Question Paper
Quantitative Methods (CFA530): October 2008

- Answer all 77 questions.
- Marks are indicated against each question.

Total Marks : 100

1. Which of the following gives the maximum number of combination of samples that can be drawn from a population of size x and sample size y ('!' is factorial sign)? <Answer>

(a) $\frac{x!}{[(x-y)!y!]}$

(b) $\frac{x!}{[(x+y)!y!]}$

(c) $\frac{x!}{[(x\times y)!y!]}$

(d) $\frac{y!}{[(x\times y)!y!]}$

(e) $\frac{y!}{[(x+y)!y!]}$. **(1 mark)**

2. The value of polynomial $x^4 - 7x^3 + 3x^2 - 8x + 5$ at $(-x)$ is equal to <Answer>

(a) $x^4 - 7x^3 + 3x^2 - 8x + 5$

(b) $x^4 + 7x^3 + 3x^2 + 8x + 5$

(c) $x^4 - 7x^3 - 3x^2 - 8x - 5$

(d) $x^4 + 7x^3 - 3x^2 + 8x - 5$

(e) $x^4 - 7x^3 - 3x^2 + 8x + 5$. **(1 mark)**

3. Which of the following is **not** an unbounded interval? <Answer>

(a) The set of all real numbers greater than a specified real number

(b) The set of all real numbers less than a specified real number

(c) The set of all real numbers greater than or equal to a specified real number

(d) The set of all real numbers less than or equal to a specified real number

(e) The set of real numbers greater than one real number and less than another real number. **(1 mark)**

4. What is the second derivative of $x^5 - 3x^4 + 2x^2 + x + 16$? <Answer>

(a) $20x^3 + 36x^2 + 4$

(b) $20x^3 - 36x^2 - 4$

(c) $40x^3 - 46x^2 + 4$

(d) $20x^3 - 36x^2 + 4$

(e) $30x^3 - 36x^2 + 3$. **(1 mark)**

5. What is the value of $\log_2 8 + \log_3 27$? <Answer>

(a) 2

(b) 4

(c) 6

(d) 8

(e) 9. **(1 mark)**

6. In a function $y = (x-1)^{-2}$, what will be the value of y, if x approaches 1?

<Answer>

(a) 1
(b) ∞
(c) 0
(d) 2
(e) 3. **(1 mark)**

7. The slope of the function, $y = x^2 - 4x + 10$ at $x = 5$ is

<Answer>

(a) 2
(b) 4
(c) 6
(d) 8
(e) 9. **(2 marks)**

8. The sum of the following geometric series $\frac{1}{4} + \frac{1}{4^3} + \frac{1}{4^5} + \frac{1}{4^7} + \ldots\ldots\ldots\infty$ is

<Answer>

(a) $\frac{1}{16}$
(b) $\frac{2}{15}$
(c) $\frac{4}{16}$
(d) $\frac{1}{64}$
(e) $\frac{4}{15}$. **(1 mark)**

9. The sum of the third and seventh term of an A.P is 8. The sum of the first 9 terms of the progression is

<Answer>

(a) 36
(b) 22
(c) 19
(d) 33
(e) 99. **(1 mark)**

10. If A, G and H are the arithmetic mean, geometric mean and harmonic mean respectively, between two given quantities a and b, then

<Answer>

(a) $G^2 = A - H$
(b) $G^2 = H - A$
(c) $G^2 = \frac{A}{H}$
(d) $G^2 = \frac{H}{A}$
(e) $G^2 = A \times H$. **(1 mark)**

11. A certain Government bond pays three different interest rates over its six-year term. The interest rates are eight percent per annum for the first two years, ten percent per annum for the third and fourth years and twelve percent per annum for the last two years. The average growth factor for this bond would be (select the nearest value):

<Answer>

(a) 1.2000%
(b) 1.7704%
(c) 3.7903%
(d) 1.0999%
(e) 1.5672%. **(1 mark)**

12. Which of the following statements regarding interpolation is **false**? <Answer>

(a) It is a method of statistical estimation
(b) It allows us to make insertions
(c) It is widely used by businessmen, administrators, sociologists, economists and financial analysts
(d) It allows us to forecast a value for some future data
(e) The figures obtained by interpolation are fairly correct as long as underlying assumptions hold good. **(1 mark)**

13. The vertices of the feasible region for a profit maximizing linear programming problem are bounded by (0, 0), (0, 12), (15, 0) and (7, 6). <Answer>

The profit function is Z = 8X + 6Y. The maximum value of Z is

(a) 70
(b) 72
(c) 92
(d) 110
(e) 120. **(1 mark)**

14. In a Linear Programming Problem (LPP) <Answer>

(a) The number of constraints depends upon the number of variables
(b) The number of decision variables depends upon the number of constraints
(c) The constraints are always linear equations
(d) The objective function is a linear function of the decision variables
(e) Both (c) and (d) above. **(1 mark)**

15. Graphical method can be employed to solve a Linear Programming Problem (LPP) only when the problem has _____ decision variable(s). <Answer>

(a) 1
(b) 2
(c) 3
(d) 4
(e) 5. **(1 mark)**

16. For any data, if we decide to construct a frequency distribution with only one class interval, then the frequency of the class interval would be equal to <Answer>

(a) One
(b) Total number of data points
(c) The largest value in the data
(d) The smallest value in the data
(e) Range of the data set. **(1 mark)**

17. In statistics, the collection of all the elements under study is called <Answer>

(a) Domain
(b) Population
(c) Range
(d) Sample
(e) Collection. **(1 mark)**

18. The 79^{th} term of the series 2, 5, 8, 11, ... is <Answer>

(a) 230
(b) 233
(c) 236
(d) 239
(e) 242. **(1 mark)**

19. Four teachers of Economics reported mean examination grades as 73, 67, 69 and 64 in their classes consisting of 15, 20, 10 and 18 students respectively. <Answer>

What is the mean of the grades of all the students?

(a) 63.89
(b) 65.91
(c) 67.89
(d) 70.32
(e) 80.71. **(1 mark)**

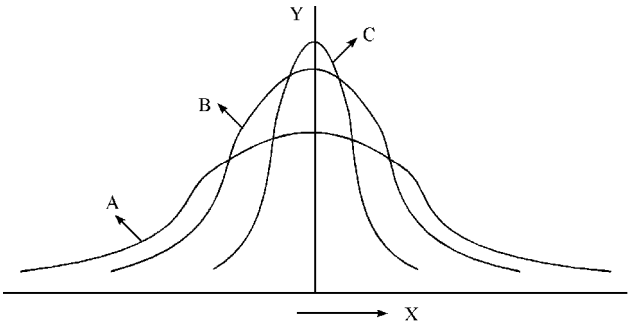
20. A normal curve is <Answer>

(a) Always symmetrical
(b) Symmetrical in most cases
(c) Positively skewed
(d) Negatively skewed
(e) Bimodal. **(1 mark)**

21. The Bienayme' – Chebyshev rule states that at least 89% of all observations are contained within 3 standard deviations of the mean when the distribution of the data is <Answer>

(a) Normal
(b) Following 't' distribution
(c) Bell shaped
(d) Skewed
(e) Not known. **(1 mark)**

22. The figure shows three symmetric curves A, B and C. Which of the following statements is **true**? <Answer>



(a) All curves have the same mean but not median and mode
(b) All curves have the same mean and median but not the mode
(c) All curves have the same mean and mode but not the median
(d) All curves have the same mean, median as well as mode
(e) All curves may or may not have the same mean, median and mode. **(1 mark)**

23. The value of mean and median of a given data are 12.6 and 13.12 respectively. The empirical mode will be equal to <Answer>

(a) 11.76
(b) 12.46
(c) 12.96
(d) 13.36
(e) 14.16. **(1 mark)**

24. In a normal curve <Answer>

(a) 94.55% of the items in the distribution fall within the range of $\mu \pm 2\sigma$
(b) 99.99% of the items in the distribution fall within the range of $\mu \pm 3\sigma$
(c) 95.75% of the items in the distribution fall within the range of $\mu \pm 2\sigma$
(d) 99.00% of the items in the distribution fall within the range of $\mu \pm 3\sigma$
(e) 95.45% of the items in the distribution fall within the range of $\mu \pm 2\sigma$. **(1 mark)**

25 The geometric mean of the numbers 3, 3.5, 4, 5 and 5.5 is <Answer>

(a) 3.9975
(b) 4.0975
(c) 5.2275
(d) 6.5675
(e) 7.8575. **(1 mark)**

26 Which of the following measures is based only on two observations in a data set? <Answer>

(a) Arithmetic mean
(b) Harmonic mean
(c) Range
(d) Mean absolute deviation
(e) Standard deviation. **(1 mark)**

27 The probability that the sum 8 appears in a single toss of a pair of fair dice is <Answer>

(a) $\frac{4}{36}$
(b) $\frac{5}{36}$
(c) $\frac{6}{36}$
(d) $\frac{7}{36}$
(e) $\frac{8}{36}$. **(1 mark)**

28 A bag contains 3 black and 2 green balls while another bag contains 2 black and 5 green balls. A ball is drawn at random from one of the bags and it turns out to be black. What is the probability that it came from the first bag? <Answer>

(a) $\frac{29}{31}$
(b) $\frac{21}{31}$
(c) $\frac{20}{31}$
(d) $\frac{15}{31}$
(e) $\frac{10}{31}$. **(1 mark)**

29 In a factory, there are three machines used in the manufacturing of screws and the three machines produce equal number of screws. The probability that Machine A turns out a defective is 0.1, Machine B turns out a defective is 0.2, Machine C turns out a defective is 0.3. A screw is picked at random and is found to be defective. What is the probability that it was produced by machine A? <Answer>

(a) $\frac{1}{2}$
(b) $\frac{1}{3}$
(c) $\frac{1}{4}$
(d) $\frac{1}{6}$
(e) $\frac{1}{10}$. **(1 mark)**

30. A mutual fund manager assesses the investment-worthiness of scrips using both fundamental and technical criteria. In a sample of scrips he finds that 60% are fundamentally strong and 30% are technically strong. If 20% are weak under both criteria, what percentage of scrips are strong under both criteria? (choose the nearest answer). <Answer>

(a) 50%
(b) 40%
(c) 30%
(d) 20%
(e) 10%. **(1 mark)**

31. The probability of an increase in demand of a particular product X in the next year is 0.75. If there is increase in demand takes place, the probability that the sales will increase by 20% or more is 0.70. If there is no increase in demand, the probability that sales will increase by 20% or more is 0.5. Given at the end of the year, the sales have risen by over 20%, what is the probability that there was an increase in demand of this product? (Select the nearest value) <Answer>

(a) 0.7577
(b) 0.6777
(c) 0.8077
(d) 0.4577
(e) 0.5577. **marks (2)**

32. If P(A or B) = P(A) + P(B) then A and B are <Answer>

(a) Independent
(b) Dependent
(c) Conditional
(d) Unconditional
(e) Mutually exclusive. **(1 mark)**

33. If A and B are two dependent events, P(B) = 0.2 and P(A and B) is 0.15, then P(A/B) is <Answer>

(a) 0.05
(b) 0.20
(c) 0.30
(d) 0.35
(e) 0.75. **(1 mark)**

34. The probability of getting exactly 3 heads in four tosses of a fair coin is <Answer>

(a) 1/2
(b) 1/4
(c) 1/8
(d) 1/10
(e) 1/16. **(1 mark)**

35. In decision making, index of optimism, ' α ' takes the values <Answer>

(a) Between 0 and 1, both 0 and 1, exclusive
(b) Between 0 and 1, both 0 and 1, inclusive
(c) Between 1 and 2
(d) Between 2 and 3
(e) Between 3 and 4. **(1 mark)**

36. A company produces drive shafts for electric motors. The drive shafts are produced from steel rods. The drive shaft of the motor must fit in a groove of the motor, with a diameter of 57.32 $\pm$ 3 cm. The steel rods used for production of drive shafts have a mean diameter of 56 cm with a standard deviation of 2.4 cm. What is the probability of a steel rod fitting in the groove, assuming that the diameter follows a normal distribution? (Choose the value nearest to the true value). <Answer>

(a) 0.7221
(b) 0.4641
(c) 0.2580
(d) 0.7031
(e) 0.7580. **marks (2)**

37 The probability distribution of a random variable X is as follows: <Answer>

.

X	15	20	25	30
Probability	0.3	0.3	0.2	0.2

The expected value of X will be equal to

(a) 21.05
(b) 21.50
(c) 21.77
(d) 22.50
(e) 22.77.

marks (2)

38 Regret is measured as <Answer>

.

(a) Maximum possible profits – Realized profits
(b) Maximum of minimum profits – Minimum of minimum profits
(c) Maximum possible profits – Foregone profits
(d) Maximum of maximum profits – Maximum of minimum profits
(e) Maximum possible profits – Minimum of maximum profits. **(1 mark)**

39 The marginal loss of increasing the stock of a particular item by one unit in a departmental store is <Answer>
. Rs.50 and the minimum probability of selling the additional unit which justifies increasing the stock of the item by an additional unit is 0.25. The marginal profit for the item is

(a) Rs. 50
(b) Rs.100
(c) Rs.125
(d) Rs.150
(e) Rs.160.

marks (2)

40 The maximin criterion for decision-making suggests that the alternative with the <Answer>

.

(a) Minimum of maximum profits must be selected
(b) Maximum of maximum profits must be selected
(c) Maximum of minimum profits must be selected
(d) Minimum of minimum profits must be selected
(e) Highest of expected profits must be selected. **(1 mark)**

41 If X follows continuous uniform distribution. It's probability density function is given by <Answer>

.

$$f(x)=\begin{cases}\frac{1}{6} & ; \quad 1\le X\le 7\\ 0 & ; \quad \text{otherwise}\end{cases}$$

What is the variance of the distribution?

(a) 1
(b) 2
(c) 3
(d) 4
(e) 5.

marks (2)

42 Assume, that the heights of 3000 male students at a University are normally distributed with mean <Answer>
. 173 cm and standard deviation 8 cm. Also, assume that from this population of 3000 all possible samples of size 25 were taken. (Sampling done without replacement).

What is the mean of the resulting sampling distribution of mean?

(a) 165
(b) 170
(c) 173
(d) 181
(e) 190. **(1 mark)**

43. A normal variable has a mean of 20 and a standard deviation of 5. What is the probability that the normal variable will take a value in the interval 14 to 19? <Answer>

(a) 0.3056
(b) 0.9506
(c) 0.2386
(d) 0.5756
(e) 0.6756. **(2 marks)**

44. A two-tailed test means <Answer>

(a) A test where a second sample is taken based on the first
(b) A test where null hypothesis is accepted if test statistic exceeds a given value
(c) A test where both upper and lower limits of confidence interval are used to take a decision of accepting null hypothesis
(d) A test used only when the sample size is small
(e) A test used only to measure the difference between two proportions. **(1 mark)**

45. For a heterogeneous population consisting of relatively homogeneous groups, which of the following sampling technique is **most** suitable? <Answer>

(a) Simple random sampling
(b) Stratified random sampling
(c) Judgmental sampling
(d) Systematic sampling
(e) Cluster sampling. **(1 mark)**

46. The standard error of sample mean is <Answer>

(a) The standard deviation of the sample
(b) The standard deviation of the population
(c) The standard deviation of the distribution of sample mean
(d) The error in computing the sample statistic
(e) The error in computing the standard deviation of the sample mean. **(1 mark)**

47. A random sample of size 9 is selected from a symmetrical population with a unique mode. The sample mean and standard deviation are 150 and 25 respectively. What is the 95% confidence interval in which the populations mean (μ) will lie? <Answer>

(a) (120.78, 149.22)
(b) (125.78, 159.22)
(c) (130.78, 169.22)
(d) (135.78, 179.22)
(e) (140.78, 189.22). **(2 marks)**

48. A statistician is trying to explore the relationship between percentage fat content (Y) and price (X), of various dairy products. He finds that the coefficient of determination is 0.4624 and that the estimated regression line is <Answer>

$$Y = 0.5 - 0.02X.$$

The coefficient of correlation would be

(a) 0.68
(b) – 0.68
(c) Lies between 0.68 and – 0.68
(d) – 0.02
(e) –0.88. **(2 marks)**

49. Many questions in finance and economics are studied by constructing <Answer>

(a) Mathematical models
(b) Physical models
(c) Real models
(d) Practical models
(e) Relative models. **(1 mark)**

50. The standard deviation of two variables and their covariance are 0.1, 0.2 and 0.02 respectively. The two variables <Answer>

(a) Have a low correlation coefficient
(b) Are not correlated to each other
(c) Are perfectly positively correlated
(d) Are negatively correlated
(e) Are perfectly negatively correlated. **(1 mark)**

51. If the Error Sum of Squares = 100 and the Total Sum of Squares = 169, what percentage of changes in the dependent variable is explained by the changes in the independent variable? <Answer>

(a) 35.0%
(b) 40.8%
(c) 42.8%
(d) 48.2%
(e) 49.0%. **(1 mark)**

52. Which of the following is **false** with regard to simple regression and correlation analysis? <Answer>

(a) If the coefficient of correlation between two variables is close to one, then there is a strong correlation between the two variables
(b) If the slope of a regression equation is positive then the coefficient of correlation between the variables involved is positive
(c) A high correlation always indicates a cause-effect relationship between the variables involved
(d) If the slope of a regression equation is negative then the coefficient of correlation between the variables involved is negative
(e) If the coefficient of correlation between two variables is equal to zero, then there is no correlation between the two variables. **(1 mark)**

53. Which of the following is the graphical plot of the values of the dependent and independent variables, in the context of correlation analysis? <Answer>

(a) Scatter diagram
(b) Frequency polygon
(c) Histogram
(d) p chart
(e) Ogive. **(1 mark)**

54. In a multiple regression analysis involving two independent variables, X and Y, we find that there is no correlation between dependent variable Z and independent variable Y. We also observe that there is no correlation between two independent variables X and Y. The partial coefficient of correlation between Z and X when Y is kept constant is equal to <Answer>

(a) Simple coefficient of correlation between Z and X
(b) Simple coefficient of correlation between Z and Y
(c) Simple coefficient of correlation between X and Y
(d) Partial coefficient of correlation between Z and Y when X is kept constant
(e) Partial coefficient of determination between Z and X when Y is kept constant. **(1 mark)**

55. Using 2004 as the base year, the consumer price index was 197 in 2007. If a person's annual salary had increased from Rs.7,000 in 2004 to Rs.11,000 in 2007, his adjusted salary has <Answer>

(a) Decreased by 97%
(b) Decreased by 20%
(c) Increased by 97%
(d) Increased by 20%
(e) Decreased by 79%. **(1 mark)**

56 Following are the price and quantity of 4 commodities used as a basket of goods to measure index. <Answer>

.

Commodity	Base Year		Current Year	
	Price (P_0) Rs.	Quantity (Q_0) Kg.	Price (P_1) Rs.	Quantity (Q_1) Kg.
A	5	13	8	12
B	7	8	12	9
C	8	6	11	10
D	3	16	4	25

Which of the following is the price index for the current year using Marshall-Edgeworth Method?

(a) 149.25
(b) 149.99
(c) 150.95
(d) 150.30
(e) 151.05.

marks
(2)

57 The index of industrial production is an example of <Answer>

.

(a) Price index
(b) Value index
(c) Quantity index
(d) Unweighted index
(e) None of the above.

(1 mark)

58 Consider the following data. <Answer>

.

Commodity	Price (Rs/unit)	
	2005	2007
Rice	32	50
Wheat	35	45
Edible Oil	90	100
Fish	120	140
Potato	35	40

What is the unweighted aggregates price index for the year 2007 using the following data, taking year 2005 as base year?

(a) 85.56
(b) 100.54
(c) 105.55
(d) 120.19
(e) 126.52.

(1 mark)

59 Patterns of change in a variable occurring within a year and which tend to be repeated from year to year are known as <Answer>

.

(a) Secular trend
(b) Cyclical fluctuation
(c) Seasonal variation
(d) Irregular variation
(e) None of the above.

(1 mark)

60 Consider the following data. <Answer>

.

$n = 16, \overline{\overline{X}} = 125.85, \overline{R} = 6.4$ and $d_2 = 3.532$.

For the data given above, the center line and the lower control limits are

(a) 7.866 and 124.073
(b) 7.866 and 127.627
(c) 125.85 and 124.491
(d) 125.85 and 127.627
(e) 0.40 and 124.073.

marks
(2)

61 Which of the following control charts is/are used to monitor the variability in a process?

<Answer>

(a) $\bar{x}$ charts
(b) R charts
(c) p charts
(d) Scatter diagram
(e) Both (b) and (c) above. **(1 mark)**

62 The chi-square statistic is given by

<Answer>

(a) $\sum \frac{(f_o - f_e)^2}{f_o}$

(b) $\sum \frac{(f_o - f_e)^{1/2}}{f_e}$

(c) $\sum \frac{(f_o - f_e)^2}{f_e}$

(d) $\frac{[\sum (f_o - f_e)]^2}{f_e}$

(e) $\frac{[\sum (f_o - f_e)]^2}{f_o}$. **(1 mark)**

63 The following table gives the probability distribution of the daily demand of a particular item.

<Answer>

Demand ('00 units)	2	3	5
Probability	30%	60%	10%

The opening inventory was 1000 units and the daily demand is to be simulated.

In one run, the random number generated was 45. The closing inventory will be

(a) 400
(b) 500
(c) 700
(d) 800 **marks**
(e) 999. **(2)**

64 Consider the following probability distribution of a variable X.

<Answer>

X	5	10	15	20	25	30	35
Probability	0.1	0.05	0.05	0.1	0.3	0.2	0.2

In a Monte Carlo simulation process the number 81 was generated in a particular run from a uniform distribution of 0 – 99. The value of X in this run will be

(a) 5
(b) 10
(c) 25
(d) 30 **marks**
(e) 35. **(2)**

65 Simplified form of expression $\left(\sqrt[4]{a^{n}} \times \sqrt[3]{a^{n}}\right) \div \sqrt[12]{a^{5n}}$ is

<Answer>

(a) $\sqrt[6]{a^{n}}$
(b) a^{-53n}
(c) a^{-3n}
(d) $\sqrt[3]{a^{n}}$
(e) $\sqrt[1/6]{a^{n}}$. **(1 mark)**

66. Solve the following simultaneous equations. <Answer>

$2x + y = 0$,

$\frac{y}{2} - 3x = 8$.

The values of x and y are

(a) 2 and 4
(b) 2 and – 4
(c) –2 and – 4
(d) –2 and 4
(e) 3 and – 6.

marks (2)

67. A company produces three products, Product A, Product B and Product C. These products have to go through some or all the departments of moulding, finishing and assembly. A single unit of product A requires 2.4 minutes of moulding time and 5.0 minutes of assembly time. The profit for product A is Rs.0.60 per unit. A single unit of Product B requires 3.0 minutes of moulding time and 2.5 minutes of finishing time. The profit for Product B is Rs.0.70 per unit. A single unit of Product C requires 2.0 minutes of moulding time, 1.5 minutes of finishing time and 2.5 minutes of assembly time. The profit associated with Product C is Rs.0.50 per unit. The moulding department has time available to allocate to these products to the extent of 1,200 minutes per week. The finishing department has 600 minutes per week and the assembly department has 1,500 minutes per week. <Answer>

Which of the following is representing the linear programming problem of the above situation?

(a) Maximize $0.60X_A + 0.70X_B + 0.50X_C$
Subject to:
$2.40X_A + 3X_B + 2X_C \geq 1{,}200$
$2.50X_B + 1.50X_C \leq 600$
$5.00X_A + 2.50X_C \leq 1{,}500$
$X_A, X_B, X_C \geq 0$.

(b) Maximize $0.60X_A + 0.70X_B + 0.50X_C$
Subject to:
$2.40X_A + 3X_B + 2X_C \leq 1{,}200$
$2.50X_B + 1.50X_C \geq 600$
$5.00X_A + 2.50X_C \leq 1{,}500$
$X_A, X_B, X_C \geq 0$.

(c) Maximize, $0.60X_A + 0.70X_B + 0.50X_C$
Subject to:
$4.80X_A + 6X_B + 4X_C \leq 1{,}200$
$2.50X_B + 1.50X_C \leq 600$
$5.00X_A + 2.50X_C \leq 1{,}500$
$X_A, X_B, X_C \geq 0$.

(d) Maximize $0.60X_A + 0.70X_B + 0.50X_C$
Subject to:
$2.40X_A + 3X_B + 2X_C \geq 1{,}200$
$5X_B + 3X_C \geq 1{,}200$
$5.00X_A + 2.50X_C \leq 1{,}500$
$X_A, X_B, X_C \geq 0$.

(e) Maximize $0.60X_A + 0.70X_B + 0.50X_C$
Subject to:
$2.40X_A + 3X_B + 2X_C \leq 1{,}200$
$2.50X_B + 1.50X_C \leq 600$
$5.00X_A + 2.50X_C \leq 1{,}500$
$X_A, X_B, X_C \geq 0$.

marks (3)

68. For four successive years, a company purchased a particular raw material for Rs.4.00, Rs.5.00, Rs.7.00 and Rs.8.00 per kg respectively. If the company's expenditure on this raw material was the same for all the four years, what is the average expenditure on the raw material over the four year period? <Answer>

(a) 1.3921
(b) 5.5721
(c) 5.7530
(d) 7.5221
(e) 3.1921.

(1 mark)

69. Anjali, head of a small business-consulting firm, must decide how many MBAs need to be hired as full-time consultants for the next year. Anjali knows from her experience that the probability distribution on the number of consulting jobs her firm will get each year is as follows: <Answer>

Consulting jobs	24	27	30	33
Probability	0.3	0.2	0.4	0.1

Anjali also knows that each MBA hired will be able to handle exactly three consulting jobs per year. The salary of each MBA is Rs.60,000 per annum. Each consulting job is worth Rs.30,000 to Anjali's firm. Each consulting job that the firm is awarded but cannot complete costs the firm Rs.10,000 in future business lost.

How many MBAs should be hired so as to maximize the expected profit?

(a) 8
(b) 9
(c) 10
(d) 11
(e) Either 9 or 10.

marks (3)

70. In a soft drink vending machine the amount of drink dispensed is a random variable with a mean of 200 ml and a standard deviation of 15 ml. What is the probability that the average (mean) amount dispensed in a random sample of size 36 is at least 204 ml? <Answer>

(a) 0.0548
(b) 0.0456
(c) 0.0512
(d) 0.0635
(e) 0.0425.

marks (2)

71. The formulation of a Linear Programming Problem (LPP) is given below: <Answer>

Maximize: $Z = 25X + 35Y$

Subject to: $4X + 8Y \leq 400$

$4X + 4Y \leq 280$

$6X + 3Y \leq 360$

$X \geq 0, Y \geq 0$

What is the optimum value of objective function if you solve the problem graphically?

(a) 1050
(b) 2050
(c) 3050
(d) 4050
(e) 5050.

marks (2)

72. In a test of ANOVA, the number of samples used is 4 and the total size of all the samples is 19. If the significance level for the test is 0.05, then what will be the critical value? <Answer>

(a) 2.90
(b) 3.29
(c) 5.80
(d) 8.74
(e) 9.50.

marks (2)

73. Consider the following sample of paired observations: <Answer>

X	3	4	7	6	5
Y	15	12	10	11	13

The covariance between X and Y is

(a) – 2.75
(b) – 2.20
(c) – 1.75
(d) 1.75
(e) 3.75.

marks (2)

74 Daily demand for ice-creams at a stall follows Binomial distribution with n = 5 and $p = \frac{2}{3}$.

There is a profit of Rs.2 for every ice-cream sold and there is a loss of Re.1 for every ice-cream unsold. If 5 ice-creams are available for sale, then expected net profit per day is

(a) Rs.25
(b) Rs.20
(c) Rs.15
(d) Rs.10
(e) Rs. 5.

marks (2)

<Answer>

75 In which of the following type of computers the speed of CPU is about 10 Million Instructions Per Second (MIPS)?

(a) Mini computers
(b) Micro computers
(c) Super mini computers
(d) Main frame computers
(e) Super computers.

(1 mark)

<Answer>

76 Which of the following is/are High-level Languages?

I. FORTRAN.
II. PASCAL.
III. COBOL.

(a) Only (I) above
(b) Only (II) above
(c) Only (III) above
(d) Both (I) and (II) above
(e) All (I), (II) and (III) above.

(1 mark)

<Answer>

77 Which of the following is a global network of computers linked by exclusive and regular phone lines, microwave and satellite signals?

(a) Extranet
(b) Internet
(c) Modem
(d) Hacker
(e) Baud.

(1 mark)

<Answer>

END OF QUESTION PAPER

Suggested Answers
Quantitative Methods (CFA530): October 2008

	ANSWER	REASON
1.	A	$\frac{x!}{[(x-y)!y!]}$
2.	B	The value of $x^4 - 7x^3 + 3x^2 - 8x + 5$ at $(-x)$ is given by $= (-x)^4 - 7(-x)^3 + 3(-x)^2 - 8(-x) + 5$ $= x^4 + 7x^3 + 3x^2 + 8x + 5.$

3. E The set of all real numbers greater than one real number and less than another real number ≤

Explanation :

a. This interval is bounded on the lower side but unbounded on the upper side

b. This interval is bounded on the upper side but unbounded on the lower side.

c. This interval is bounded on the lower side but unbounded on the upper side.

d. This interval is bounded on the upper side but unbounded on the lower side.

Therefore option (e) is correct.

4. D Given that $y = x^5 - 3x^4 + 2x^2 + x + 16.$ ≤

$$\Rightarrow \frac{dy}{dx} = 5x^4 - 12x^3 + 4x + 1$$

$$\Rightarrow \frac{d^2y}{dx^2} = 20x^3 - 36x^2 + 4.$$

Hence, second derivative of $x^5 - 3x^4 + 2x^2 + x + 16$ is $20x^3 - 36x^2 + 4.$

5. C $\log_2 8 + \log_3 27 = \log_2 2^3 + \log_3 3^3$ ≤

$= 3 \times \log_2 2 + 3 \times \log_3 3$

$= 3 \times 1 + 3 \times 1$

$= 6.$

6. B $\lim_{x \to 1} \frac{1}{(x-1)^2} \to \infty.$ ≤

7. C Given, $y = x^2 - 4x + 10$ ≤

$$\text{Slope} = \frac{\partial y}{\partial x} = 2x - 4$$

At $x = 5,$

$$\frac{\partial y}{\partial x} = 2(5) - 4 = 10 - 4 = 6.$$

8. E Here, a = 1/4 and $r = 1 / 4^2$ ≤

$$\text{So, } S = \frac{a}{1-r} = \frac{1/4}{1-1/16} = \frac{4}{15}.$$

9. A The third term $t_3 = a + 2d$ ≤

The seventh term $t_7 = a + 6d$

$t_3 + t_7 = 2a + 8d = 8$

Sum of first 9 terms of an AP is given by

$$S_9 = \frac{9}{2}[2a + 8d]$$

$$= \frac{9}{2}[8]$$

$$= 36.$$

10. E

Here, $A = \frac{a+b}{2}$, $G = \sqrt{a \cdot b}$ i.e. $G^2 = ab$

and $H = \frac{2ab}{a+b}$

From the above three relationship, $H = \frac{G^2}{A}$ or, $G^2 = A.H$

11. D $GM = [(1.08)(1.08)(1.10)(1.10)(1.12)(1.12)]^{1/6} = 1.09999\%$.

12. D Extrapolation is used for forecasting purposes. Hence (d) is the answer.

13. E Substitute the different values of X and Y of the vertices of the feasible region and find the maximum value of Z as follows:

$Z = 8X + 6Y$

For (0, 0), $Z = 8 \times 0 + 6 \times 0 = 0$

For (0, 12), $Z = 8 \times 0 + 6 \times 12 = 72$

For (15, 0), $Z = 8 \times 15 + 6 \times 0 = 120$

For (7, 6), $Z = 8 \times 7 + 6 \times 6 = 92$.

Hence (e) is the answer.

14. D In LPP the number of constraints is independent of the number of variables or vice-versa. The constraints and the objective function are expressed as a linear function of variables and constraints could be inequalities or equalities. Hence, (d) is the answer.

15. B Graphical method can be employed to solve a LPP problem only when the problem has two decision variables. For solving problems with more than two decision variables, simplex method is used. Hence, the answer is (b).

16. B The frequency of a class interval is the number of data points that fall within that class interval. Hence, if we decide to construct a frequency distribution with only one class interval then its frequency would be equal to total number of all data points.

17. B In statistics, the collection of all the elements under study is called population.

18. C Given series is 2, 5, 8, 11, ...
Therefore, a = 2 and common difference d = 3.
n^{th} term is $T_n = a + (n-1)d$
79^{th} term $= 2 + (79-1)3 = 2 + 234 = 236$.

19. C Grand Mean = [(73 x 15) + (67 x 20) + (69 x 10) + (64 x 18)]/(15 + 20 + 10 + 18) = [1095 + 1340 + 690 + 1152]/63 = 4277/63 = 67.89.

20. A A normal curve is always symmetrical. At a given distance above and below the mean we find the same number of measurements.

21. E If a particular random phenomenon follows the pattern of bell-shaped model which is usually a normal distribution, we know precisely how likely it is that any element is close to or far from its mean. But if the population model is not known, the Bienayme'-Chebyshev rule applies. This rule tells how likely it is that any particular value lies within a specified distance from the mean.

22. D Except standard deviation and variance, all the curves will have the same mean, median and mode.

23. E Empirical mode = 3 Median – 2 Mean
= 3(13.12) – 2(12.6)
= 39.36 – 25.2
= 14.16.

24. E In a normal curve, 68.27% of the observations fall between the range of the arithmetic mean plus 1 standard deviation and minus 1 standard deviation ($\mu \pm 1\sigma$), 95.45% of the observations fall between the range of the arithmetic mean plus and minus 2 standard deviation ($\mu \pm 2\sigma$) and 99.73% of the observations fall within three standard deviations of the mean ($\mu \pm 3\sigma$).

25. B GM = $(3 \times 3.5 \times 4 \times 5 \times 5.5)_{1/5} = 4.0975$.

26. C Range = (Highest value – Lowest value) is based only on two observations in a data set.
Arithmetic mean, harmonic mean, mean absolute deviation and standard deviation are based on all the observations.

27. B

Favorable events (i.e. sum of 8) ={ (2,6) (3,5) (4,4) (6,2) (5,3) }

Total events = 36

P(sum = 8) = $\frac{5}{36}$.

28. B

P (That the ball is from the first bag given that it is black) = $\frac{\frac{3}{5}}{\frac{3}{5}+\frac{2}{7}}=\frac{21}{31}$.

29. D

Let E be the event that the screw is defective.

Let A be the event that the screw is produced on machine A.

Let B be the event that the screw is produced on machine B.

Let C be the event that the screw is produced on machine C.

Required probability = P(E/A) = $\frac{0.1}{0.1+0.2+0.3}$

= 1/6.

30. E

P(A or B) = P(A) + P(B) – P(A and B). In the sample of scrips he finds that 60% are fundamentally strong (implying that 40% are fundamentally weak) and 30% are technically strong (implying that 70% are technically weak). Thus, the percentage of scrips are weak = 40% + 70% – 20% = 90%. Hence, the percentage of scrips that are strong under the both criteria = (100 – 90)% = 10%.

31. C

Let I be the event that there will be an increase in the demand of a particular product.

Let D be the event that there will be no increase in the demand of the product.

Let S be the event that the sales will increase by 20%.

Given P(I) = 0.75, P(D) = 1– 0.75 = 0.25, P(S/I) = 0.70 and P(S/D) = 0.50

Required probability = P(I/S) = $\frac{0.70 \text{ x } 0.75}{0.70 \text{ x } 0.75+0.50 \text{ x } 0.25}$ = 0.8077.

32. E

If P(A or B) = P(A) + P(B) – P(A and B), then the events A and B may be either mutually exclusive or non-exclusive. In case of mutually exclusive events P(A and B) would be equal to 0. Thus, P(A or B) = P(A) + P(B) (for mutually exclusive events).

33. E

P(A/B) = P(A and B)/P(B) = 0.15/0.2 = 0.75.

34. B

$P=\frac{n!}{r!(n-r)!}(p)^r\,(q)^{n-r}$

= 4!/ [3! (4 – 3)!] $(0.5)^3$ $(0.5)^{4-3}$

= 0.25 or 1/4.

35. B In decision making, index of optimism, 'α' takes the values Between 0 and 1, both 0 and 1, inclusive. ≤

36. A $z = (x_1 - \mu)/\sigma$, where $x_1 = 57.32 + 3 = 60.32$ ≤

$z = (60.32 - 56)/2.4 = 1.8$

The P $(56 < x < 60.32) = 0.4641$ (see the corresponding value for z-score, 1.8)

$z = (x_2 - \mu)/\sigma$, where $x_2 = 57.32 - 3 = 54.32$

$z = (54.32 - 56)/2.4 = -0.7$

The P $(54.32 < x < 56) = 0.2580$ (see the corresponding value for z-score, 0.7).

Thus, the probability of a steel rod fitting in the groove is equal to 0.4641 + 0.2580 = 0.7221.

37. B The expected value of X is equal to [15(0.3) + 20(0.3) + 25(0.2) + 30(0.2)] = 4.5 + 6 + 5 + 6 = 21.5. ≤

38. A Regret is a measure of magnitude of loss/cost (opportunity loss or cost) incurred by not selecting the best alternative. The regret we realize is measured by the difference between the maximum profits we would have realized had we known the state of nature and the profit we realize. ≤

39. D $P^* = ML/(ML + MP)$, where P^* represents minimum required probability of selling at least one additional unit to justify the stocking of that additional unit. ≤

$0.25 = 50/(50 + MP)$; MP = 200 – 50 = Rs.150.

40. C Under Maximin Criterion, the decision maker first identifies the lowest profit associated with each decision alternative and then chooses that alternative which is the maximum of the above minimum profits. ≤

41. C The probability density function of a typical random variable is given by ≤

$$f(x) = \begin{cases} \frac{1}{(b-a)} & ; \ a \le X \le b \\ 0 & ; \ \text{otherwise} \end{cases}$$

Mean= E(X)= $\frac{(a+b)}{2}$

Variance= V(X)= $\frac{(b-a)^2}{12}$

Given that a =1 and b = 7.

$\therefore$ Variance = $\frac{(7-1)^2}{12} = \frac{36}{12} = 3.$

42. C When the population is normally distributed, the sampling distribution of mean has a mean equal to the population mean. Symbolically, μ = mean of $\bar{x} = \bar{\bar{X}} = \mu = E(\bar{x})$. So the mean value is 173 cm. ≤

43. A Given that, A normal variable has a mean of 20 and a standard deviation of 5. ≤

We have to find the probability that the normal variable will take a value in the interval 1**4** to 19.

i.e., X follows $N(20, 25)$ We have to find $P(14 \le X \le 19)$.

$$P(14 \le X \le 19) = P\left(\frac{14-20}{5} \le \frac{X-\mu}{\sigma} \le \frac{19-20}{5}\right)$$
$$= P(-1.2 \le Z \le -0.2)$$
$$= 0.3056.$$

44. C A two-tailed test is a test where both upper and lower limits of confidence interval are used to take a decision of accepting null hypothesis. ≤

45. B Stratified sampling is generally used when the population is heterogeneous. In this case, the population is first subdivided into several parts (or small groups) called strata according to some relevant characteristics so that each stratum is more or less homogeneous. Each stratum is called a sub-population. Then a small sample (called sub-sample) is selected from each stratum at random. All the sub-samples combined together form the stratified sample. ≤

46. C The standard error of sample mean is the standard deviation of the distribution of sample mean. ≤

47. C ≤

Here, $\bar{X} = 150$

s = 25

n = 9

Degrees of freedom = n – 1 = 9 – 1=8

If we refer to the **t** table we see that for 8 degrees of freedom, the area in both tails combined is 0.5 or 5%, when t=2.306.

Hence, area under the curve between $\bar{X} - t\left(\frac{s}{\sqrt{n}}\right)$ and $\bar{X} + t\left(\frac{s}{\sqrt{n}}\right)$ is 95% when t = 2.306.

So, the 95% confidence interval is $150 - \left[2.306 \times \frac{25}{\sqrt{9}}\right]$ to $150 + \left[2.306 \times \frac{25}{\sqrt{9}}\right]$.

Hence, we are 95% confident that the population mean lies in the interval 130.78 to 169.22.

48. B If coefficient of determination, r^2 = 0.4624, the absolute value of coefficient of correlation, |r| would be equal to $\sqrt{r^2}$ or $\sqrt{0.4625}$ = 0.68. Since the slope of the regression line is negative (–0.02), the relationship between the two variables is negative. Thus, the value of coefficient of correlation, r would be equal to –0.68. ≤

49. A Mathematical model is the general characterization of a process, object, or concept, in terms of mathematics, which enables the relatively simple manipulation of variables to be accomplished in order to determine how the process, object, or concept would behave in different situations. Mathematical models used for solving many questions in finance and economics. ≤

50. C The coefficient of correlation, r = Cov (X,Y)/$S_X S_Y$ = 0.02/(0.1 x 0.2) = 1. Thus, the two variables in this case are said to be perfectly positively correlated. ≤

51. B Statisticians sometimes interpret the sample coefficient of determination by looking at the amount of the variation in Y that is explained by the regression line. This implies that the proportion of variation in a dependent variable that is explained by the independent variable is nothing but the sample coefficient of determination, r^2. r^2 = RSS = TSS – ESS = 169 – 100 = 69. Therefore, the percentage of changes in the dependent variable is explained by the changes in the independent variable is equal $1-\frac{ESS}{TSS}$(simply) to 69/169 x 100 = 40.8%. ≤

52. C
(a) This is true for correlation analysis. If the coefficient of correlation between two variables is close to one, then there is a strong correlation between the two variables. ≤
(b) This is true for correlation analysis. If the slope of a regression equation is positive then the coefficient of correlation between the variables involved is positive.
(c) This is false for correlation analysis. Even a highly significant correlation does not necessarily mean that a cause and effect relationship exists between the two variables. Correlation does not necessarily imply causation or functional relationship though the existence of causation always implies correlation or association between two variables.
(d) This is true for correlation analysis. If the slope of a regression equation is negative then the coefficient of correlation between the variables involved is negative.
(e) This is a true statement. If the coefficient of correlation between two variables is equal to zero, then there is a no correlation between the two variables.

53. A
i. The graphical plot of the values of the dependent and independent variables, in the context of correlation analysis, is called scatter diagram. ≤
ii. A frequency polygon is a graphical representation of a frequency distribution which uses straight lines to join the top mid-points of the rectangles in a histogram.
iii. A histogram is a graphical representation of a frequency distribution.
iv. A p chart is a quality control chart.
v. An ogive is a graphical plot of a cumulative frequency distribution.

54. A
(a) This is the right answer. The partial coefficient of correlation between Z and X when Y is kept constant is equal to the simple coefficient of correlation between Z and X, if the coefficient of correlation between Z and Y and coefficient of correlation between X and Y are zero. ≤
(b) This is the wrong answer. The partial coefficient of correlation between Z and X when Y is kept constant is not equal to simple coefficient of correlation between Z and Y for the given condition.
(c) This is the wrong answer. The partial coefficient of correlation between Z and X when Y is kept constant is not equal to simple coefficient of correlation between X and Y for the given condition.
(d) This is the wrong answer. The partial coefficient of correlation between Z and X when Y is kept constant is not equal to partial coefficient of correlation between Z and Y when X is kept constant for the given condition.
(e) This is the wrong answer. The partial coefficient of correlation between Z and X when Y is kept constant is not equal to partial coefficient of determination between Z and X when Y is kept constant for the given condition.

55. B Adjusted salary = 11,000 x 100/197 = 5583.75, which is Rs.1,416.25 less than the salary in 2004. Thus, the adjusted salary has decreased by 20 percent (that is, 1,416.25/7,000 x 100). ≤

56. D The formula for calculating the price index through Marshall-Edgeworth method is as follows: ≤

$$\frac{\sum (Q_0 + Q_1) P_1}{\sum (Q_0 + Q_1) P_0} \times 100$$

Commodity	P_0	Q_0	P_1	Q_1	$Q_0 + Q_1$	$P_1 (Q_0 + Q_1)$	$P_0 (Q_0 + Q_1)$
A	5	13	8	12	25	200	125
B	7	8	12	9	17	204	119
C	8	6	11	10	16	176	128
D	3	16	4	25	41	164	123
						$\sum P_1 (Q_0 + Q_1) = 744$	$\sum P_0 (Q_0 + Q_1) = 495$

Price Index = $\frac{744}{495} \times 100 = 150.30$.

57. C The index of industrial production is an example of Quantity index. ≤

58. D The unweighted aggregate price index for the given commodity with year 2005 as base year ≤

$$= \frac{\sum P_1}{\sum P_0} \times 100 .$$

From the table we have $\sum P_0 = 312$ and $\sum P_1 = 375$

Therefore unweighted aggregate price index = 120.19.

59. C Under Seasonal variation, we observe that the variable under consideration shows a similar pattern during certain months of the successive years. An example of seasonal variation would be an increase in water borne diseases during rainy season. That is, this phenomenon seems to be repeating itself every year in a regular fashion. Usually, the time period over which this variation is considered can consist of days, weeks, months and at the most one year. ≤

60. C ≤

We know that the value of $\bar{\bar{X}}$ is used to draw the center line. Therefore, from the given data the center line is drawn at 125.85. The lower control limits is calculated as follows:

$$\text{Lower control limit} = \bar{\bar{X}} - \frac{3\bar{R}}{d_2\sqrt{n}}$$

$$= 125.85 - \frac{3(6.4)}{3.532(\sqrt{16})}$$

$$= 125.85 - \frac{19.2}{14.128}$$

$$= 125.85 - 1.359$$

$$= 124.491.$$

61. B

(a) This is a wrong answer. The $\overline{X}$ charts are constructed using the mean value as the central limit and three standard deviations from the mean as upper and lower control limits.

(b) This is the right answer. R charts are used to monitor the variability in the individual characteristics of the product. The control limit is the mean range and the upper and lower control limits are constructed with the standard deviation in the range values.

(c) This is the wrong answer. p charts deal with the attributes that are qualitative in nature. The measure that is applied here is the proportion of the data points satisfying the given criteria and the proportion of the data points that does not satisfy the criteria.

(d) This is the wrong answer.

(e) This is the wrong answer.

62. C

$$\chi^2 = \Sigma \frac{(f_o - f_e)^2}{f_e}$$

Where, f_o is the observed frequency and f_e is the expected frequency.

63. C

Daily Demand ('00)	Probability	Cumulative Probability	Random numbers allotted
2	0.3	0.3	00 – 29
3	0.6	0.9	30 – 89
5	0.1	1.00	90 – 99

Since the random number generated was 45 (which fall in between 30 – 89), the daily demand is 300. Closing inventory = Opening inventory – sales = 1000 – 300 = 700.

64. E

X	Probability	Cumulative Probability	Random numbers allotted
5	0.10	0.10	00 – 09
10	0.05	0.15	10 – 14
15	0.05	0.20	15 – 19
20	0.10	0.30	20 – 29
25	0.30	0.60	30 – 59
30	0.20	0.80	60 – 79
35	0.20	1.00	80 – 99

Since the random number generated was 81 (which fall in between 80 – 99), the value of X in this run is 35.

65. A

$$\sqrt[4]{a^n} \times \sqrt[3]{a^n} \div \sqrt[12]{a^{5n}}$$

$$\Rightarrow \frac{a^{n/4} \times a^{n/3}}{a^{5n/12}}$$

$$\Rightarrow \frac{a^{7n/12}}{a^{5n/12}}$$

$$\Rightarrow a^{(7n/12 - 5n/12)}$$

$$\Rightarrow a^{2n/12}$$

$$\Rightarrow a^{n/6}$$

$$\Rightarrow \sqrt[6]{a^n}.$$

66. D

The simultaneous equations are:

$2x + y = 0$ …..…… (1)

$y/2 – 3x = 8$ …..…… (2)

Equations (1) and (2) expressed in terms of 'x' will be

$x = –y/2$

$x = (y – 16)/6$

Since, 'x' in both the equations is the one and the same, we have

$–y/2 = (y –16)/6$

$–y = (y – 16)/3$

$–3y = y – 16$

$–3y – y = –16$

$–4y = –16$

$y = 16/4$

$y = 4$

We substitute the value of 'y' in equation (1),

$2x + 4 = 0$

$2x = – 4$

$x = – 4/2 = –2.$

67. E

Let X_A = Number of units of A to be produced

X_B = Number of units of B to be produced

X_C = Number of units of C to be produced

We need to

Maximize $0.60X_A + 0.70X_B + 0.50X_C$

Subject to:

$2.40X_A + 3X_B + 2X_C \leq 1{,}200$

$2.50X_B + 1.50X_C \leq 600$

$5.00X_A + 2.50X_C \leq 1{,}500$

$X_A, X_B, X_C \geq 0.$

68. B

The average cost for the four year period is given by the harmonic mean of the costs per kg for each of the four years.

Harmonic mean = $\dfrac{4}{\frac{1}{4}+\frac{1}{5}+\frac{1}{7}+\frac{1}{8}} = 5.5721.$

69. E

Action: Anjali can hire 8, 9, 10 or 11 MBAs

Event: Number of jobs awarded

An incomplete job results in a loss of Rs.10,000

Conditional Profit Table

Action \ Event	24	27	30	33
8	2,40,000	2,10,000	1,80,000	1,50,000
9	1,80,000	2,70,000	2,40,000	2,10,000
10	1,20,000	2,10,000	3,00,000	2,70,000
11	60,000	1,50,000	2,40,000	3,30,000
Probability	0.3	0.2	0.4	0.1

b. Expected profit from hiring

i. 8 MBAs

2,40,000 x 0.3 + 2,10,000 x 0.2 + 1,80,000 x 0.4 + 1,50,000 x 0.1 = 2,01,000

ii. 9 MBAs

1,80,000 x 0.3 + 2,70,000 x 0.2 + 2,40,000 x 0.4 + 2,10,000 x 0.1 = 2,25,000

iii. 10 MBAs

1,20,000 x 0.3 + 2,10,000 x 0.2 + 3,00,000 x 0.4 + 2,70,000 x 0.1 = 2,25,000

iv. 11 MBAs

60,000 x 0.3 + 1,50,000 x 0.2 + 2,40,000 x 0.4 + 3,30,000 x 0.1 = 1,77,000

Maximum profit is attained by hiring 9 or 10 MBAs.

70. A

Mean of the sampling distribution of means = μ = 200 ml.

Standard deviation of the sampling distribution of means $= \frac{\sigma}{\sqrt{n}} = \frac{15}{\sqrt{36}} = \frac{15}{6} = 2.5\,\text{ml}$

We have to find $P(\overline{X} > 204)$

$= \frac{\overline{X} - \mu}{\sigma_{\overline{X}}} = \frac{204 - 200}{2.5} = \frac{4}{2.5} = 1.6$

$P(\overline{X} > 204) = P(Z > 1.6) = 0.5 - 0.4452 = 0.0548.$

71 B The LPP formulation can be rewritten as follows: ≤

Maximize : 25X + 35Y

Subject to : $X + 2Y \leq 100$

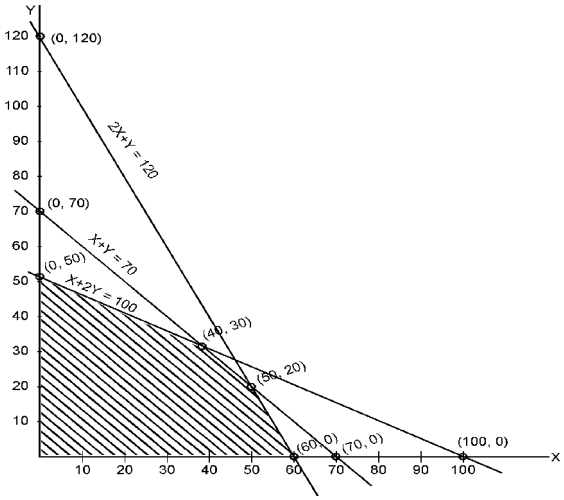
$X + Y \leq 70$

$2X + Y \leq 120$

$X \geq 0$

$Y \geq 0.$

Considering above inequalities as equations and plotting them as straight lines on the graph we get feasible region.



From the graph we can see that the feasible region is bounded by the points

(0,0), (0,50), (40,30), (50,20) and (60,0)

Point	Z = 25X + 35Y
X = 0, Y = 0	Z = 0
X = 0, Y = 50	Z = (25 × 0) + (35 × 50) = 1750
X = 40, Y = 30	Z = (25 × 40) + (35 × 30) = 2050
X = 50, Y = 20	Z = (25 × 50) + (35 × 20) = 1950
X = 60, Y = 0	Z = (25 × 60) + (35 × 0) = 1500

The maximum value of the objective function is 2050 at the point (X = 40, Y = 30).

Hence, the optimal solution to the LPP is (X = 40, Y = 30).

72 B The applicable distribution is F distribution ≤

No. of degrees of freedom for the numerator of the F statistic

= No. of samples – 1

= 4 – 1 = 3

No. of degrees of freedom for the denominator of the F statistic

= Total sample size – No. of samples

= 19 – 4 = 15

From F table, $F_{3,15}(\alpha = 0.05) = 3.29.$

73. A

For a paired sample {X,Y}

$$\text{Cov}_{XY} = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{n-1}$$

Here n=5, $\sum X = 25$, $\sum Y = 61$

$$\bar{X} = 5,\ \bar{Y} = 12.2 \text{ and } \sum(X-\bar{X})(Y-\bar{Y}) = -11$$

$$\therefore \text{Cov}_{XY} = \frac{-11}{5-1} = \frac{-11}{4} = -2.75$$

74. E

$n = 5,\ p = \frac{2}{3},\ q = \frac{1}{3}$

Profit for each ice-cream is 2 Rs.

Loss for each ice-cream is 1 Rs.

X: number of ice-creams sold.

Y: Profit for selling X number of ice-creams.

Let us suppose 3 ice-creams are sold on one day (X = 3). So that 2 ice-creams are unsold on that day.

Then Y= $3\times 2 - 2\times 1 = 4$

X:	0	1	2	3	4	5
Y:	−5	−2	1	4	7	10
P(X):	$\frac{1}{3^5}$	$\frac{10}{3^5}$	$\frac{40}{3^5}$	$\frac{80}{3^5}$	$\frac{80}{3^5}$	$\frac{32}{3^5}$

Expected profit is $E(Y) = (-5)\frac{1}{3^5} + (-2)\frac{10}{3^5} + (1)\frac{40}{3^5} + (4)\frac{80}{3^5} + (7)\frac{80}{3^5} + (10)\frac{32}{3^5}$

$$= \frac{1}{3^5}[-5 - 20 + 40 + 320 + 560 + 320]$$

$$= \frac{1215}{243} = \text{Rs.}5.$$

75. D

The computers the speed of CPU is about 10 Million Instructions Per Second (MIPS) is called main frame computers.

76. E

The following all are High-level Languages.

I. FORTRAN.
II. PASCAL.
III. COBOL.

Hence option (e) is correct.

77. B

Internet is a global network of computers linked by exclusive and regular phone lines, microwave and satellite signals.

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