database and applications.
- (iv) **Intrusion detection:** Detect malicious activity on the host – based ID systems and, network-based ID systems,
Provide automated network security assessment and policy compliance evaluation.
- (v) **Storage on demand:** Provide back-end infrastructure as well as expertise, best practices and process to give a robust and cost-effective storage strategy. Data storage infrastructure provide security, reliability and availability of data to meet company demands.

Question 15

What are the constituents of a Data Centre ? (PE-II Nov. 2005)

Answer

Constituents of a Data Centre: To keep equipments running reliably, even under the worst circumstances, the data centre is built with following carefully engineered support infrastructure:

- (i) Network connectivity with various levels of physical connectivity using Fibre Optic and copper communication link and service provider redundancy.
- (ii) Dual DG sets and Dual UPS,
- (iii) Heating, ventilation and Air Conditioning (HVAC) systems for temperature control.
- (iv) Fire extinguishers.
- (v) Physical security systems like Security guards, Biometric devices, Smart Card, CCTV etc.
- (vi) Raised flooring to avoid flood and water logging.
- (vii) Network equipments, Network Management software,
- (viii) Network security by segregating the public and private network using Intrusion detection system (IDS) and firewalls.

Question 16

Explain any five features offered by e-mail software.

(PE -II Nov. 2005)

Answer

Five features offered by e-mail software: Electronic mail (e-mail) on the Internet provides quick and cost effective transfer of messages to other email users worldwide. The e-mail software comprises of many important and useful features. Five of them are briefly discussed below:

- (i) **Composing messages:** With the help of an Internet Browser, it is possible to compose messages in an attractive way using various fonts. It is also possible to spell-check the message before finalizing it.
- (ii) **Replying to the mails received:** It is possible to reply to any mail received by merely using the "Reply" facility available on the Internet Browser. This facility also allows one to send the same reply to all the recipients of the original message. This helps in saving lot of time in terms of remembering addresses, typing the subject matter etc.
- (iii) **Address book:** This is an electronic form of address book wherein the following information can be saved: Name, full address, email address, organization and designation of a person etc. It is also possible to store addresses on the basis of categories. Letters or circulars can be sent to individual address or all members of a particular category.
- (iv) **Printing of messages:** It is possible to print messages received as well as messages sent. As a result, hard copy of any message can also be kept.
- (v) **Offline Editing/Composing/Reading:** One does not have to be connected to the Internet all the time to be able to read/edit/compose messages. Ideally, one should log on to the Internet, download all the messages on to one's own hard disk and then get disconnected from the Internet. Once the user is offline, he should read all the messages

that have been received. Even composing of messages can be done offline. This saves Internet time as well as helps in keeping the telephone line free.

In addition to above mentioned features, email software also allows forwarding of messages, transfer of data files and sending e-greeting cards on various occasions.

Question 17

Write short notes on the following:

- (i) *Extranet* (PE-II, May 2003 & Nov. 2005)
- (ii) *Teleconferencing* (PE – II May 2004)
- (iii) *Video Conferencing.* (PE-II Nov. 2005)
- (iv) *Web Casting or push technology* (PE – II May 2004 & Nov. 2006)
- (v) *World Wide Web* (PE-II Nov. 2006)
- (vi) *Voice Messaging* (PE – II May 2007)

Answer

(i) **Extranet:** An **extranet** is an extension of an Intranet that makes the latter accessible to outside companies or individuals with or without an intranet. It is also defined as a collaborative Internet connection with other companies and business partners. Parts of an intranet are made available to customers or business partners for specific applications. The extranet is thus an extended intranet, which isolates business communication from the Internet through secure solutions. Extranet provides the privacy and security of an Internet while retaining the global reach of the Internet. The key characteristic of an Extranet is that it extends the Intranet from one location to another across the Internet by securing data flows using cryptography and authorization procedures, to another Intranet of a business partner. This way, Intranets of business partners, material suppliers, financial services, distributors, customers, etc. are connected to the Extranets by an agreement between the collaborating parties. The emphasis is on allowing access to authorized groups through strictly controlled mechanisms. This has led to the true proliferation of e-commerce.

(ii) **Teleconferencing:** **Teleconferencing** refers to electronic meeting that involves people who are at physically different sites. Telecommunication technology allows members of the meeting to interact with one another without traveling to the same location. Three types of teleconferencing namely audio teleconferencing, video teleconferencing and computer teleconferencing exist.

Audio Teleconferencing is the use of voice communication equipments to establish an audio link between geographically dispersed persons and to conduct a conference. This does not require a computer but requires two-way communication facilities. Video conferencing is the use of television equipments to link geographically dispersed participants. Equipment provides both sound and picture. With this conferencing participants can see and hear each other. Lastly, computer conferencing is the use of

networked computers that allow participants with some common characteristics to exchange information concerning a particular topic. A computer conference group can consist of large number of participants and it can be used within a single geographic site.

- (iii) **Video conferencing:** **Video Conferencing** is the use of television equipment to link geographically dispersed conference participants. The equipment provides both sound and picture. Like audio conferencing, video conferencing does not require a computer.

In video conferencing participants can see and hear each other, generally, participants gather in relatively expensive, specially equipped rooms that can handle the complexities of simultaneous video and audio transmission.

There are three possible video conferencing configurations:

One way Video and Audio: Video and Audio signals are sent from a single transmitting site to one or more receiving sites.

One way Video and two way Audio: People at the receiving sites can talk to people at the transmitting site, while every one views the same video images.

Two way Video and Audio: The Video and Audio communications between all sites are two-way. This is the most effective of the electronically aided conferencing approaches.

- (iv) **Webcasting** or push technology is web-based technology. This allows users to passively receive broadcast information rather than actively search the Web for information. Push technology allows users to choose from a menu of sources, specifying what kind of information they want to receive. Once selected, the information is automatically forwarded to the user. Internet news services, which deliver the day's activities to the user's desktop, are an example of push technology.

Users can also download software, select the frequency with which they will receive services, and subscribe to a variety of information sources. There is very little cost involved to the user for push services because information is delivered with advertising, and users view their custom-tailored news off-line. Webcasting eliminates the frustration of the user which he/she faces while surfing the Internet to get right kind of information.

- (v) **World Wide Web** : The **World Wide Web (WWW)** or the Web is a component of the Internet that provides access to large amounts of information located on many different servers. The Web also provides access to many of the services available on the Internet.

The fundamental unit of the Web is the Web page. The Web page is a text document that contains links to other Web pages, graphic and audio files, and other Internet services such as file transfer protocol (FTP) and E-mail. Tens of thousands of Web servers are connected to the Internet running special software in the servers allowing the users to access Web pages. A user can access directly any Web page on one of these servers and follow the links to other pages. This process creates a Web of links around the world and so the name World Wide Web.

To view a Web page, the user must use a special client software package called a Web browser. There are number of browsers in the market, like Mosaic, Netscape Navigator and Internet Explorer etc.

- (vi) **Voice Messaging:** This communication approach is similar to Electronic mail except in this approach, audio messages rather than text messages are processed. A sender speaks on the phone giving the name of the recipient and message. Sender's voice signals are converted to digital signals and stored. The system then transfers the message to the recipient. The message is converted back to analog form when it is received by the recipient. Recipient hears the same voice as it had been spoken by the sender. Voice messaging requires a computer with the ability to store the message by converting it into digital form and converting back to analog form upon retrieval. Main advantage of voice messaging over electronic mail is that the sender need not have to type the message.

Question 18

Briefly discuss features of data centres.

(PE-II May 2006 & Nov. 2006)

Answer

Features of Data Centers

- (i) **Size:** Data Centers are characterized by the size of their operations. It can have hundred to several thousand servers. It would require a minimum area of approx. 5000 to 30000 Sq. Meters. It must have high quality construction to withstand the weight of servers to be installed inside.
- (ii) **Data Security:** Data Centers have maximum data security and 100 per cent availability. They are protected from intruders with the help of firewalls and password/access rights. These are able to withstand the natural calamities like fire, flood and power failures. Security of data is also maintained by use of anti-virus software and proper backup/recovery procedures. The recovery site is well maintained and everything in data centre is replicated for failure recovery.
- (iii) **Availability of data:** The goal of the data center is to maximize the availability of data and to minimize downtime. Therefore, redundancy is built into all mission critical infrastructure of the data centre such as connectivity, electrical supply and air conditioning, surveillance and fire suppression.
- (iv) **Electrical and Power systems:** Data Centers have highest power availability using Uninterrupted Power supply (UPS).
- (v) **Security:** Physical security and Data security are critical to operations. Physical security of data is maintained with the help of security guards, Biometric devices, Smart card and Closed circuits TV. Data security is addressed at multiple levels through firewalls, IDS, anti-virus, and access control mechanism.

Question 19

Explain the benefits offered by electronic commerce application and implementation.

(PE – II Nov. 2006)

Give an account of the benefits of 'Electronic Commerce' application and implementation.

(PE – II May 2008)

Answer

Following are the benefits of Electronic Commerce application and its implementation:

- (i) **Reduced costs to buyers and suppliers by accessing on-line databases** – Costs to buyers have reduced due to increased competition in procurement as more suppliers are able to compete in an electronically open marketplace. Even suppliers can electronically access on-line databases of bid opportunities, on-line abilities to submit bids, and on-line review of rewards, thereby reducing their costs.
- (ii) **Reduced time to complete business transactions** – Since each and every transaction, from delivery to payment, can be done electronically; the time taken to complete these transactions has reduced substantially.
- (iii) **Creation of new markets through the ability to reach potential customers** – As tens of millions of people are currently using Internet and the number is increasing day -by- day; business via Internet has opened the door to new markets and easy-to-reach potential customers.
- (iv) **Reduced errors, time and overhead costs in information processing** – By eliminating the requirements for re-entering data in processing of information, the overhead costs, errors and time have reduced.
- (v) **Better quality of goods** as specifications are standardized and competition has increased, and improved variety of goods through expanded markets and the ability to produce customized goods exist.
- (vi) **Reduced inventories and reduction of risk of obsolete inventories** – As the demand for goods and services is electronically linked through just-in-time inventory and integrated manufacturing techniques, the holding and ordering costs of inventories have also gone down.
- (vii) **Ability to undertake major global programs** in which the cost and personnel needed to manage a non-automated system would be unreasonable or prohibitive.
- (viii) **Improved market intelligence and strategic planning** – Business via Internet serves as a useful tool to search for information about competitors, customers and suppliers. This information helps in managerial decision-making and strategic planning.
- (ix) **Equal access to market for all categories of businessmen** – The use of a public network-based infrastructure can "level the playing field" for both small and large businesses. This allows companies of all sizes to extend their reach to a broad customer base.
- (x) **Reduced overhead costs through uniformity**, automation and large scale integration of management processes.

- (xi) **Reduced delivery cost** – Especially for goods that can also be delivered electronically, the cost of delivery has reduced.
- (xii) **Reduced design and manufacturing cost** – With the use of CAD and CAM technology, better products can be designed faster and manufactured at lower costs.
- (xiii) **Reduced advertising cost** – Products and services can now be advertised on the home pages of the organizations. Even queries can be attended to by advising the potential customers to access the information on the web site of the organization, rather than responding them with brochures and literature.
- (xiv) **Faster time to market** as business processes are linked, enabling seamless processing and eliminating the delays.
- (xv) **Optimization of resource selection** – As businesses form cooperative teams to increase the chances of economic successes, and to provide the customer products and capabilities more exactly meeting his or her requirements; resource selection process has been optimized.
- (xvi) **Reduced use of ecologically damaging materials** through electronic coordination of activities and the movement of information rather than physical objects.
- (xvii) **Customer involvement in product and service innovation has increased.**

Question 20

Explain general management concerns in E-commerce.

(PE – II May 2007)

Answer

General Management Concerns in E-Commerce are as follows:

- (1) **Loss of Paper audit trail:** Since no paper work is involved in doing the business transactions electronically, hence keeping the track of business activities will be difficult.
- (2) **Business Continuity:** In E-Commerce, all the transactions are done with the help of computers, hence if computer system fails then entire business organization will be paralyzed.
- (3) **Exposure of data to third parties:** Due to sharing of data among organizations, there is possibility of exposure of secret information to other parties.
- (4) **Record retention:** Electronic information is required to be kept safely as a statutory requirement, therefore organizations will have to take appropriate measures for the safety of data.
- (5) **Segregation of duties:** There are more chances of fraud in an electronic environment. Hence, duties of various persons working in electronic environment must be properly defined, in order to fix their responsibilities at later stages.
- (6) **Legal Liability:** The inability to complete transactions or meet deadlines, or the risk of inadvertently exposing information of trading partners poses legal risks.

Question 21

What is Teleconferencing? Explain different types of teleconferencing. (PE – II Nov. 2007)

Answer

Teleconferencing: It refers to the electronic meeting between people who are geographically scattered. Telecommunication technology allows the people to interact with each other without traveling to the same location which saves a lot of money and valuable time.

There are three types of teleconferencing:

1. **Audio conferencing:** It is the use of audio communication equipments which allows the user to communicate with geographically dispersed persons. Audio conferencing does not require a computer but requires a two way audio communication facility.

Guidelines to make Audio conferencing more efficient:

- (i) All the participants must have an opportunity to speak.
- (ii) Number of participants must be kept to manageable size.
- (iii) Copy of conferencing agenda must be sent to all the participants in advance through FAX.
- (iv) Participants must identify themselves.
- (v) Conferencing discussion must be recorded.
- (vi) Hard copy of the discussion must be prepared and should be sent to all the participants for approval.

2. **Video conferencing:** In this conferencing, participants can see and hear each other. It uses the television and does not require a computer. Participants gather in specially equipped rooms having audio and video facility.

There are three types of Video Conferencing:

- (i) One way Video and Audio: In this case, audio and video is traveled only in one direction e.g. Television.
 - (ii) One way Video and Two way Audio: In this case, audio is transferred in both the directions but video is transferred only in one direction e.g. discussion of news reader with field correspondent.
 - (iii) Two way video and Audio: In this case, audio and video is transferred in both the directions between sender and receiver e.g. discussion of persons between different studios of a news channel.
3. **Computer Conferencing:** It is the use of networked computer that allows participants with some common characteristics to exchange information concerning a particular topic. It is more disciplined form of E-Mail. It can be used within single geographic site which is not practical in case of Audio and Video conferencing.

Question 22

How is digital signature created? Describe it.

(PE – II May 2008)

Answer

The digital signature is created in two distinct steps as follows:

- (1) First the electronic record is converted into a message digest by using a mathematical function known as "hash function". This function digitally freezes the electronic record thus ensuring the integrity of the content of the intended communication contained in the electronic record. Any tampering will immediately invalidate the digital signature.
- (2) Secondly, the identity of the person affixing the digital signature is authenticated through the use of a private key, which attaches itself to the message digest. This can be verified by anyone who has the public key corresponding to such private key. This will enable anybody to verify whether the electronic record is retained intact or has been tampered with since it was so fixed with the digital signature. It will also enable the person having public key to identify the originator of the message.

Question 23

Explain, why Internet has dramatic impact on the scope of business applications.

(PE – II Nov. 2008)

Answer**Reasons for Internet's dramatic impact on the scope of business applications:**

1. **Universality:** Any business using the Internet can interact with any other business using the Internet.
2. **Reach:** The Internet is everywhere; large cities and small towns throughout the modern and developing world.
3. **Performance:** The Internet provides its user with a high-function window to the world, in addition to handling everyday networking tasks such as electronic mail and visual images, audio clips and other large electronic objects.
4. **Reliability:** Internet technology is highly robust and reliable, in spite of significant differences in the extent to which various Internet service providers actually implement and ensure its reliability.
5. **Cost:** Compared with alternative networking technologies, Internet costs are very low.
6. **Momentum:** The rate of growth of Internet users is increasing manifold every year, thus business use is increasing at a dramatic rate.

Question 24

Discuss the various challenges faced by management of data centre.

(PE – II Nov. 2008)

Answer

Challenges faced by Management of Data Centre:

The management of data centre needs to face the following challenges:

- **Maintaining a skilled staff and the high infrastructure needed for daily operations:** A company needs to have staff which is expert at network management and has software and hardware skills. The company has to employ a large number of such people, as they have to work on rotational shifts.
- **Maximizing uptime and performance:** While establishing sufficient redundancy and maintaining watertight security, data centers have to maintain maximum uptime and system performance.
- **Technology Selection:** The other challenges that enterprise data centres face is technology selection, which is crucial to the operations of the facility, keeping business objectives in mind. Another problem is compensating for obsolescence.
- **Resource Balancing:** The enterprise needs to strike a working balance between reduced operational budgets, increased demands on existing infrastructure, maximizing availability, ensuring round-the-clock monitoring and management, and the periodic upgrades that today's technology demands.

Question 1*Distinguish between the following:-*

- (i) *Horizontal Partitioning and Vertical Partitioning* (PE – II May 2004)
 (ii) *Logical Record and Physical Record* (PE – II May 2007)

Answer

- (i) **Horizontal partitioning and Vertical partitioning : Horizontal partitioning** breaks a data relation into multiple record specifications by placing different rows into different records based on common column value. It makes sense when different categories of rows of a table are processed separately. Horizontal partitioning is more secure as the file level security can be used to prohibit user from seeing certain rows of data. Also each partitioned table can be organized differently, appropriate for how it is individually used. Further each partitioned files can be placed on a separate disk driver to reduce contention for the same drive, hence improves performance across the database.

Vertical partitioning, on the other hand, distributes the columns of a relation into separate files, repeating the primary key in each of the files. An example of vertical partitioning would be breaking apart a part relation by placing the part number along with accounting related part data into one record specification, the part number along with engineering related part data into another record specification and the part number along with sales related part data into another record specification. The other advantages of vertical partitioning are similar to those of horizontal partitioning.

(ii)

No.	Logical Record	Physical Record
1.	The record defined by user is called Logical Record.	Storage of Logical Record in the computer is called Physical Record.
2.	It is the collection of those fields which are accessed by a single primary key.	It is the collection of those fields which are stored in adjacent memory location.
3.	Logical records are linked together with	Physical records are linked together with

	the help of File pointers.	the help of Address Pointers.
4.	It may consist of Fixed length fields and Variable length fields.	All fixed length fields of Logical record are stored in one Physical record and each variable length field of Logical record is considered as separate physical record.
5.	Field Names, their data type and width are defined by user according to the requirements.	Physical record size is defined by Database Administrator (DBA) in such a way that it results in faster accessing of data.
6.	User is concerned with Logical record for insertion, deletion and updation of data.	Computer performs the required manipulation in the physical record.
7.	Sequence of fields in Logical record may be according to the convenience of user.	Sequence of fields in Physical record may not be same as Logical record.

Question 2

Discuss the importance of "data volume" and "usage analysis" in the design of database.

(PE – II May 2003)

Answer

Data Volume and Usage Analysis: The physical design of data base requires certain information that should have been collected and produced during initial phases of system development. These include:

- (i) Normalized relations, including volume estimates,
- (ii) Definition of each attribute
- (iii) Description of where and when data are used, entered, retrieved, deleted and updated.
- (iv) Requirement for response time and data security, back up, recovery and integrity etc.

The above information can be generated by data volume and usage analysis. Thus, data volume and frequency -of - use statistics are critical inputs. The first step one needs to take in physical design of the data base is to estimate the size and usage pattern of the database.

The volume and frequency statistics are generated during the system analysis phase of the system development process when system analysts are studying currents and proposed data processing activities. The data volume statistics represent the size of the business and should be calculated assuming business growth over a considerable period of time. The access frequencies are from the timing of events, transactions volumes and reporting and querying activities. Ad-hoc query may increase frequency of usage. The data volume and usage analysis helps in identifying the key areas where the greatest attention needs to be given in order to achieve the best possible performance.

Question 3

What are the important decisions, which influence the physical design of a database? Explain.

(PE – II May 2004 & Nov. 2006)

Answer

Physical database design requires several critical decisions that will affect the integrity and performance of the application system. These key decisions include the following:

- (i) Choosing the storage format called data-type for each attribute from the logical data model. The format is chosen to minimize storage space and to maximize data integrity.
- (ii) Grouping attributes from the logical data model into physical records.
- (iii) Arranging similarly structured records in secondary memory (primary hard disks) so that individual and groups of records (called file organizations) can be stored, retrieved and updated rapidly. Consideration may also be given to protect data and recovering data after errors are found.
- (iv) Selecting structures (called indexes and database architectures) for storing and connecting files to make retrieval of related data more efficient.
- (v) Preparing strategies for handling queries against the database that will optimize performance and take advantage of the file organizations and indexes that the users have specified. Efficient database structures will be of benefit only if queries and the database management systems that handle those queries are tuned intelligently to use those structures.

Question 4

Write a short note on Program Library Management Systems

(PE – II Nov. 2002, Nov. 2004 & Nov. 2008)

Answer

Program Library Management Systems: It provides several functional capabilities to facilitate effective and efficient management of the data center software inventory. The inventory may include system and application software program code, job control statements that identify resources used and processes to be performed and processing parameters which direct processing.

Some of the library management system capabilities are:

Integrity: Each source program is assigned a modification number and version number and each source statement is associated with a creation date. Security over program libraries, job

control language sets and parameter files is provided through the use of passwords, encryption, data compression facilities and automatic back up creation.

Update: It facilitates the addition, deletion, re-sequencing and editing of library members. For example, by creating an automated back-up copy prior to changes being made and maintaining the audit trail of all library activities.

Reporting: Lists of additions, deletions, modifications, library catalog and library member attributes can be prepared for management and audit review.

Interface: It may interface with the operating system, job scheduling system, access control and online program management.

Question 5

Which areas of DBMS should be addressed while maintaining a database? Explain.

(PE-II May 2005)

Answer

Following five areas of DBMS managements are be considered when trying to maintain a well-tuned database:

(i) Installation of database

Correct installation of the DBMS product.

Ensuring that adequate file space is available.

Proper allocation of disc space for database.

Allocation of data files in standard sizes for I/O balancing.

(ii) Memory Usage – One should know about following memory management issues:

How the DBMS uses main memory ?

What buffers are being used ?

What needs the programs in main memory have?

Knowledge of above issues can help in efficient usage of memory.

(iii) Input / Output (I/O) contention

Achieving maximum I/O performance is one of the most important aspects of tuning.

Understanding how data are accessed by end-users is critical to I/O contention.

Simultaneous or separate use of input and / or output devices.

Clock speed of CPU requires more time management of I/O.

Spooling/Buffering etc. can be used.

Knowledge of how many and how frequently data are accessed, concurrently used database objects need to be striped across disks to reduce I/O contention.

(iv) CPU Usage

Multi programming and multi processing improve performance in query processing

Monitoring CPU load.

Mixture of online/back ground processing need to be adjusted.

Mark jobs that can be processed in run off period to unload the machine during peak working hours.

Question 6

Discuss the several integrity controls that DBMS has to support.(PE-II Nov. 2003 & Nov. 2005)

OR

What are the integrity controls that DBMS package may offer? Explain in brief.

(PE – II May 2007)

Answer

Data Integrity Controls (i.e. controls on the possible value a field can assume) can be built into the physical structure of the fields. In order to have the correct database, DBMS needs to have certain controls on the data fields. Some of the security controls that DBMS imposes on data fields are as follows:

- (i) **Data Type:** In the data field, the data type defines the type of data to be entered in the field. It may be numeric, character etc.
- (ii) **Length of data field:** The length of data field defines the maximum number of characters or digits (depending upon the data type) to be entered in the data field. It may be 256, 65536 etc.
- (iii) **Default value:** It is the value a field will assume unless a user enters an explicit value for an instance of that field. Assigning a default value to a field can reduce data entry time and entry of a value to that field can be skipped. Default value helps in reducing the probability of data entry errors for most common values.
- (iv) **Range Control:** This limits the set of permissible values a field can assume. The range may be numeric lower to upper bound or a set of specific values. Range control must be used with caution since the limits of range may change with time. A combination of range control and coding led to Y2K problem, in which a field for the year was represented by only the numbers 00 to 99.
- (v) **Null Value Control:** Null value is an empty value. Each primary key field must have an integrity control that prohibits a null value. Any other required field may also have a null value control placed on it depending upon the policy of the organization. For example, a university may prohibit adding a course to its database unless that course has a title as well as value to the primary key, course-ID. Many fields legitimately may have null values so this control is to be used only when truly required.

- (vi) **Referential Integrity:** This control on a field is a form of range control in which the value of that field must exist as the value in some field in another row of same or different table. That is the range of legitimate values comes from the dynamic contents of a field in a data base table, not from some pre-specified set of values. Referential integrity guarantees that only some existing cross-referencing value is used, not that it is the correct one.

Question 7

Explain the importance of "Data Volume" and "Usage Analysis" in the design of a database.

(PE-II May 2006)

Answer

Data Volume and Usage Analysis: Data-volume and usage analysis i.e. frequency-of-use statistics are critical inputs to the physical database design process. The volume and frequency statistics are generated during the systems analysis phase of the systems development process when systems analysts are studying current and proposed data processing and business activities. The data-volume statistics represent the size of the business, and should be calculated assuming business growth over at least a several-year period. The access frequencies are estimated from the timing of events, transaction volumes, and reporting and querying activities. Since many databases support ad hoc accesses, and such accesses may change significantly over time, the access frequencies tend to be less certain than the volume statistics. Fortunately, precise numbers are not necessary. What is crucial is the relative size of the numbers, which will suggest where the greatest attention needs to be given in order to achieve the best possible performance. Data volume and usage analysis helps in taking decisions regarding the following:

- Hardware configuration including Processor speed and Hard disk capacity
- File organization and Indexing field
- Selection of a database structure like Hierarchical, Network or Relational database structure
- Selection of DBMS/RDBMS like Foxpro, MS-Access, Oracle or SQL.

Question 8

Describe briefly the term 'DBMS' with reference to Information Technology (PE – II May 2007)

Answer

DBMS: It is a complex system software package which allows the user to create and maintain the database files. Data security is defined with the help of DBMS using passwords and access rights. DBMS allows only authorized users to access the data according to their access privileges.

Question 1

Describe briefly, the following term with reference to Information Technology:

- (i) Packet Switching. (PE-II Nov. 2002)
- (ii) Asymmetric crypto system (PE-II May 2005 & PE-II May 2007)

Answer

- (i) **Packet Switching:** It is a sophisticated means of data transmission capacity of networks. In packet switching, all the data coming out of a machine is broken up into chunks. Each chunk has the address of the location it came from and also the address of the destination. This technique is used to move data around on the Internet.
- (ii) **Asymmetric Crypto System :** It refers to a system of a secure key pair consisting of a private key for creating a digital signature and a public key to verify the digital signature.

Question 2

Give one or two reasons for Birth of the Information Technology Act, 2000 (PE – II May 2003)

Answer

Birth of Information Technology Act, 2000: The Law of Evidence is traditionally based upon paper-based records and oral testimony, which bear signatures. The government of India realized the need for introducing a new law to facilitate e-commerce and give legal recognition to electronic records and digital signatures. This gave birth to the Information Technology Act, 2000.

Question 3

Explain the main objectives of IT Act, 2000 (PE – II May 2003, May 2007 & May 2008)

Answer

Objectives of the Information Technology Act, 2000

- (a) To grant legal recognition to transactions carried out by means of EDI and E-Commerce in place of paper based methods of communication.
- (b) To give legal recognition to digital signatures for authentication of any information.
- (c) To facilitate electronic filing of documents with Government Departments.
- (d) To facilitate electronic storage of data.
- (e) To facilitate and give the legal recognition to electronic fund transfers between bank and financial institutions.
- (f) To give legal recognition for keeping books of accounts in electronic form by bankers.
- (g) To amend the Indian Penal Code, the Indian Evidence Act, the Banker's Book Evidence Act and Reserve Bank of India Act.

Question 4

Describe the scope of Information Technology Act, 2000

(PE – II Nov. 2003)

Answer

This Act is called the Information Technology Act, 2000. It shall extend to the whole of India and, unless otherwise provided in the Act, it applies also to any offence or contravention thereunder committed outside India by any person. The Act was enforced by the Central Government from October 17, 2000.

The Act shall not apply to the following:

- (i) a negotiable instrument as defined in section 13 of the Negotiable Instrument Act;
- (ii) a power-of-attorney as defined in section 1 A of the Powers of Attorney Act 1882;
- (iii) a will as defined in section (h) of section 2 of the Indian Succession Act, 1925 including any other testamentary disposition by whatever name called;
- (v) any contract for the sale or conveyance of immovable property, or any interest in such property;
- (vi) any such class of documents or transactions as may be notified by the Central Government in the Official Gazette.

Question 5

Explain the duties of certifying authority in respect of digital signature.

(PE – II May 2004)

Answer

Duties of Certifying Authority in respect of Digital Signature:

- (i) Every certifying authority shall follow certain procedures in respect of digital signatures as given below:

- make use of hardware, software and procedures that are secure from intrusion and misuse,
 - provide a reasonable level of reliability in its services which are reasonably suited to the performance of intended functions,
 - adhere to security procedures to ensure that the secrecy and privacy of the digital signatures are assured and
 - observe such other standards as may be specified by regulations.
- (ii) Every certifying authority shall also ensure that every person employed by him complies with the provisions of the Act, or rules, regulations or orders made there under.
- (iii) A certifying authority must display its license at a conspicuous place of the premises in which it carries on its business and a certifying authority whose license is suspended or revoked shall immediately surrender the license to the controller.
- (iv) Every certifying authority shall disclose its digital signature certificate, which contains the public key corresponding to the private key used by that certifying authority and other relevant facts.

Question 6

Explain the various matters on which Central Government can make rules under Section 87 of Information Technology Act. (PE – II Nov. 2004)

OR

Explain the powers of Central Government to make rules as defined in Section 87 of IT Act, 2000. (PE – II Nov. 2007)

Answer

Section 87: This Section has been discussed in Chapter 13 – Miscellaneous of IT Act, 2000. According to this section, Central government has powers to make rules regarding the following:-

- (i) The manner in which any information may be authenticated by digital signature.
- (ii) The electronic form in which filings, issue, grant or payment shall be effected.
- (iii) The matter relating to the type of digital signature, manner and format in which it may be affixed.
- (iv) Security procedure for creating secure electronic record.
- (v) Qualifications and experience of Controller, Deputy Controller & Assistant Controller.
- (vi) Requirements for applying for a license to issue Digital Signature Certificate.
- (vii) The format of application form for license, period of validity of license and amount of fees payable.
- (viii) The form and fee for renewal of license.

- (ix) The fee to be paid to the Certifying Authority for issue of a Digital Signature Certificate.
- (x) The qualification and experience of the adjudicating officer.
- (xi) The salary, allowances and other terms and conditions of service of Presiding Officer.

Question 7

Write short notes on the following:

- (a) *Computer Crimes and Penalty in IT Act 2000* (PE – II Nov. 2002)
- (b) *Cyber Regulation Appellate Tribunal* (PE – II May 2003)
- (c) *Digital Signature* (PE – II Nov. 2003 & Nov. 2006)
- (d) *IT Act 2000* (PE – II Nov. 2005)

Answer

(a) Computer Crimes and Penalty in IT Act 2000: In IT Act, 2000, the Chapter XI deals with some computer crimes and provides penalties amounting one to two years imprisonment with or without a fine of 1-2 lakh or both. The Section 65 to 78 deals with these crimes and provides for penalties for these offences. Some of the important crimes are as following:

- (i) Section 65 provides for punishment for tampering with computer source documents
- (ii) Section 66 provides for punishment for hacking with computer system
- (iii) Section 67 provides for punishment for publishing or transmitting or causing to be published or transmitted, information which is obscene in electronic form.

Section 71 to 78 of IT Act provides for penalties. Some of the important penalties are as following:

- (i) Misrepresenting or suppressing any material [Section 71] – imprisonment for upto two years or fine which may extend to Rs. 1 lakh or both.
- (ii) Breach of confidentiality and privacy of electronic records, books, information [Section 72] -imprisonment upto two years or fine of Rs. 1 lakh or both.
- (iii) Publishing false Digital Signature Certificate [Section 73] - imprisonment for a term of upto two years or fine of Rs. 1 lakh or both.
- (iv) Publishing of Digital Signature Certificate for fraudulent purpose [Section 74] - imprisonment for a term of upto two years or fine of Rs. 1 lakh or both.
- (v) Offence committed outside India involving a computer, computer system or computer network located in India [Section 75].

- (b) **Cyber Regulation Appellate Tribunal:** The "Cyber Regulations Appellate Tribunal" has appellate powers in respect of orders passed by any adjudicating officer.

The section 48 of IT Act, 2000 allows to establish one or more Appellate Tribunals to be known as Cyber Regulations Appellate Tribunals. The Tribunal shall consist of one person only, called the Presiding officer, who shall be appointed by notification by the Central Government. Such a person must be qualified to be a judge of High Court. He shall hold office for a term of five years or upto a maximum age limit of 65 years, whichever is earlier.

Section 58 of IT Act provides for the procedure and powers of the Cyber Appellate Tribunal. The Tribunal shall also have the powers of the civil Court under the Code of Civil procedure, 1908.

Some of the powers specified are in respect of the following matters.

- (a) Summoning and enforcing the attendance of any person and examining him on oath.
- (b) Requiring production of documents and other electronic records.
- (c) Receiving evidence on affidavits
- (d) Reviewing its decisions
- (e) Issuing commissions for examination of witness etc.

Section 61 provides that no court shall have jurisdiction to entertain any suit or proceeding in respect of any matter which an adjudicating officer has jurisdiction to determine.

- (c) **Digital Signature:** Digital signature is a form of security for electronic records that the dual key technology offers. The digital signature is encrypted with a private key which when attached to an encrypted message uniquely identifies the sender. Since the encryption used in the digital signature is linked to the message sent, 'forger' will be unable to copy the digital signature by simply cutting and pasting it to another message. Section 3 of Information Technology Act gives legal recognition to electronic records and digital signatures.

The digital signature is created in two distinct steps. First, the electronic record is converted into a message digest by using a mathematical function known as "hash function" which digitally freezes the electronic record thus ensuring the integrity of the content of the intended communication contained in the electronic record. Any tampering with the contents of the electronic record will immediately invalidate the digital signature. Secondly, the identity of the person affixing the digital signature is authenticated through the use of a private key which attaches itself to the message digest and which can be verified by anybody who has the public key corresponding to such private key. This will enable anybody to verify whether the electronic record is retained intact or has been tampered with since it was so fixed with the digital signature. It will also enable a person who has a public key to identify the originator of the message.

- (d) **IT Act 2000:** Computers are being used to create, transmit and store the information in electronic form instead of paper documents but the main hurdle in e-Governance is the requirement of writing and signature for legal recognition. At present, many legal provisions require the evidence in the form of paper documents having signatures. The law of evidence is based on paper-based records; hence for success of *e-Governance e-Commerce*, legal changes were required.

Therefore, Govt. of India introduced a new law for giving legal recognition to electronic records. This gave birth to Information Technology bill, 1999 which was passed by both the houses of Parliament in May 2000 and the President gave his assent in August 2000. This Information Technology bill is called Information Technology Act, 2000 which also contains cyber laws.

Objectives of the Information Technology Act 2000 are:

- (a) To grant legal recognition to transactions carried out by means of EDI and E-Commerce in place of paper based methods of communication.
- (b) To give legal recognition to digital signatures for authentication of any information.
- (c) To facilitate electronic filing of documents with Govt. departments.
- (d) To facilitate electronic storage of data.
- (e) To facilitate and give legal recognition to electronic fund transfers between bank and financial institutions.
- (f) To give legal recognition for keeping books of accounts in electronic form by bankers.
- (g) To amend the Indian penal code, the Indian Evidence Act, the Banker's Book Evidence Act and Reserve bank of India Act.

The Act consists of 94 Sections spread over thirteen chapters and four schedules to the Act. The schedules of Act contain related amendments in other acts namely the Indian Penal Code, the Indian Evidence Act, 1972, the Banker's Book Evidence Act, 1891 and the Reserve Bank of India, 1934.

Question 8

Describe about the various actions, which warrant penalty under the Section 43 of the IT Act, 2000.
(PE-II May 2005 & Nov. 2008)

Answer

Penalty Action under Section 43

Section 43 deals with penalty for damage to computer or computer system by any of these methods:

- (i) Securing access to the computer, computer system or computer network.
- (ii) Downloading or extracting any data, computer database or information from such computer system or those stored in any removable storage medium.

- (iii) Introducing any computer contaminant or computer virus into any computer, computer system or network.
- (iv) Damaging any computer, computer system or network or any computer data, database or programme.
- (v) Disrupting any computer, computer system or network.
- (vi) Denying access to any person authorised to access any computer, computer system or network.
- (vii) Providing assistance to any person to access any computer, computer system or network in contravention of any provisions of this Act or its Rules.
- (viii) Charging the services availed of by one person to the account of another person by tampering with or manipulating any computer, computer system or network.

Question 9

Explain the various matters on which power of controller can make rules under Section 89 of Information Technology Act. (PE-II Nov. 2005)

Answer

The Controller has been given powers under Section 89 to make regulations consistent with the Information Technology Act and the related rules so as to carry out the purposes of this Act. However, he may do so after consultation with the Cyber Regulations Advisory Committee and with the previous approval of the Central Government. These regulations shall be notified in the Official Gazette. These regulations shall be related to the following matters:

- (i) the particulars relating to maintenance of data base containing the disclosure record of every Certifying Authority,
- (ii) the conditions and restrictions subject to which the Controller may recognise any foreign Certifying Authority,
- (iii) the terms and conditions subject to which a licence may be granted,
- (iv) other standards to be observed by a Certifying Authority,
- (v) the manner in which the Certifying Authority may make the disclosure under Section 34,
- (vi) the particulars of statement to be submitted along with an application for the issue of a Digital Signature Certificate,
- (vii) the manner in which the subscriber should communicate the compromise of private key to the Certifying Authority.

Question 10

Define the following terms with reference to Section 2 of Information Technology Act, 2000:

- (i) Key Pair
- (ii) Originator
- (iii) Digital Signature
- (iv) Secure System
- (v) Computer Network.

(PE-II May 2006)

Answer

- (i) **Key pair:** In an asymmetric crypto system, comprising of a private key and its related public key. These keys are so related that the public key can be used to verify a digital signature created by the private key.
- (ii) **Originator:** It refers to a person who sends, generates, stores or transmits any electronic message or causes any electronic message to be sent, generated, stored or transmitted to any other person but does not include an intermediary.
- (iii) **Digital signature:** It refers to authentication of any electronic record by a subscriber by means of an electronic method or procedure in accordance with the provision of section 3.
- (iv) **Secure system:** It means computer hardware, software and procedures which are reasonably secure from the unauthorized access and misuse, provide a reasonable level of reliability and correct operation and adhere to generally accepted security procedures.
- (v) **Computer network:** It refers to the interconnection of two or more computers through the use of special cabling like UTP/Fiber optic cable, telephone lines, microwave or satellite link or other communication media; and terminals or a complex consisting of two or more interconnected computers whether or not the interconnection is continuously maintained.

Question 11

Explain the duties of Certifying Authorities under Section 30 of Information Technology Act.

(PE-II Nov. 2006)

Answer

Duties of Certifying Authorities under Section 30 of Information Technology Act are stated below:

- (1) (a) Make use of hardware, software and procedures that are secure from intrusion and misuse;
- (b) Provide a reasonable level of reliability in the services, which suit to the performance of intended functions.
- (c) Adhere to security procedures to ensure that the secrecy and privacy of the digital signatures are assured.
- (d) Observe such other standards as may be specified by regulations.
- (2) Every certifying Authority shall also ensure that every person employed by him complies with the provisions of the Act, or rules, regulations or orders made there under.
- (3) A certifying Authority must display its license at a conspicuous place of the premises in which it carries on its business. A certifying Authority whose licence is suspended or revoked shall immediately surrender the licence to the controller.

- (4) Certifying Authority shall disclose its digital signature certificate, which contains the public key corresponding to the private key used by that authority and other relevant facts.

INTRODUCTION TO FLOWCHARTING

Question 1

An insurance company follows the following rules:

- (i) If a person's health is good and age is between 20 and 40 years and lives in a city and sex is male, then the premium is Rs.20 per thousand and he will be insured for maximum amount of Rs.10.0 lakhs.*
- (ii) If a person satisfies all the above conditions, except that sex is female, then the premium is Rs.15 per thousand and maximum insured sum will be Rs.15.0 lakhs.*
- (iii) If a person's health is poor and age is between 20 and 40 years, but lives in a village. For a male sex, premium is Rs.50 per thousand and maximum insured sum is Rs.1.0 lakh only.*
- (iv) In all other cases, the person is not to be insured.*

Draw a flow chart to find the eligibility of a person to be insured, premium rate and maximum amount of Insurance. (PE – II Nov. 2002)

Question 2

An electricity distribution company has three categories of consumers namely -

- (i) Domestic*
- (ii) Commercial*
- (iii) Industry*

The charges of electricity per unit consumed by these consumers are Rs.3, Rs.4 and Rs.5 respectively. The computer database of the company has following information:

- Consumer's name*
- Category*
- Units consumed*
- Bill date*
- Date of payment.*

The company processes bills according to the following criterion.

If the consumer is domestic and pays his bill within 10 days of the bill date, 5% discount is given. If he pays the bill within 15 days, no discount is given. If he makes the payment after 15 days of the bill date, 10% surcharge is levied. For the non-domestic consumers (commercial or industry), corresponding percentage be 10%, 0% and 15% respectively.

Draw a flowchart to calculate the bill amount, discount, surcharge and net amount of the bill for each type of consumer and print it. (PE – II May 2003)

Question 3

A bank accepts fixed deposit for a year or more and the policy on interest rate is as follows:

- (i) If a deposit is less than Rs.10,000 and for two or more years, the interest rate is 5% compounded annually.
- (ii) If a deposit is Rs.10,000 or more, but less than Rs.50,000 and for two or more years, the interest rate is 7% compounded annually.
- (iii) If the deposit is Rs.50,000 or more and is for one year or more the interest rate is 8% compounded annually.
- (iv) On all deposits for five years or more interest rate is 10% compounded annually.
- (v) On all other deposits not covered by the above conditions, the interest rate is 3%.
- (vi) If the customer is holder of any type of account for last five years, an additional 1% interest is allowed.

Draw a flow chart to obtain the money in customer's account and interest credited at the time of withdrawal. (PE – II Nov. 2003)

Question 4

Draw a flow chart to compute and print Income-tax, Surcharge and Education cess on the income of a person, where income is to be read from terminal and tax is to be calculated as per the following rates:

	Slab (Rs.)	Rate
(i)	1 to 1,00,000	No tax
(ii)	1,00,001 to 1,50,000	@ 10% of amount above 1,00,000
(iii)	1,50,001 to 2,50,000	Rs. 5,000 + 20% of amount above 1,50,000
(iv)	2,50,001 onwards	Rs. 25,000 + 30% of amount above 2,50,000
	Surcharge	@ 10% on the amount of total tax, if the income of a person exceeds Rs. 10,00,000
	Education cess	2% on the total tax

(PE – II Nov. 2006)

Question 5

A company ABC Ltd. is engaged in selling consumer goods to different categories of customers. In order to increase its sales, different types of discounts are offered to customers. The policy of discount is as given below:

- (i) On cooking range, a discount of 12 percent is allowed to dealers and 9 percent to retailers irrespective of the value of the order.
- (ii) A discount of 12 percent is allowed on washing machine irrespective of the category of customer and the value of the order.
- (iii) On decorative products, dealers are allowed a discount of 20 percent provided that the value of the order is Rs. 10,000 and above. Retailers are allowed a discount of 10 percent irrespective of the value of the order.

Draw a flow chart to calculate the discount for the above policy.

(PE – II May 2004)

Question 6

A bicycle shop in a city hires bicycles by the day at different rates for different models as given below:

Model No.	Hire rate per day
Model No. 1	Rs. 10
Model No. 2	Rs. 9
Model No. 3	Rs. 8
Model No. 4	Rs. 7

In order to attract customers, the shopkeeper gives a discount of 15 percent to all those customers, who hire a bicycle for more than one-week period. Further to attract women customer, he gives additional discount of 10 percent irrespective of hire period. For every bicycle hired a security deposit of Rs. 25 must be paid.

Draw a flow chart to print out the details of each customer such as name of customer, bicycle model number, number of days a bicycle is hired for, hire charges, discount and total charges including deposits.

(PE – II Nov. 2004)

Question 7

An electric supply company charges the following rates for its domestic consumers:

No. of units consumed	Charges/unit (Rs.)

For the first 200 units	1.60
For the next 300 units	2.10
Over 500 units	3.90

Surcharge @ 20% of the bill is to be added to the charges.

Draw a Flow chart for the above, which will read the consumer number and the number of units consumed and print out the total charges with the consumer number and the units consumed. (PE – II Nov. 2006)

Question 8

A bank has 500 employees. The salary paid to each employee is sum of his basic pay, Dearness Allowance and House rent allowance. For the purpose of computing house rent allowance bank has classified his employees into three classes A, B and C. The house rent allowance for each class is computed at the rate of 30 percent, 20 percent and 10 percent of the basic pay respectively. The dearness allowance is computed at a flat rate of 60 percent of the basic pay.

Draw a flow chart to determine the percentage of employee falling in the each of the following salary slabs:

- (i) Above Rs. 30,000
- (ii) Rs. 15,001 to Rs. 30,000
- (iii) Rs. 8,001 to Rs. 15,000
- (iv) Less than or equal to Rs. 8,000.

(PE – II May 2005)

Question 9

A water distribution company has two categories of consumers (Domestic and Commercial).

The charges of water per unit consumed by these consumers are Rs. 5.00 and Rs. 8.00 respectively. The computer database of the company has the following information:

- Consumer's name
- Category
- Units consumed
- Bill's date
- Date of payment.

The company processes bills according to the following criterion:

If the consumer is domestic and pays his bill within 10 days of the bill date, 7% discount is given. If he pays the bill within 15 days, no discount is given. If he makes the payment after 15 days of the bill date, 10% surcharge is levied. For commercial consumers, corresponding percentage be 15%, 0% and 15% respectively.

Draw a Flow chart to calculate the bill amount, discount, surcharge and net amount of the bill for each type of consumer and print it. (PE – II Nov. 2005)

Question 10

A company offers discounts to customers on the following basis:

Quantity ordered	Normal discount
Less than 101	5%
From 101 to 500	10%
From 501 to 1,000	15%
More than 1,000	20%

The normal discount as given above is admissible only if the Customer's account balance in below Rs. 1,000 and the order value is Rs. 10,000 or more. If the account does not satisfy both of these conditions, the discount is reduced by 2% and if only one condition is violated, the discount is reduced by 1%.

Draw a Flow Chart to print customer name, discount offered and net amount payable for 25 customers. (PE – II May 2007)

Question 11

A computer file contains the customer name, type, bill number, bill date, amount and date of payment. The bill is generated according to the following rules:

If a customer is a dealer and pays his bill within 15 days, 5% discount is allowed. If he pays the bill between 15 and 30 days, the discount allowed is 2%. If payment period is more than 30 days but upto 60 days, 5% surcharge is levied. For payment after 60 days, 10% surcharge has to be paid.

If a customer is a manufacturer, the corresponding percentages are 7%, 5%, 7% and 12% respectively.

Draw a program flowchart to calculate discount, surcharge and net amount for each of the 20 customers. Also print total discount and surcharge paid by all the customers.

(PE – II Nov. 2007)

Question 12

There are total 6,000 students in a university having four different disciplines. Their discipline code and yearly tuition fee per student, details are as follows:

Discipline of student	Code	Yearly tuition fee
-----------------------	------	--------------------

Medical	M	80,000
Engineering	E	60,000
Science	S	40,000
Arts	A	25,000

Draw a flowchart to read the name, discipline code of the student's from the terminal/file. Find the total yearly revenue earned and the number of students discipline wise. Also find the percentage of contribution to the total revenue from each discipline of students.

Print the total revenue collected and the number of students, the percentage of their contribution discipline wise to the total revenue earned by the university. (PE – II May 2008)

Question 13

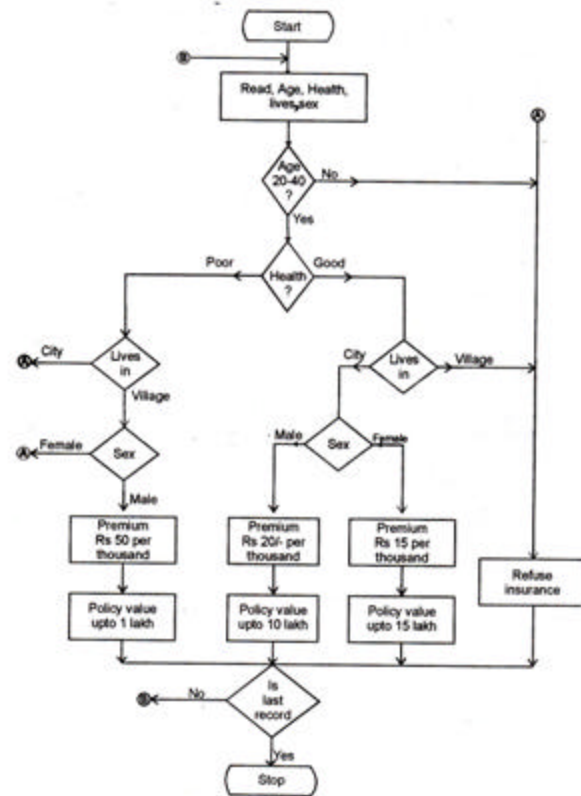
The goods imported from the foreign countries are classified into four categories for the purpose of levying Custom duty. The rate of Custom duty on value of goods 'V' for each category is given below:

Category (K)	Type of Goods	Custom Duty (%)
1.	Electronic items	10
2.	Heavy machinery	15
3.	Footwear items	20
4.	All other unclassified items	25

Draw a flow chart to compute appropriate custom duty including educational cess at the rate of 3% of the value of custom duty. (PE – II Nov. 2008)

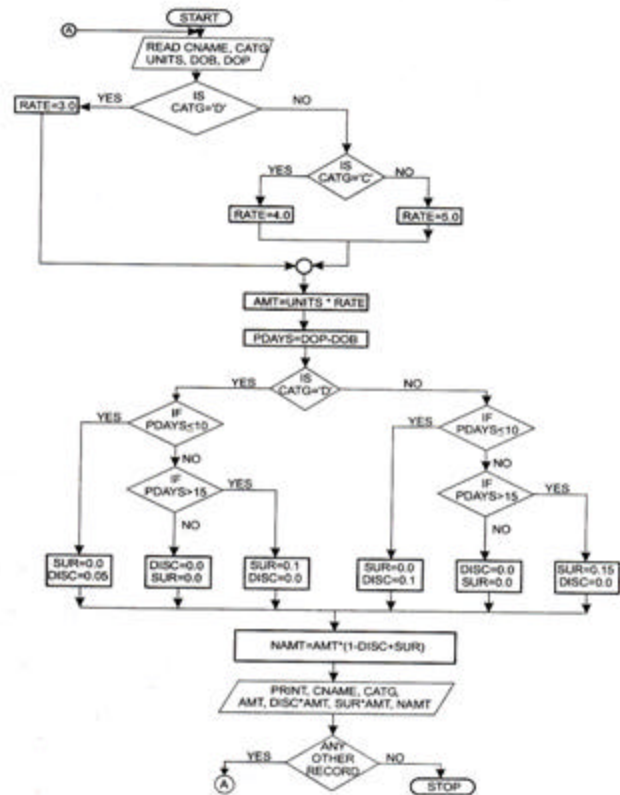
Answer of question 1

The required flowchart is given below:



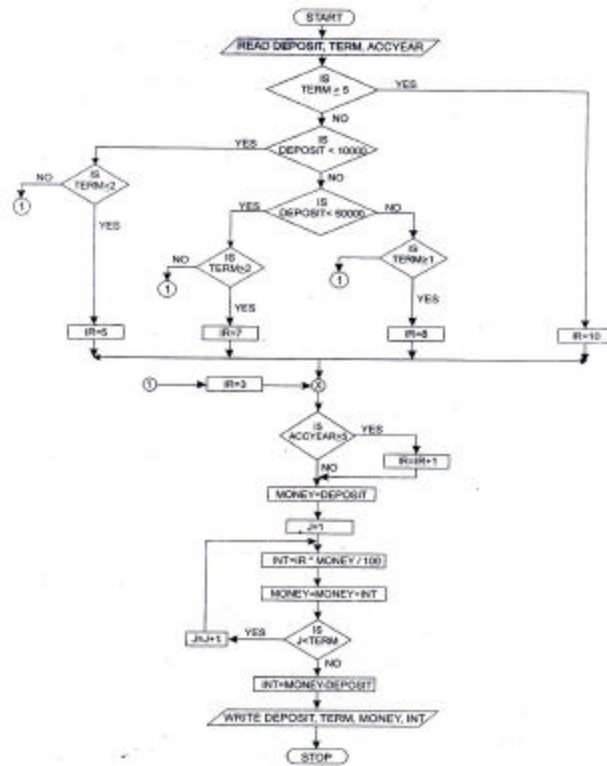
Answer of question 2

Flowchart is given below:



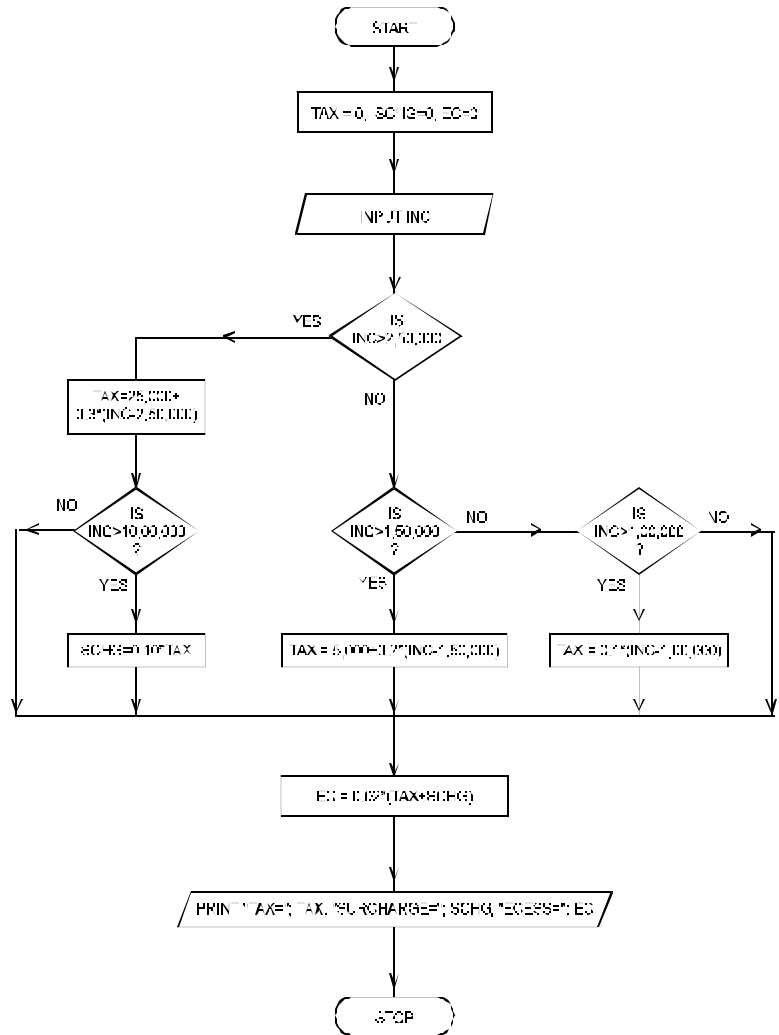
Answer of question 3

The flowchart is given below:



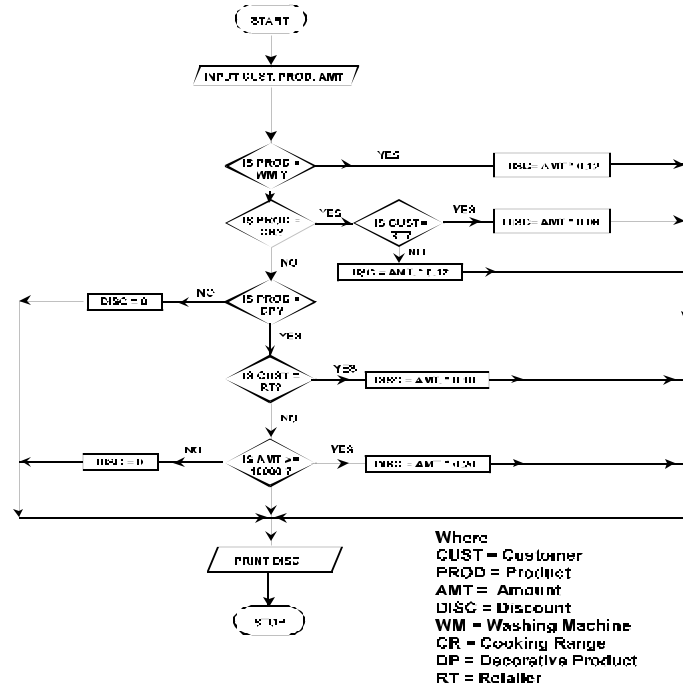
Answer of question 4

The flowchart is given below:



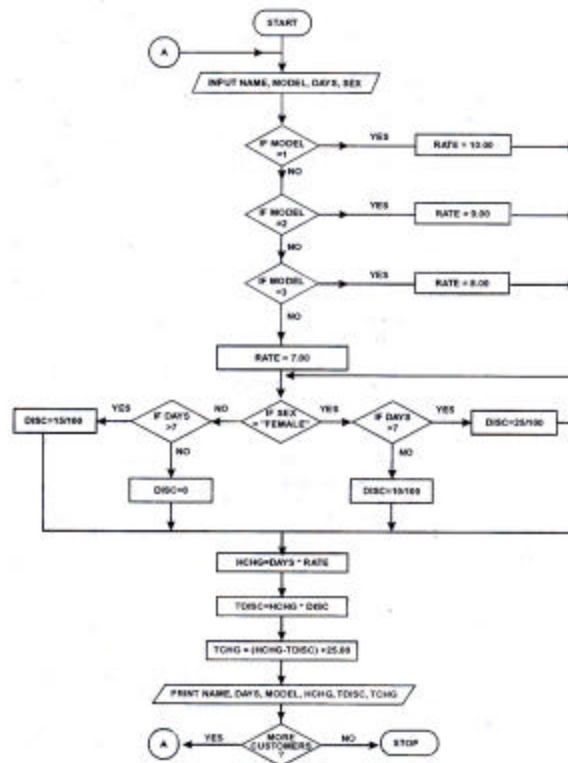
Answer of question 5

The flowchart is given below:



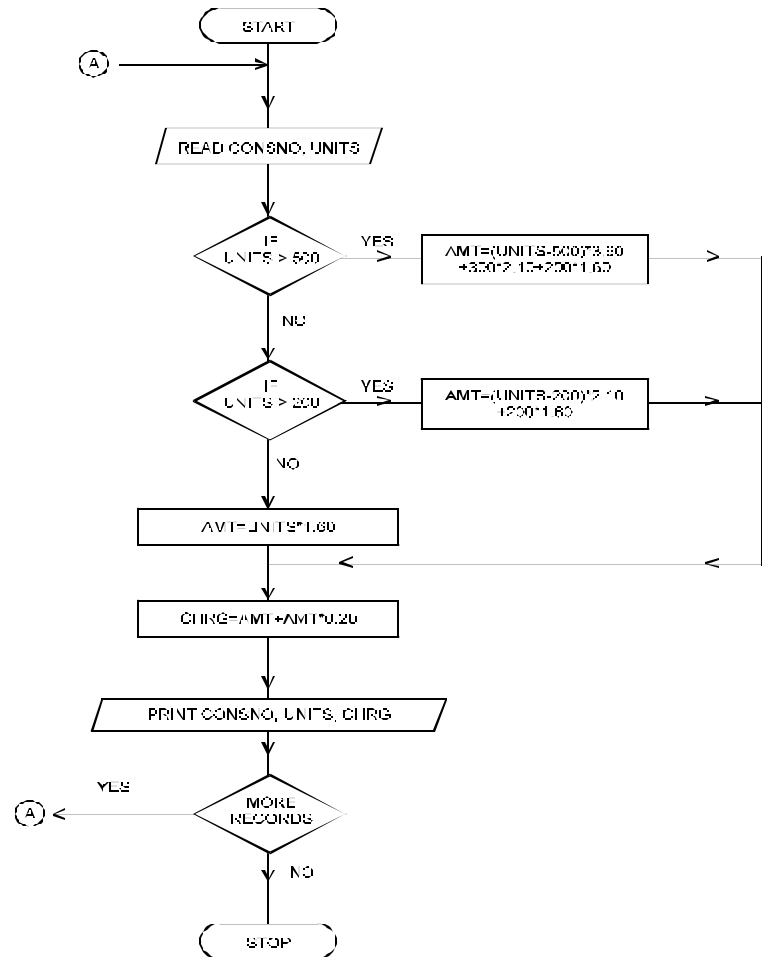
Answer of question 6

The flowchart is given below:



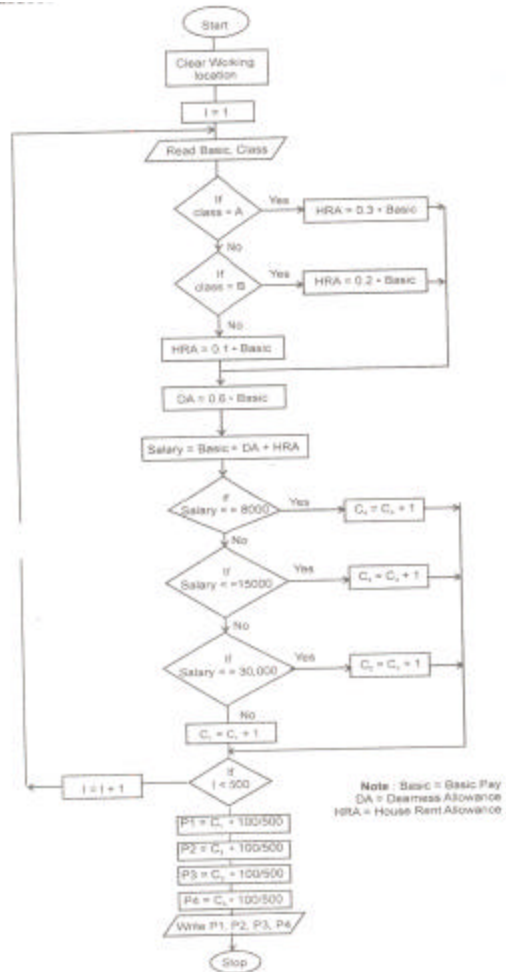
Answer of question 7

The flowchart is given below:



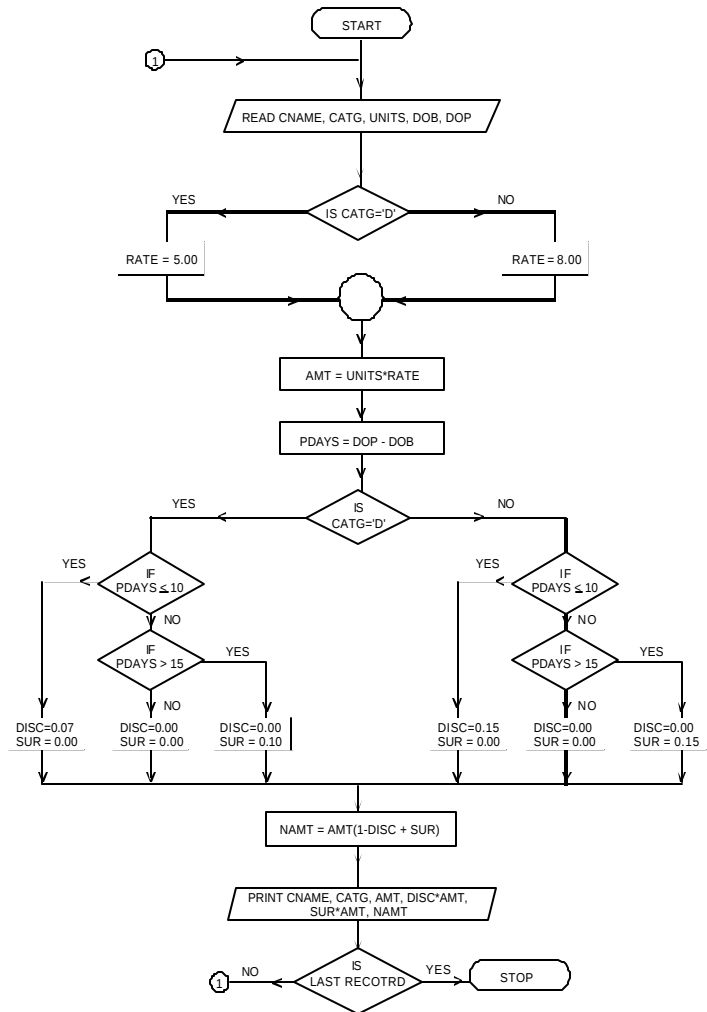
Answer of question 8

The flowchart is given below:



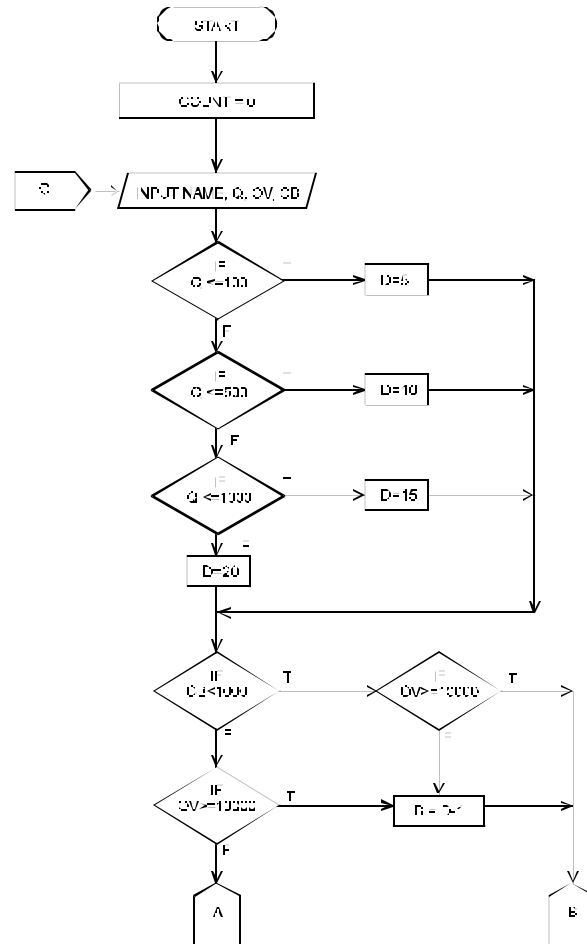
Answer of question 9

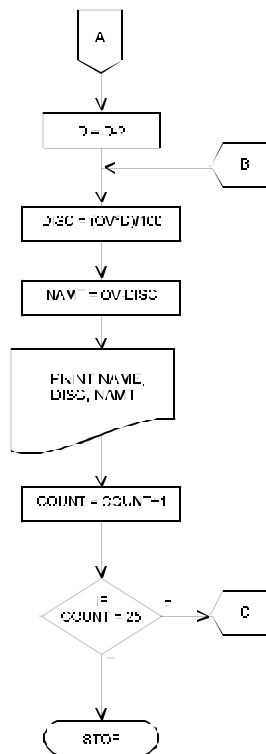
The flowchart is given below:



Answer of question 10

The required flowchart is given below:





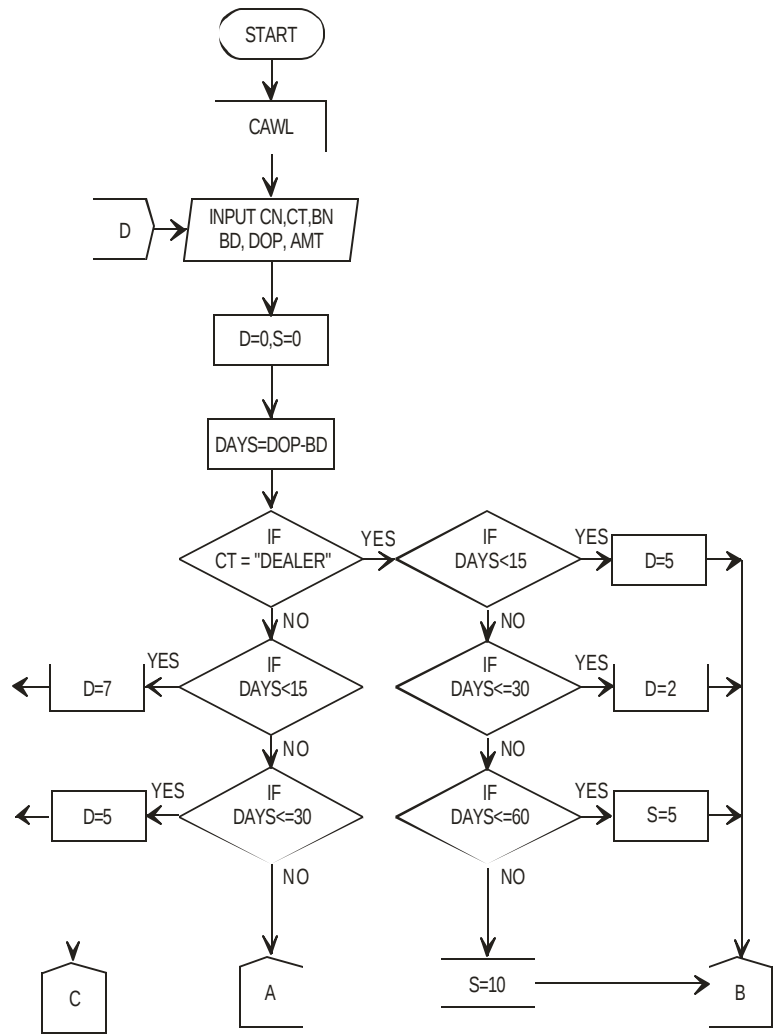
Abbreviations:

Q	=	Quantity
OV	=	Order Value
CB	=	Customer's Accounts Balance
NAMT	=	Net Amount
D	=	Disscount
Disc	=	Discount offered
True	=	T

False = F

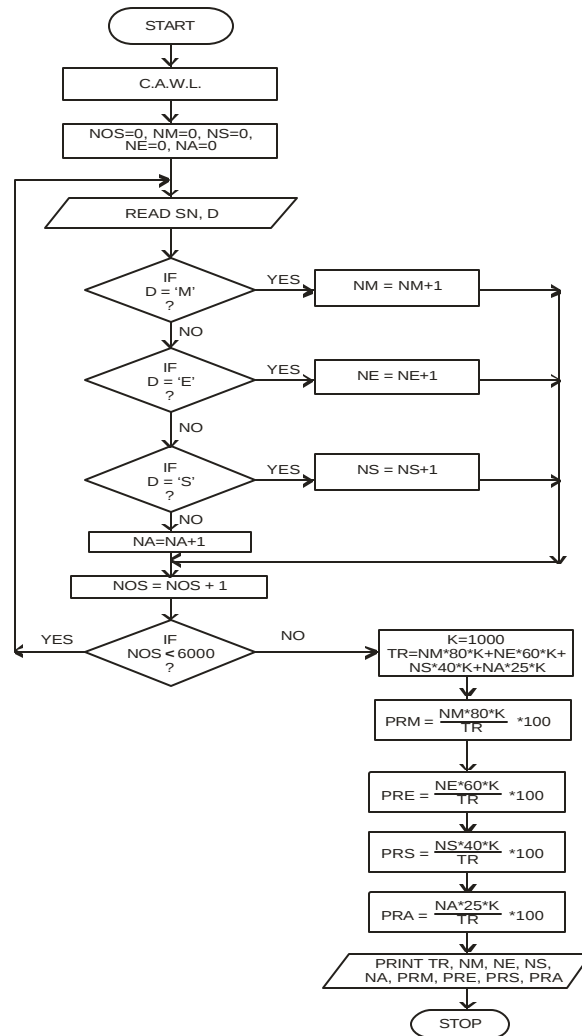
Answer of question 11

Flowchart is given below:



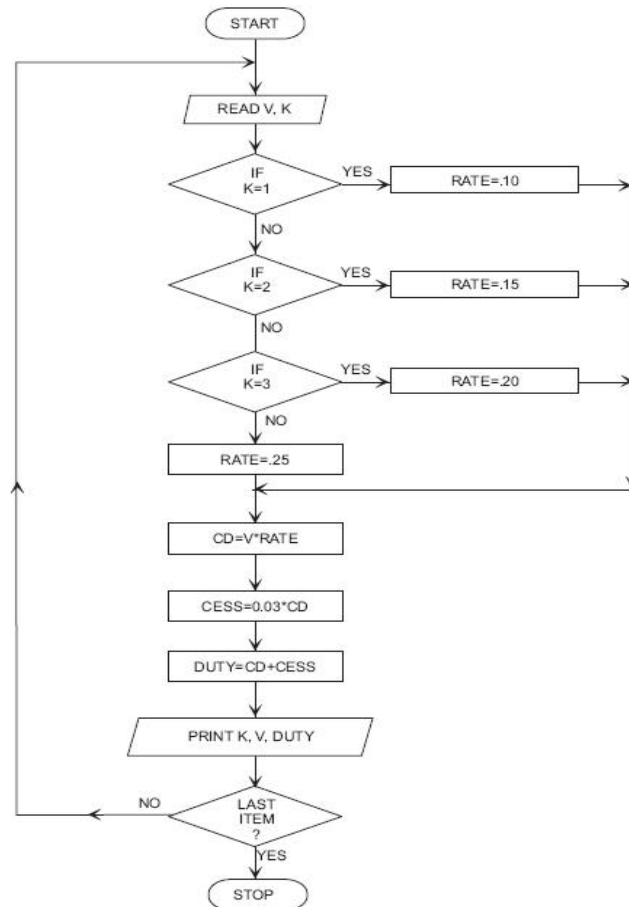
Answer of question 12

The flowchart is given below:



Answer of question 13

The flowchart is given below:



Question 1

A wholeseller has three commodities to sell and has three types of customers. The discount is given as per following rules:

- (i) For Govt. orders, 15% discount is given irrespective of the value of the order.
- (ii) For orders of more than Rs.20,000, an agent gets a discount of 20% and the retailer 15% respectively.
- (iii) For orders of value between Rs.10,000 and Rs.20,000, agent gets discount of 15% and the retailer gets 10%.
- (iv) For order of value less than Rs.10,000 the agent and retailer get discount 10% and 5% respectively.

The above rules do not apply to furniture items. However, in case of furniture items, a flat rate of 10% discount is admissible to all type of customers.

Prepare a limited entry decision table.

(PE – II Nov. 2002)

Answer**Limited Entry Decision Table**

Conditions	Rule Number							
	1	2	3	4	5	6	7	8
Order : < 10,000	-	N	N	N	N	Y	Y	-
≥ 10,000 and < 20,000	-	N	N	Y	Y	N	N	-
> 20,000	-	Y	Y	N	N	N	N	-
Customer: Govt.	Y	N	N	N	N	N	N	-
Agent	N	Y	N	Y	N	Y	N	-
Retailer	N	N	Y	N	Y	N	Y	-

Product : Furniture	N	N	N	N	N	N	N	Y
Action								
Discount of 5%							X	
10%					X	X		X
15%	X		X	X				
20%		X						

Alternative solutions exist.

Question 2

Explain "Decision table". Explain in brief four parts of a decision table. (PE-II Nov. 2005)

Answer

A decision table is a table, which may accompany a flowchart, defining the possible contingencies that may be considered within the program and the appropriate course of action for each contingency. Decision tables are necessitated by the fact that branches of the flowchart multiply at each diamond (comparison symbol) and may easily run into scores and even hundreds. If, therefore, the programmer attempts to draw a flowchart directly, he is liable to miss some of the branches.

A decision table is divided into four parts:

- (i) **Condition stub:** It contains statements i.e., the factors to be considered in making a decision.
- (ii) **Action stub:** It introduces one or more actions i.e., steps to be taken when a certain combination of conditions exists.
- (iii) **Condition entries:** It lists in its various columns the possible permutations of answers to the questions in the condition stub.
- (iv) **Action entries:** It lists in its columns corresponding to the condition entries, the actions contingent upon the set of answers to the questions in that column.

Question 3

Explain the advantages of decision tables.

(PE-II May 2006)

Answer

Advantages of Decision tables

- (i) A decision table provides a framework for a complete and accurate statement of processing or decision logic. It forces a discipline on the programmer to think through all possible conditions.
- (ii) A decision table may be easier to construct than a flow chart.
- (iii) A decision table is compact and easily understood making it very effective for communication between analysts or programmers and non-technical users. Better documentation is provided by it.
- (iv) Direct conversion of decision table into computer program is possible.
- (v) It is possible to check that all test combinations have been considered.
- (vi) Alternatives are shown side by side to facilitate analysis of combinations.
- (vii) The tables show cause and effect relationships.
- (viii) They use standardized format.
- (ix) Complex tables can easily be split into simpler tables.
- (x) Table users are not required to possess computer knowledge.

Question 4

Explain the various types of decision tables.

(PE-II Nov. 2006)

Answer

There are three types of decision tables as discussed below:

- (i) *Limited Entry Tables*: In this type of decision table, the condition and action statements are complete. The condition and action entries merely define whether or not a condition exists or an action should be taken. The symbols used in the condition entries are:
 - Y : Yes, the condition exists.
 - N : No, the condition does not exist.
 - : Irrelevant, the condition does not apply, or it makes no difference whether the condition exists or not.
 The symbols used in the action entries are:
 - X : Execute the action specified by the action statement.
 - : Do not execute the action specified by the action statement.
- (ii) *Extended Entry Table*: The condition and action statements in an extended entry table are not complete, but are completed by the condition and action entries.
- (iii) *Mixed Entry Table*: It combines both the limited and extended entry forms. While the limited and extended entry forms can be mixed within a table, only one form may be used within a condition statement/entry or an action statement/entry.

Question 1

Give one or two reasons for the Use of Auto Text feature in MS WORD (PE – II Nov. 2004)

Answer

Use of Auto Text feature in MS-WORD: It is a unique feature of MSWORD. It allows storing formatted text even paragraphs and graphics. These can be recalled by pressing some keys. It has dictionary of its own and can be customized.

Question 2

Write True or False for each of the following:

- (i) In MS-WORD, if the font size is 10 points and the line spacing is set to 1.5, then line spacing will be approximately 15 points. (PE – II Nov. 2002)
- (ii) In word processing package, Header and Footer can be selected from the VIEW menu. (PE – II Nov. 2003)
- (iii) In MS-WORD, Drop cap can be selected from Tool Menu. (PE – II May 2006)

Answer

- (i) True (ii) True (iii) False

Question 3

Briefly explain the concept of Mail merge. (PE – II Nov. 2002, 2004 & 2006.)

OR

Write various steps involved to perform Mail-Merge. (PE – II May 2008)

Answer

Mail Merge is a tool for producing repetitive documents. It gives flexibility while sending letter and then personalizing each copy of it with information such as names, addresses, dates etc. For establishing Mail Merge, two

documents need to be created, i.e. the main document and the data source. Following steps are followed to set-up Mail Merge:

- (i) Setting up the Main Document.
- (ii) Setting up the Data Source.
- (iii) Editing the Data Source.
- (iv) Addition of fields to the Main Document.
 - Place the cursor in the Main Document where we want our first field to appear.
 - Activate the 'Insert Merge Field' button from the Mail Merge toolbar.
 - From the list, select the field that we would like to place first.
 - Take the cursor to the next line.
 - Click the 'Insert Merge Field' and select the next field. Continue doing this until we get all the required fields on our main document.

Question 4

Explain briefly the various language tools available in MS-WORD.

(PE-II May 2003, May 2004, Nov. 2006, May 2007 & May 2008)

Answer

MS-Word offers following useful language tools to aid writing and to increase efficiency:

- (i) **Auto Correct:** Auto correct has a dictionary of its own which contains a list of commonly mistyped words. Adding words we mistype, one can customize this dictionary. Correct spellings of the word is to be provided with which MS-Word should replace the mistyped word. Once the entry in the Auto Correct dictionary is made, word automatically makes corrections of such words. This saves the trouble of going back to make corrections every time the word is mistyped.
- (ii) **Auto Text:** This is a unique feature of the word. It allows storing formatted text even paragraphs and graphics. These can be recalled by pressing some keys. Auto Text is like auto correct in that it also has dictionary of its own and can be customized. Auto text has an Auto complete tip that will complete the text without you having to type the entire word. New Auto text entries can be made for any text in the document using the Create Auto Text entry dialog box.
- (iii) **Spelling and Grammar:** The spell checking function checks each word in the article against the dictionary and underlines it with a red curly line if the word with wrong spelling appears. Words not found in the dictionary are also marked with a red curly line. User on running the spell check function will be able to get the right spelling and rectify it. Additional words can also be added to the dictionary.

- (iv) **Thesaurus:** Thesaurus is a book in which words and phrases of similar meaning are grouped together. It comes with Word package. With the help of Thesaurus, one can select the more precise word.
- (v) **Find and Replace Text:** 'Find' command helps to locate specific text in a document while 'Replace' command helps to substitute it with new text. This has the option of replacing all found words with one keystroke if one is sure that all the entries of that word need to be replaced.

Question 5

Describe any five formatting features available in MSWORD.

(PE – II Nov. 2003, Nov. 2005 & Nov. 2008)

Answer

MS-WORD offers a wide variety of formatting features to enable user to choose the options that best suits his specific needs. Five main formatting features are discussed below:

- (i) **Modify Fonts** – Font refers to the print type, style and size of characters used in printing. The use of different fonts changes the look of the text. Word 2000 offers a number of different font types to choose from, e.g. Times New Roman, Arial, Courier, CG Times etc. The default font in any Word document is Times New Roman. Besides the regular style, font can be made either bold, italic or bold italic. Underlining the text can further enhance the style. Word 2000 also offers eleven different effects that can be applied to text. Text can be shadowed, outlined, embossed, engraved etc.
- (ii) **Paragraph Alignment** – Alignment of lines for the written text is the most common convention followed. Each line of written matter on a page maintains a constant horizontal distance from the left edge of the page. Word makes alignment effortless even while offering four types of alignment to text. They are Left, Right, Centre and Justify.
- (iii) **Indenting & Line spacing** – Indenting of paragraph means that we specify the distance of the text from the margin. By using indenting, the selected paragraphs stands out from the other text in the document. Increasing or decreasing the indent alters the distance of the text from the margins. Word also offers some special indentation features like 'First-line' only and 'Hanging' indents.

Various types of paragraph indent options are available in Word 2000. Line spacing determines the amount of vertical space between lines of text. By increasing the line spacing, the readability of document increases. Word offers several options for line spacing.

- (iv) **Numbers and Bullets** – While writing certain kind of communication, e.g. business or legal communication, it is convenient to state the ideas point by point. This usually happens in letter where user is trying to put across his views and wishes to give reasons. Word offers numbers and bullets options to highlight each new point in the list. It is also possible to have multi-level bullets and numbering.

- (v) *Headers and Footers* – When a user wants to insert some information to appear on every page, he can insert this using the Header and Footer option. Header is placed in the top margin while footer is placed in the bottom margin of a page. One can use the same header and footer throughout a document or header and footer can be changed for part of the document by inserting a section break.

Question 6

Define the following terms related to MS-WORD:

- | | |
|-----------------------------------|---------------------------------|
| (i) <i>Fonts</i> | (PE – II Nov. 2002) |
| (ii) <i>Drop Cap</i> | (PE – II Nov. 2002) |
| (iii) <i>Header</i> | (PE – II Nov. 2002) |
| (iv) <i>Section</i> | (PE – II Nov. 2002) |
| (v) <i>Text Wrap</i> | (PE – II Nov. 2002 & Nov. 2007) |
| (vi) <i>Bullets</i> | (PE – II May 2003) |
| (vii) <i>Thesaurus</i> | (PE – II Nov. 2003) |
| (viii) <i>Headers and Footers</i> | (PE – II Nov. 2007) |
| (ix) <i>Tab</i> | (PE – II Nov. 2007) |
| (x) <i>Indenting</i> | (PE – II Nov. 2007) |
| (xi) <i>Paragraph Alignment</i> | (PE – II Nov. 2007) |

Answer

- (i) **Fonts** : Fonts refer to the print type, style and size of characters, letters, numbers etc. used in printing. The use of different fonts changes the look of the text.
- (ii) **Drop Cap** : It is a kind of formatting used in MS Word in which the first character of a word at the beginning of a chapter or article is enlarged, often reaching to the lines below it.
- (iii) **Header** : In a report, the information which appears on the top of every page is called header, e.g. name of a chapter in a book. One can use same header throughout the document or change the header for part of the document by inserting a section break.
- (iv) **Section** : A section refers to those pages in a document that have the same number of columns and share a common margin, header and footer and have the page numbers in sequence.
- (v) **Text Wrap**: This feature of word processing package restricts the appearance of characters between left and right margins. When the words in a line exceed than the words which can be accommodated in one line, then remaining words are automatically

shifted to next line.

- (vi) **Bullets:** Bullet is a mark which highlights each new point in the MS-Word text or slide presentation. Bullets can be marked by numbers, symbols, alphabets and even. Multilevel bullets are also allowed.
- (vii) **Thesaurus:** Thesaurus is a book in Word in which words and phrases of similar meaning are grouped together.
- (viii) **Headers & Footers:** Information like company name, report title is required to appear on every page of the document, and that information can be inserted on every page of the document using Header and Footer option. This kind of information appears either in the top or bottom margin. Headers are placed in the top margin and footers are placed in the bottom margin of a page.
- (ix) **Tab:** In order to present the data in tabular form, space bar can be used. But this is very cumbersome and unreliable, particularly when the data to be tabulated is several lines long. All word processors have 'Tab' function similar to manual and electronic typewriter. Word allows the usage of 'Tab' according to the requirement. Depending upon the size of the text, the width of tab can be specified.
- (x) **Indenting:** It refers to the distance of text from the margin. By using indenting, the selected paragraph stands out from other text in the document. Word offers two types of Indents namely 'First-line' and 'Hanging' indents. In the case of 'First-line' option, the first line is indented more or less than the lines that follow it. 'Hanging' indent hangs the lines of paragraph to the right of left margin.
- (xi) **Paragraph alignment** Word offers four types of alignment to text. They are Left, Right, Center and Justify. In Left alignment, text lines up with the left margin, leaving the right margin irregular. Right alignment means that the text lines up with the right margin, leaving the left margin irregular. Centered text is evenly placed between left and right margins. Justified text is fully aligned between left and right margin.

Question 7

With reference to word processing, differentiate between the following:

- (i) Text Editor and Word Processor
- (ii) Type face and Font

(PE-II May 2005)

Answer

- (i) **Text Editor and Word Processor:** **Text Editors** can edit plain text only and offer no formatting features. The user must hit ENTER at the end of each line. They are good for short documents or e-mail text bodies, HTML, web pages and programs.

Word Processors edit text and allow embedded formatting for words, paragraphs and whole documents. They also support word wrap, margins and different typefaces in the same document.

Word processors are specifically designed to prepare such document material as letters and reports whereas text editors are designed to manipulate non-document instructions in computer programs or data. Text editors lack the text formatting and document printing capabilities of word processors.

- (ii) A **typeface** is the set of characters making up an alphabet that all share similar design characteristics (this says nothing about size, weight, style, etc.). A **font** is typeface of a particular point size, weight, and style. For example, "Times -Roman" is a typeface, but "Times -Roman, 12 point, bold, italic" is a font.

Question 8

Write short notes on Clip Gallery

(PE-II May 2008)

Answer

Clip Gallery: Clip Gallery is a collection of multimedia effects available in MS-WORD. Multimedia effects such as sound and videos are particularly welcomed by the users. The clips can be used in the following manner:

Insert Clip: Select 'Insert/Picture/Clipart'. A dialog box 'Microsoft Clipart Gallery' will appear on the screen. Select 'Clipart' tab on it and then choose the category. In the adjoining window all the related clips can be found. The user can search through and select the appropriate clip and click at the <Insert> button. The clip selected will be placed in the document, at the cursor position.

Resizing Clip: The clip on the document may not be of the desired size. It can be resized. The user can select the clip by clicking anywhere on it. Eight sizing handles appear on the boundary of the clip. On taking pointer to a desired handle, the pointer gets changed into a double-headed click. The user can click and drag the handle in the desired direction. When the required size is achieved, the mouse pointer can be released.

Question 1

Give one or two reasons for the Need for Macro in Spreadsheet.

(PE – II Nov. 2003, Nov. 2006 & May 2007)

Answer

Need for Macro in Spreadsheet: Macro is a small program that carries out predefined and prerecorded series of steps by giving a few keyboard shortcuts. We can say that macro is like a recorded movie, which can be run any number of times. Macro is just a way of doing work in a series of steps, which it carries out automatically once it is triggered. Hence, the need for Macro is to automate the tasks, thus saving lot of precious time.

Question 2

Write True or False for each of the following:

- (i) Formatting of numbers in Excel 2000 is similar to formatting in WORD 2000.*
(PE – II Nov. 2002)
- (ii) In MSEXCEL, if a cell pointer points to a cell that contains data, then that data will also be displayed in the formula bar.*
(PE – II May 2003)
- (iii) In worksheet the cell 65231 to 256th column will be referred as IV 65231.*
(PE – II Nov. 2003)
- (iv) Every formula written in MS-EXCEL has to begin with a dollar (\$) sign.*
(PE – II May 2004)
- (v) The default number of worksheets in an MS-EXCEL workbook is three.*
(PE – II May 2006)
- (vi) The F2 key is used to edit the formula cell in a spreadsheet.*
(PE – II Nov. 2006)
- (vii) Formula is an equation that performs operation on worksheet.*
(PE – II May 2008)

Answer

- | | | | |
|-----------|-----------|------------|------------|
| (i) False | (ii) True | (iii) True | (iv) False |
| (v) True | (vi) True | (vii) True | |

Question 3

Explain the concept of MACRO in MS-EXCEL and list the procedure to create it.

(PE – II May 2003)

OR

Write the steps for creating a new macro on MS-EXCEL

(PE – II May 2008)

Answer

Concept of MACRO in MS-EXCEL: Macro is a small program that carries out pre-defined and pre-recorded series of steps by giving a few keyboard shortcuts. It is like a recorded movie which can be run any number of times. It automates tasks, thus saves a lot of precious time. EXCEL offers macros in two languages – Excel Visual Basic and Excel 4.0 Macro language. In Excel 4.0 macro language, a macro can be created by following the procedure explained below:

Steps for creating a new Macro on MS-EXCEL: Before proceeding to create a macro in MS-Excel, first decide the steps that are supposed to be performed by the macro. Following steps are then carried out:

- (i) Select 'Tools/Macro' option from the main menu.
- (ii) Select 'Record new Macro' option from the cascading menu.
- (iii) Name the macro under which it is to be saved. A macro can be assigned a name in the 'Macro name' box.
- (iv) The user can assign a keyboard shortcut to the macro. It will enable him to execute the macro using a keyboard.
- (v) In case the macro is to be used in the current work book only, then in 'Store Macro in' box, select the option 'This workbook' from the drop down list. However, if the macro is to be made available to other workbooks also, then 'Newworkbook' option may be selected from the drop down list. Excel will ask the name of the new workbook in which the macro is to be saved.
- (vi) In the 'Description' box, give some relevant and important details about the macro such as purpose, date of creation and owner of macro etc.
- (vii) Once all relevant details are filled in the 'Record Macro' box, click at the 'O.K.' button.
- (viii) Perform all the essential steps required to accomplish the desired task. Now click at the 'stop recording' button on the 'Stop Recording' toolbar.
- (ix) The macro is now ready to be executed.

Question 4

Describe the various types of charts which can be created through MS-EXCEL.

(PE – II May 2004)

Answer

Various types of charts, which can be created through MS-Excel, are briefly discussed below:

- (i) **Pie chart:** It shows only a single data series. It shows the proportionate contribution of various items that make up the data series. That is to say when a data series is given, Excel sums up the individual values in the series and calculates the percentage contribution of each in the total. This will then determine the size of each data point's pie slice. Data labels can be used in a pie chart to display either the actual value of each point or the percentage.
- (ii) **Line chart:** In many situations, we have more than one data series to represent. In line chart, data points of one data series are connected by lines, showing an upward or downward trend in value. Each data series is a line in the chart. A line chart is usually two –dimensional.
- (iii) **Area charts:** A variation of the line chart is the area chart. It is similar to a line chart but the area below the line is filled thus marking out an area for each data series. Thus, an area chart plots each data series one on top of the other. The magnitude of change over time is clearly visible in this chart.
- (iv) **Column and Bar charts:** Column and bar charts are used to compare values across categories. In a bar chart the value axis is organized horizontally while the categories axis is arranged vertically. Column charts are similar to bar charts but have the categories axis at the bottom. Each bar represents a single data value in the data table. MS-Excel offers several variations in bar and column charts.

Question 5

Define the following functions used in MS-Excel:

- (i) DB (PE-II Nov. 2002 & May 2008)
- (ii) FV (PE-II Nov. 2002, Nov. 2004 & Nov. 2006)
- (iii) NPV (PE-II Nov. 2002, May 2007 & May 2008)
- (iv) PMT (PE-II Nov. 2002, Nov. 2004 & Nov. 2007)
- (v) IRR (PE-II Nov. 2002 & May 2005)
- (vi) COUNT (range) (PE-II Nov. 2003, Nov. 2004 & May 2008)
- (vii) STD (range) (PE-II Nov. 2003)
- (viii) MOD (x/y) (PE-II Nov. 2003, May 2005 & Nov. 2007)
- (ix) INT (x) (PE-II Nov. 2003, Nov. 2004, Nov. 2006 & May 2008)

(x) ROUND (x, n)	(PE-II Nov. 2003)
(xi) DMAX	(PE-II May 2004 & Nov. 2006)
(xii) RATE	(PE-II May 2004)
(xiii) PPMT	(PE-II May 2004)
(xiv) VAR	(PE-II May 2004, Nov. 2006 & Nov. 2008)
(xv) SUM	(PE-II Nov. 2004, Nov. 2006 & Nov. 2008)
(xvi) IRR	(PE-II May 2005)
(xvii) LEN	(PE-II May 2005, Nov. 2005 & May 2007)
(xviii) DMIN	(PE-II May 2005)
(xix) POWER	(PE-II May 2005)
(xx) STDEV	(PE-II Nov. 2005 & Nov. 2008)
(xxi) TRUNC	(PE-II Nov. 2005 & Nov. 2007)
(xxii) SQRT	(PE-II Nov. 2005)
(xxiii) `PV.	(PE-II Nov. 2005)
(xxiv) ABS	(PE-II May 2006 & Nov. 2008)
(xxv) NPER	(PE-II May 2006)
(xxvi) AVERAGE	(PE-II May 2006)
(xxvii) ROUND	(PE-II May 2006 & May 2008)
(xxviii) PROPER	(PE-II May 2006)
(xxix) LN	(PE-II Nov. 2005 & Nov. 2008)
(xxx) LOG	(PE-II May 2007)
(xxxi) DCOUNT	(PE-II Nov. 2007)
(xxxii) UPPER	(PE-II Nov. 2007)
(xxxiii) COUNTIF	(PE-II May 2008)
(xxxiv) CLEAN	(PE-II May 2008)

Answer

- (i) **DB ()**: It is a financial function which returns the depreciation of an asset for a specified period using the fixed-declining balance method.
- Syntax of the function is:
- DB(cost, salvage, life, period, month)
- where,

'cost' is the initial cost of the asset.

'salvage' is the value at the end of the depreciation.

'life' is the number of periods over which the asset is being depreciated.

'period' is the period for which you want to calculate the depreciation.

'month' is the number of months in the first year. If month is omitted, it is assumed to be 12.

(ii) **FV:** It is a financial function, which calculates the future value for a series of equal investments (also called annuity) earning a fixed periodic rate of interest.

(iii) **NPV ():** It is a financial function which calculates the net present value of an investment by using a discount rate and a series of future payments (negative values) and income (positive values).

Syntax of the function is:

NPV (rate,value1,value2, ...)

where,

'rate' is the rate of discount over the length of one period.

'value1, value2, ...' are 1 to 29 arguments representing the payments and income.

(iv) **PMT (rate, nper, pv):** This financial function is used to calculate the payment for a loan at the given rate of interest and for particular time period where

pv: Total present value to be paid

rate: Rate of Interest

nper: No. of periods

(v) **IRR:** This function gives internal rate of return for a series of cash flows.

(vi) **COUNT:** It is a statistical function, which counts the number of arrangement values in the specified list. Empty cells are ignored/not counted.

(vii) **STD (range):** It is a statistical function which calculates standard deviation ('N' method) of the value specified in the list.

(viii) **MOD (x/y):** It is a mathematical function which computes the modules value of x/y that is the remainder that would be left when we divide x by y. For example, if x=7 and y=2, then value returned will be 1.

(ix) **INT():** It is a mathematical function which rounds a number down to the nearest integer.

Syntax of the function is:

INT (number)

where,

'number' is the real number you want to round down to an integer.

- (x) **ROUND (x, n):** It is also a mathematical function which rounds off the number x to n decimal places.
- (xi) **DMAX:** It is a data base function, which returns the largest number in the field of records in the database that matches the conditions you specify.
- (xii) **RATE:** It is a financial function, which returns the interest rate per period of a loan or an annuity.
- (xiii) **PPMT:** It is a financial function, which returns the payment on the principal for a given investment based on periodic, constant payments and a constant interest rate.
- (xiv) **VAR:** It is a statistical function and it is used to estimates variance based on a sample. It ignores logical and text values.
- (xv) **SUM (number1, number2, ...):** It is a mathematical function, which calculates the sum of all the numbers in a range of cells.
- (xvi) **IRR –** It is financial function and returns the internal rate of returns for series of cash flows.
- (xvii) **LEN (text string):** It returns the number of characters in the text string e.g. if text string = 'Examination', then this functi on will return 11.
- (xviii) **DMIN –** It is a database function and returns the smallest number in the field of records in the database that matches the condition specified by the user.
- (xix) **POWER –** It is a mathematical function and is used to calculate the value of one number raised to the power of another number (x^y).
- (xx) **STDEV (number1, number2, ...):** It estimates standard deviation of items in a given range of cells (ignores logical and text values).
- (xxi) **TRUNC (number, num -digits):** This mathematical function truncates a number to an integer by removing the fractional part of the number, if number of digits specified is zero otherwise number is truncated to specified number of digit e.g. = TRUCN (8.9,0) = 8 and = TRUNC (8.928,2) = 8.92.
- (xxii) **SQRT:** This mathematical function is used to calculate the square root of a number.
- (xxiii) **PV:** This financial function is used to calculate the present value of payments made in each period and not changed during the life of annuity at the given rate of interest and for a particular time period.
- (xxiv) **ABS(X):** It is a mathematical function used to calculate the absolute value of x where x is any number. For example, if $x = -3$ then $ABS (x) = 3$.
- (xxv) **NPER:** It is a financial function which returns the number of periods for an investment based on periodic constant payment and a constant interest rate.
- (xxvi) **AVERAGE:** It is a statistical function which calculates the average of the values in the list of its arguments.

(xxvii) **ROUND (x, n)**: It is a mathematical function used to round off the number x to n number of decimal places e.g. if x = 2.1752 and n=2 then ROUND (x, n) will return 2.18

(xxviii) **PROPER (text string)**: This is a text function which capitalizes the first letter in each word of a text string and converts all other letters to lowercase letters, e.g. if the text string is 'eXAMination', then this function will return 'Examination'.

(xxix) **LN(x)**: This mathematical function is used to calculate natural logarithm of a number to the base.

(xxx) **LOG(x)**: Returns the logarithm of a number to the base 10.

(xxxi) **DCOUNT(database, field, criteria)**: This database function is used to count the number of cells containing numbers in the field (column) of records in the database that match the conditions specified.

(xxxii) **UPPER (text string)**: This text function converts a text string to all uppercase letters e.g. if the text string is 'exam', then this function will return 'EXAM'.

(xxxiii) **COUNTIF()**: It is a statistical function which counts the number of cells within a range that meet the given criteria.

Syntax of the function is:

COUNTIF(range, criteria)

where,

'range' is the range of cells from which you want to count cells.

'criteria' is the criteria in the form of a number, expression, cell reference, or text that defines which cells will be counted.

(xxxiv) **CLEAN ()**: It is a text function which removes all nonprintable characters from text.

Syntax of the function is:

CLEAN(text)

where,

'text' is any worksheet information from which you want to remove nonprintable characters.

Question 6

Define the following terms related to office productivity tools:

(i) NPER

(PE-II May 2003)

(ii) ABS

(PE-II May 2003 & May 2004)

(iii) STDEV

(PE-II May 2003)

(iv) PV

(PE-II Nov. 2003)

- (v) *LEN* (PE-II Nov. 2003)
 (vi) *SQRT* (PE-II Nov. 2003)
 (vii) *Goal Seek* (PE-II Nov. 2003)

Answer

- (i) **NPER:** It is a financial function available in MS-Excel. It returns number of payment periods either in years, months, days etc. for an investment based on periodic constant payment and constant interest rate.
- (ii) **ABS:** It is a mathematical function. It returns the absolute value of a number, a number without its sign.
- (iii) **STDEV:** It is a statistical function available in MS-Excel. It estimates standard deviation based on a sample ignoring logical values and text in the sample.
- (iv) **PV:** It is a financial function and returns the present value of an investment; the total amount that a series of future payment is worth now.
- (v) **LEN:** It is a text function which returns the number of characters in a text string.
- (vi) **SQRT:** It is a mathematical function which returns the square root of a number.
- (vii) **Goal Seek:** When user knows the desired result of a single formula but not the input value of the formula and needs to determine the result, he can use goal seek feature of the spreadsheet program.

Question 7

Describe any five categories with their purposes under which various functions available in MS-EXCEL are classified. (PE-II May 2005)

Answer

The functions available in MS-Excel can be categorised under several distinct heads. Five such categories and the purpose for which they can be used are stated below:

S. No.	Category	Purpose
1.	Financial	To calculate interest, depreciation, loan payment, IRR, NPV etc.
2.	Statistical	For common functions such as totals, averages, mean, median, mode etc. and advanced functions.
3.	Maths and Trig	To calculate the absolute values such as pi, logarithms, degrees and angles etc.
4.	Lookup & Reference	To search for and return values from a range, also to create hyperlinks etc.

- | | | |
|----|-----------|--|
| 5. | Data base | To calculate the values in an Excel data base based on conditions specified by the user. |
|----|-----------|--|

Question 8

Explain the pre-defined function FV (rate, nper, pmt, pv, type) available in MS-EXCEL.

(PE – II Nov. 2008)

Answer

MS-EXCEL function FV (rate, nper, pmt, pv, type)

FV (Future Value function) is a financial function in MS-Excel that is used to calculate the future value for a series of equal investments (also called annuity) earning a fixed periodic rate of interest. Its arguments are:

- **rate:** Interest rate per period on a loan, or the discount or interest on an investment.
- **nper:** Number of periods, i.e., the total number of payment periods either in years, months, days, etc.
- **pmt:** Payment made each period, it includes interest and principal amount.
- **pv:** Present value, that is the lump-sum value of an investment or loan today.
- **type:** Indicates when payments are due-whether end of period or at the beginning. Can either be 0 or 1. If type is omitted, it is assumed to be 0.

**BUSINESS PROJECT MANAGEMENT AND
PRESENTATION TOOLS**

Question 1

Write True or False for each of the following:

- (i) A graph created in Excel can be copied and linked to a power point presentation slide.
(PE-II Nov. 2002)
- (ii) In MS-POWER POINT, changes can be made on the individual slide without making changes in the slide master.
(PE-II Nov. 2003)
- (iii) Outline view of MS-POWER POINT permits frequent switching between text and object on a slide.
(PE-II May 2005)

Answer

- (i) True (ii) True (iii) False

Question 2

Define the term related to office productivity tools: Tri-Pane view. (PE-II May 2003)

Answer

Tri-Pane View: It is a view feature of Power Point 2000 which allows to view three different aspects of presentations which include Normal view, outline and slide view.

Question 3

Discuss the important features of MS-POWER POINT. (PE-II May 2004)

OR

Write short note on the enhanced features of 'Power Point'. (PE-II May 2008)

Answer

Important Features of Power Point:

- (i) **Creating a presentation:** Microsoft Power Point offers four different ways of creating a presentation – using the auto content wizard, using a design template, using a blank slide or opening an existing presentation.
- (ii) **View a slide :** Power point 2000 offers five ways to view a slide viz., normal, outline, slide, slide sorter and slide views.
- (iii) **Modifying the impact of slides:** Power point offers you many different design options to suit various presentation needs. You can for instance add objects, graphical bullets and animation to your slides. You can also insert sound and video to play in your slide shows. You can modify the visual impact of a presentation by using transitions.
- (iv) **Adding objects:** Objects like clip arts, word art, tables and charts can be inserted on all slides or to selected slides. For instance, if you want to introduce your company logo in your presentation, you may like it to appear on all slides. You can insert objects to slides in the slide view or the normal view. The object you may want to introduce could be text, clip art, a table, chart, a video clip, a sound clip or some other object.
- (v) **Creating Graphical Bullets:** Apart from the regular bullets that are available in the bullets and numbering dialog box, you can also click the character button to view more bullet options. You can browse the option of bullets from the dropdown list of font sets displayed in the bullet dialog box. You can even change the color and size of the bullets.
- (vi) **Adding transitions and animations:** PowerPoint offers several special effects and features that can enhance the work of an online presentation. You can use things such as slide transitions, movies, animation etc. You can set transitions by viewing the slide transitions dialog box in the slide show menu. You can activate the slide transition option only by selecting a slide in the slide sorter view.

Question 4

Briefly describe about the different views of a slide offered by PowerPoint to create a better presentation. (PE-II Nov. 2004 & May 2007)

Answer

Power point comes with different views to help in creating better presentations. It offers five views:

- | | | |
|------------------------|----------------------|------------------|
| (i) Normal View | (ii) Outline View | (iii) Slide View |
| (iv) Slide sorter View | (v) Slide show View. | |

Each view offers a different way to look at the presentation and modify it. One can easily switch between the various views using the buttons on the left hand corner of the scroll bar.

- (i) **Normal View:** Normal view is a tri-pane view which offers the slide view, the outline view and the Notes pane. The user should work in normal view when there is a need to frequently switch between text and objects on slide. This view allows editing text both on the slide and the outline view. The slide is also large enough for inserting objects.

- (ii) **Outline View:** It is the most comfortable view for working on text. The standard and formatting toolbars are available for editing text. The user can therefore work on the text just like MS- WORD. One can even check spellings and use Find and Replace features to modify text. In this view, the slide is visible only in miniature form. Notes can also be added.
- (iii) **Slide View:** The slide view allows the user to see how the text and objects that have been created will appear on each slide. In this slide view, it is convenient to insert objects and modify them. Sometimes, the text inserted on a slide using outline view, runs into too many lines on the slide and even runs out of the slide. In such cases, it is required to trim the text or use an additional slide. The user can edit the text on each slide in the slide view.
- (iv) **Slide Sorter View:** It is possible to view all the slides at one time in the slide sorter view. Though it is not possible to rearrange the text or objects on individual slides in this view but one can move the slides around. Even in outline view the slides can be moved around. But if it is desired to see the visual effect of the rearrangement, then the slide sorter view is most useful.
- (v) **Slide Show View:** This view displays slides in a sequence, moving from one slide to another, transitioning with special effects that have been set, and moving at a preset timings that can be controlled.

Question 5

Explain briefly, the enhanced features of power point.

(PE-II May 2006)

Answer

The enhanced features of Power Point are briefly discussed below:

- (i) **Modifying the impact of slides:** We can add message by adding effective text to the slides to enhance the presentation. Power point offers many different design options to suit various presentation needs. One can add objects, graphical bullets and animation. Sound and video to play in the slides can also be added. The user can modify visual impact for a presentation by using transitions.
- (ii) **Adding objects:** Objects like clip art, Word Art, tables and charts can be inserted on all slides or to selected slides. Logos of companies can be displayed using slide master. Text, clipart, table, video clip, a sound clip, or other objects can also be added to slides in the slide view or normal view. Certain objects can be selected from the clip art gallery. Picture tools bar can be used to modify these pictures.
- (iii) **Creating graph bullets:** Bullets are used frequently for placing text on slides and to determine the levels of various lines of text on a slide. Various types of bullets can be used and they enhance the look and clarity of the presentation. From the bullets and numbers dialogue box, characters button can be pressed to view more bullets apart from the regular bullets that are available. Bullets can be created using any picture file also.

- (iv) **Adding transitions and animations:** Power point offers special effects and features that can enhance the work of an online presentation. One can use things such as slide transitions, timings, movies and animations etc.

By using transition, the presenter can set the way each slide appears on the screen. Speed of the transitions can also be set. Slide transitions can be accompanied by special sound effects to enhance the presentation. One can even animate pictures and charts to produce dramatic effects during presentation.

Question 6

Explain the following terms with reference to presentation package:

- (i) *Slide timings*
- (ii) *Transition*
- (iii) *Tri-pane view*
- (iv) *Handouts*
- (v) *Notes.*

(PE-II Nov. 2007)

Answer

- (i) **Slide timings** In order to run the presentation on its own, like presentation at a trade show where slides automatically change from one to another, slide timings are required to be set up for each slide of the presentation. Slide timings are considered by keeping in mind that, perfect co-ordination between speech and slides is maintained. Slide timings can be set up using the Rehearse Timing button on the Slide Sorter toolbar.
- (ii) **Transitions:** Transitions are the way each slide appear on the screen like appearance of slide from the right, box in, box out or dissolve. For setting transitions, one can use 'Slide Transition' toolbar after selecting a slide in Slide sorter view. Speed of transition can be set as slow, medium or high. Slide transition can also be accompanied by special sound effects to enhance the presentation.
- (iii) **Tri-Pane View:** It allows to view three different aspects of the presentation at the same time on the screen. These three views are Normal view, Outline view and Slide View.
- (iv) **Handouts:** These are prints of slides or outline of the presentation which are given to the participants. On a handout, 2,3,4,6 or 9 slides can be printed. These are slides printed without any notes.
- (v) **Notes:** These are the points that are made regarding a slide to help in remembering about a presentation or to help the participants with details of background information regarding a slide. Notes are printed along with a small version of slide.

Question 1

Distinguish between the Audit around the Computer and Audit through the Computer.

(PE-II Nov. 2002)

Answer

Audit around the Computer and Audit through the Computer: Audit around the computer approach was followed in early days of data processing applications. Computer functions replicated manual processes in a straightforward fashion and left a trail of the work done which enabled auditor to follow trail of manual documents around the computer ignoring what was happening inside the computer.

In audit around computer approach, the reliance is completely on the non-EDP segment of a system. Internal controls are reviewed and test of transactions and account balance verification procedures are performed in the same manner as in non-EDP systems. There is no attempt to test the client's EDP controls or to use the computer to perform audit procedure.

In this approach auditor verifies the system and controls that exist:

- (i) to ensure correct and complete data being made available for processing
- (ii) to ensure checks and controls on output for accuracy and completeness
- (iii) to provide adequate data security
- (iv) to prevent unauthorized amendments
- (v) to provide for error detection and correction.

Under **audit through the computer approach**, the auditor examines the internal working of the computer system. The auditor can verify the program himself and technically satisfy himself that systems, checks, controls, error detection and data security procedures are satisfactory. The auditor uses testchecks to test the system in operation and asks for special printouts by making use of programming facilities available within the installation. The auditor's main concern is:

- (i) to check system controls
- (ii) examination and testing of computer implemented controls

- (iii) to improve quality of audit
- (iv) to reduce time spent on detailed verification of transactions.

Question 2

Describe the procedure to perform Computer Assisted Auditing using generalized audit package.
(PE-II Nov. 2002, Nov. 2004 & Nov. 2006)

OR

What do you mean by Generalised Audit Packages (GAPs). Write down the typical steps in using Audit package.
(PE-II Nov. 2008)

Answer

Generalized Audit Package: GAPs are standard packages developed by software companies specifically for the purpose of auditors for auditing data stored on computer. These are extremely used by auditors for audit through computer and are quite often the most economical. These can be used across wide platform of hardware, operating systems, operating environments and database.

Typical steps is using audit package:

- (i) Define the audit objectives.
- (ii) Identify the tests that the package will be required to do in order to assist the meeting of the audit objectives.
- (iii) Make out the package input forms for these tests.
- (iv) Compile the package on the computer, clearing reported edit errors. There should be full edit of the parameter cards to execution (Step vii). Maintain security over the package and the audit tests at all times.
- (v) If a program was used to add coded routines to the package, to fill out the input forms or to advise generally, his work must be tested.
- (vi) Obtain copies of the application files to be tested.
- (vii) Attend the execution of the package against the copy files.
- (viii) Maintain security of the copy files and output until the tests have been fully checked out.
- (ix) Check results of the test and draw audit conclusions.
- (x) Interface the test results with whatever subsequent manual audit work has to be done.

Question 3

Describe the various factors which determine the use of Computer Assisted Audit Techniques (CAAT).
(PE-II May 2003)

Answer

The use of computer-assisted audit techniques (CAAT) in a organization primarily depends upon the following factors:

- (i) *Computer knowledge, expertise and experience of the auditor*: The auditor should have sufficient knowledge to plan, execute and use the results of the particular CAAT adopted. The level of knowledge required depends upon the complexity and nature of the CAAT and of the entity's accounting system.
- (ii) *Availability of CAATs and suitable computer facilities*: The auditor should consider the availability of CAATs, suitable computer facilities and the necessary computer-based accounting systems and files. The auditor may plan to use other computer facilities when the use of CAATs on the entity's computer is uneconomical or impractical.
- (iii) *Impracticability of manual tests*: Many computerized accounting systems perform tasks for which no visible evidence is available and, in these circumstances, it may be impracticable for the auditor to perform tests manually. The lack of visible evidence may occur at different stages in the accounting process. For example, where orders are entered online, input documents may be non-existent. The system may not produce a audit trail of transactions processed through the computer. Output reports may either be not printed or a printed report may contain only summary totals.
- (iv) *Effectiveness and Efficiency*: The effectiveness and efficiency of auditing procedures may be improved throughout the use of CAATs in obtaining and evaluating audit evidence. The auditor may consider the life cycle of the CAAT application in the evaluation of the efficiency and effectiveness of a CAAT.
- (v) *Timing*: Certain computer files, such as transaction files, are often retained only for a short time and may not be available in machine readable form when required by the auditor. Thus, the auditor will need to make arrangements for the retention of data. Where the time available to perform an audit is limited, the auditor may plan to use a CAAT, as it will meet his time requirement better than other procedures.

Question 4

What is Generalised Audit Package (GAP)? Describe the various facilities to be provided by the GAP?
(PE-II Nov. 2003)

Answer

Generalised audit packages are standard packages developed by software companies specifically for the purpose of auditors for auditing data stored on computer. These are standard packages available off the shelf, which can be used by auditor for audit through the computer.

GAPs should have following facilities:

- Should be able to run over a wide platform of hardware, operating systems and database environment.
- Wide access to various types of databases.

- Extract and analyse data as per set parameters as defined by the auditor.
- Should be able to do footings and cross-footing of any specified data field(s).
- Able to do random selection and classification of data as required.
- Should be able to pick up exceptional data based on pre-defined criteria.
- Should be able to compare current version of a file with previous year's version.
- Should be able to print various reports as required by the auditor.

Typical operations which can be performed using GAPs include sampling, extraction, totaling of items meeting selection criteria, aging of data, calculations, file comparison and production of circularization letters.

Question 5

What major steps are required to be undertaken by the auditor prior to implementation of a CAAT? Explain.
(PE-II May 2004 & May 2006)

Answer

The major steps to be undertaken by the auditor in the application of a CAAT are to:

- (i) Set the objectives of the CAAT application
- (ii) Determine the content and accessibility of the entity's files.
- (iii) Define the transaction types to be tested.
- (iv) Define the procedures to be performed on the data.
- (v) Define the output requirements.
- (vi) Identify the audit and computer personnel who may participate in the design and application of the CAAT.
- (vii) Refine the estimates of costs and benefits.
- (viii) Ensure that the use of the CAAT is properly controlled and documented.
- (ix) Arrange the administrative activities, including the necessary skills and computer facilities.
- (x) Execute the CAAT application and evaluate the results.

Question 6

Write a short note on the White Box Approach for Audit

(PE-II Nov. 2003, Nov. 2005 & May 2007)

Answer

White Box Approach for Audit: Presently, computer system has progressed to a point where entire processing cycle occurs within the computer system. Therefore, traditional audit trail has disappeared. No corresponding manual documents are available. Hence, it becomes necessary to examine the internal working of a computer system.

The auditor can verify the programs himself and get technically satisfied that the system's internal checks, controls, error - detection and data security procedures are satisfactory. Auditor can use test checks to test the system in operation and ask for special print outs by making use of programming facilities available within the organisation. By acquiring the necessary skills, the auditor can use the computer itself as an audit tool to improve the quality of his own audit and can reduce time spend on detailed verification of transactions. This type of audit approach is called *White box approach for audit*.

In this type of white box approach, the auditor's primary concern includes the system of controls, examination and testing of computer implemented controls. The computer itself can be used to perform such examination and testing functions. In some cases, the volume and complexity of transactions require use of powerful tools such as Computer Assisted Audit Techniques (CAAT).

Question 7

Describe the Integrated Test Facility (ITF) method used in conducting audit through computer.

(PE-II May 2005)

OR

Write short note on Integrated Test Facility.

(PE-II Nov . 2007)

Answer

Integrated Test Facility – ITF is a particular form of test data involving the establishment of a dummy entity through which data may be procured. Once the dummy entity is established, the auditor can input transactions and process these using the clients live system alongside the client's live data. It will be necessary to delete the test transactions from the system after the test has been performed. As with all test packs, the output produced is compared with predicted results to determine whether the programmed procedures being tested are operating correctly.

An ITF can be particularly useful in more complex environments, for example, in an on-line, real time banking system. A single terminal can be set up as an "audit bank" (a separate branch which is not consolidated into bank's accounts), which can then be used to perform any of the banking functions for its own dummy customers. In this way extensive testing of the entire system may be carried out without the client's staff being aware that it is taking place.

In order for the ITF technique to be effective the auditor should have a detailed knowledge of the complete system, including the possible effects of the ITF data on all related system files.

Knowledge amongst the client's staff of the existence of the Integrated Test Facility should be limited to those who need this knowledge in order to perform their tasks properly.

Question 8

Write short note on the Program (Parallel) Simulation.

(PE-II May 2006)

Answer

Program (Parallel) Simulation: The auditor also may adopt this concept through parallel Simulation. This consists of a separate computer application that performs the same functions as those used by the installed program. It uses the same data and files and the results must be the same as those produced by the installed program. Conceptually this is the same as auditing around the computer. Parallel simulations may be done in any programming language. General -purpose audit software makes it possible for non-technical persons to create the parallel programs with little effort. Speed of execution is not a criterion, as the parallel simulation will be done only on a one-off basis and not as a regular basis.

This application uses computer audit programs designed to perform the same procedures as client programs. The computer audit program is applied to the client data files and the results obtained are compared with the results of processing done by the client's program on the same file. Program simulation is analogous to the clerical performance of an accounting routine. It confirms that the program procedures have operated correctly. It may also verify that the resulting balances are derived correctly from the input data.

The list of instructions to the audit staff should include an instruction to check whether there is a procedure of reprocessing some important or sensitive applications and comparing the results with those obtained earlier.

Question 9

Explain the following techniques of audit used by internal auditors:

(i) System activity file interrogation.

(ii) Program comparison

(PE-II May 2007)

Answer

(i) **System Activity File Interrogation:** Many computer operating systems automatically create a log file listing all the exceptional events occurring in the system. This log file is stored on hard disk and review of this file helps in identification of exceptional events as listed below:

- The use of utility program instead of application program to change the data file.
- Attempt to break password to gain access of the system.
- The running of an application program without normal sequence.
- Change in application programs.

(ii) **Program Comparison:** This tool compares two different versions of the same program to check that they are identical. Software is available to do this comparison on source code as well as on object code. This tool can be used in the following situations:

- Comparing the program actually implemented with the one tested and accepted by user.
- Comparing the programs installed at different locations.
- Comparing the presently installed version with a copy of previously tested version under the control of the auditor.

Any difference between the two copies will require programming skill to know the impact of changes on the output.

Question 10

Explain "test data technique" of audit in a computerized environment with the help of test pack approach. (PE-II Nov. 2007)

Answer

Test data techniques are used to conduct audit by way of entering sample of transactions into client's computer system and comparing the output with predetermined output to make sure that the output being generated by client's computer system is correct. Test data may be dummy data or the transactions selected from the previously processed transactions.

Test packs: The use of test packs is the application of auditors test data (live or dummy) to clients application programs. A small sample of data is processed through the computer and output is compared with manually generated output using the same data. This audit approach requires little computer expertise but designing of test data which will represent all the possible combinations is a time consuming and difficult process. Use of test data generators can overcome this disadvantage.

Question 11

Mention uses of CAATs. What factors should be considered in determining whether to use CAATs? (PE-II May 2008)

Answer

CAATs may be used in performing various auditing procedures, including:

- (i) **Tests of details of transactions and balances** – for example, the use of audit software to test all, or a sample of the transactions in a computer file.
- (ii) **Analytical review procedures** - for example, the use of audit software to identify unusual fluctuations or items.
- (iii) **Compliance tests of general EDP controls** - for example, the use of test data to test access procedures to program libraries.
- (iv) **Compliance tests of EDP application controls** - for example, the use of test data to test the functioning of a programmed procedure.

The use of computer-assisted audit techniques (CAATs) in an organization primarily

depends upon the following factors:

- (i) **Computer knowledge, expertise and experience of the auditor:** The auditor should have sufficient knowledge to plan, execute and use the results of the particular CAAT adopted.
- (ii) **Availability of CAATs and suitable computer facilities:** The auditor should consider the availability of CAATs, suitable computer facilities and the necessary computer-based accounting systems and files.
- (iii) **Impracticability of manual tests:** Many computerized accounting systems perform tasks for which no visible evidence is available and, in these circumstances, it may be impracticable for the auditor to perform tests manually.
- (iv) **Effectiveness and Efficiency:** The effectiveness and efficiency of auditing procedures may be improved through the use of CAATs in obtaining and evaluating audit evidence.
- (v) **Timing:** Where the time available to perform an audit is limited, the auditor may plan to use a CAAT, as it will meet his time requirement better than other procedures.

Question 12

Write short note on Data File Interrogation.

(PE-II Nov. 2008)

Answer

Data File Interrogation: Data File Interrogation is a method which is used to interrogate financial data files. It is a form of substantive testing, as it involves the direct examination of transactions and balances. Using this method large volume of transactions can be examined and manipulated and information can be extracted in a much efficient way thus enabling the scope of audit testing to be increased significantly. The work is carried out faster and more accurately. Moreover, the clerical audit work can be devoted to an examination of those items which are defined in the interrogation program as significant for audit purposes. Therefore, the work is concentrated on testing rather than selection.

Question 13

What considerations should be given while using CAATs in Small Business Computer Environment? Discuss in brief.

(PE-II Nov. 2008)

Answer

Considerations for use of CAATs in small business computer environment:

The following points should be given consideration in such environments:

- (1) The level of general EDP controls may be such that the auditor will place less reliance on the system of internal control. This will result in:

- Greater emphasis on tests of details of transactions and balances and analytical review procedures, which may increase the effectiveness of certain CAATs, particularly audit software.
 - The application of audit procedures to ensure the proper functioning of the CAAT and validity of the entity's data.
- (2) In cases where small volumes of data are processed, manual methods may be more cost effective.
- (3) Adequate technical assistance may not be available to the auditor from the entity, thus making the use of CAATs impracticable.
- (4) Certain audit package programs may not operate on small computers, thus restricting the auditor's choice of CAATs. However, processing can be carried out on another suitable computer by copying the entity's data files there.

INTRODUCTION TO AN ACCOUNTING PACKAGE

Question 1

Write True or False for E.X.NGN offers 72 basic reports in accounting. (PE-II Nov. 2005)

Answer

True

Question 2

Describe the various facilities to be provided by the user-friendly accounting software package. (PE-II Nov. 2002)

OR

Explain the facilities provided by financial accounting package. (PE-II Nov. 2007)

Answer**Facilities provided by Financial Accounting Package**

Financial accounting package must be user friendly with on-line help facility so that even novice user can use it without any problem. Security must be of prime importance in a good financial accounting package so that no unauthorized user can enter/modify the financial data. It must provide the following facilities:-

- a. It must offer well designed data entry screens with various verification/validations controls so that correct data could be entered easily and fastly.
- b. It must have screen to create information about company such as its name, address, contract numbers, Income tax number, Sales tax number and other relevant details
- c. It must have flexibility to modify the company's accounting and inventory features by the authorized users using their passwords.
- d. It must be able to maintain the Group Accounts (Single Group & Multiple Groups) as well as single and multiple ledgers.

- e. It must facilitate day-to-day accounting transactions through voucher entry like entry of sales, purchase, receipt, payment and journal vouchers without the need of remembering the accounting codes.
- f. It must generate various financial statements like Day book, Cash book, Bank book, General ledger, Subsidiary ledger, Profit & Loss A/Cs, Trial balance, Balance sheet etc. In addition to these, the package must prepare various financial statements required by auditors and Government. It must be possible that all the required reports could be customized by user according to their requirements rather than generation of the same in standardized formats.

Question 3

Describe the salient features of EX.NGN accounting package.

(PE-II May 2003, Nov. 2004 & Nov. 2006)

Answer

Salient Features of Ex.NGN Package: E.X. Next Generation is one of the most user friendly business accounting software designed to work on Windows NT and 95/98. The software provides ready to use accounting modules for various business enabling online accounting within minutes of installation. The product is developed on Visual C++ and all reports are designed on Crystal reports. It has the following salient features:

- (i) It is a 32 bit application, which is compatible with Windows 95/98 and Windows NT.
- (ii) The software provides easy-to-use graphical user interface (GUI) as per the Microsoft GUI guidelines.
- (iii) Multi-tasking facility allows to perform various functions simultaneously.
- (iv) Different security passwords can be set for various activities.
- (v) It supports multiple companies to be created and maintained.
- (vi) Zoom in facility allows to obtain more detailed information at transaction level. Throughout the software, the user can view details on a click of a button.
- (vii) The 'account selection window provides all the accounting support without requiring the user to remember various codes for different accounts.
- (viii) It provides the facility to customize invoice, receipt bill, payments with some particular information, which may not be part of the pre-defined document.
- (ix) It can prepare seventy two different types of reports in accounting, which includes balance sheet, profit and loss account, trial balance, stock position, financial summary, and bank reconciliation etc.
- (x) It has a powerful feature, which enables the user to capture information based on various business parameters and attributes for subsequent analysis and printing of analysis reports. The user can construct queries to obtain different kinds of information based on these parameters.

Question 4

What are the different OLE automation support provided by E.X.NGN software?

(PE-II Nov. 2005)

Answer

Different OLE automation support provided by E.X.NGN software: Automation allows the user to program on E.X.NGN. The automation objects can be called using VBA scripts for getting data from E.X.NGN or data into E.X.NGN. Various functions of E.X. are provided as automation objects. The properties and a methods of these objects can be set from outside E.X. Some of the important E.X automation objects are create accounts, maintain accounts and balances, maintain items and narration and enter vouchers through OLE controllers. OLE automation offers the unique opportunity of integrating another application say payroll software, personal management, portfolio management etc. along with E.X NGN so as umbrella of applications can be integrated with EX.NGN.