

Question Paper

Quantitative Methods – I (131): January 2007

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

1. According to the inverse property of addition

[< Answer >](#)

- I. For every element a , there exists another element $-a$ such that the multiplication of the both gives us zero.
 - II. For every element a , there exists another element $-a$ such that the addition of the both gives us zero.
 - III. For every element a , there exists another element $1/a$ such that the addition of the both gives us zero.
 - IV. On a number line, an element and its additive inverse lie at equi-distant from the origin.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Both (II) and (III) above
 - (d) Both (II) and (IV) above
 - (e) Both (III) and (IV) above.

(1 mark)

2. The factors of $x^3 + 6x^2 + 11x + 6$ are

[< Answer >](#)

- (a) $(x+1)$, $(x-1)$ and $(x-2)$
- (b) $(x+1)$, $(x-1)$ and $(x+2)$
- (c) $(x+1)$, $(x-2)$ and $(x+3)$
- (d) $(x+1)$, $(x-2)$ and $(x-3)$
- (e) $(x+1)$, $(x+2)$ and $(x+3)$.

(2 marks)

3. The roots of the equation $49x^2 + 28x + 4 = 0$ are

[< Answer >](#)

- (a) $\frac{-2}{7}, \frac{2}{7}$
- (b) $\frac{-2}{7}, \frac{-2}{7}$
- (c) $\frac{3}{11}, \frac{1}{5}$
- (d) $\frac{1}{9}, \frac{5}{6}$
- (e) $\frac{7}{2}, \frac{1}{3}$.

(1 mark)

4. The ratio between the sum of n terms of two Arithmetic Progressions is $(5n + 7) : (8n + 13)$. Find the ratio [< Answer >](#) between their fifteenth terms.

- (a) 236 : 217
- (b) 217 : 125
- (c) 138 : 227
- (d) 127 : 116
- (e) 152 : 245.

(2 marks)

5. $\frac{1}{2}x + \frac{1}{3}y - \frac{1}{3}z = -1$

$$\frac{1}{2}y + \frac{1}{3}x - \frac{1}{6}z = 4$$

$$\frac{1}{6}x - \frac{5}{6}y + \frac{1}{2}z = 3$$

The value of x in the above simultaneous equations would be

- (a) 3
- (b) 6
- (c) 9
- (d) 12
- (e) 24.

(1 mark)

6. If ${}^{28}C_{2r} : {}^{24}C_{2r-4} = 225 : 11$, then the value of r is [< Answer >](#)

- (a) 4
- (b) 5
- (c) 6
- (d) 7
- (e) 8.

(2 marks)

7. $\log_n \left(1 - \frac{1}{5}\right) + \log_n \left(1 - \frac{1}{6}\right) + \log_n \left(1 - \frac{1}{7}\right) + \dots + \log_n \left(1 - \frac{1}{n}\right) =$ [< Answer >](#)

- (a) 1
- (b) -1
- (c) $2\log_n 2 - 1$
- (d) $2\log_n 2 + 1$
- (e) $\log_n 2$.

(2 marks)

[< Answer >](#)

8. If $\frac{\log x}{(y-z)} = \frac{\log y}{(z-x)} = \frac{\log z}{(x-y)}$, then the value of $x^x \cdot y^y \cdot z^z$ is equal to

(a) 0
(b) 1
(c) x
(d) y
(e) z.

(2 marks)

[< Answer >](#)

9. If ${}^{4n}P_3 = 28 \times {}^{2n}P_2$, then the value of n is equal to

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

(1 mark)

10. The sum of three numbers in an A.P. is 15. If 1, 4 and 19 are added to them respectively, then they are in G.P. [< Answer >](#)
The possible highest number of the three is

(a) 13
(b) 19
(c) 21
(d) 23
(e) 26.

(3 marks)

[< Answer >](#)

11. The equation of line through $(-4, 6)$ with slope 5 is

(a) $x = 26 - 5y$
(b) $x = 26 + 5y$
(c) $y = 26 - 5x$
(d) $y = 26 + 5x$
(e) $x = -4 + 5y$.

(1 mark)

[< Answer >](#)

12. If $f(x, y, z) = x^2(y-z) + y^2(z-x) + z^2(x-y)$ then $\frac{\partial f}{\partial x} + \frac{\partial f}{\partial y} + \frac{\partial f}{\partial z} =$

(a) 0
(b) 1
(c) $f(x, y, z)$
(d) $2f(x, y, z)$
(e) $3f(x, y, z)$.

(1 mark)

[< Answer >](#)

13. If $y = x + e^x$ then $\frac{d^2x}{dy^2} =$

(a) $\frac{-e^x}{(1+e^x)^2}$

(b) $\frac{e^x}{(1+e^x)^2}$

(c) $\frac{e^x}{(1+e^x)^3}$

(d) $\frac{-e^x}{(1+e^x)^3}$

(e) $\frac{e^x}{(1+e^x)}$

(2 marks)

[< Answer >](#)

14. If $y = \left[x + \sqrt{x^2 + 4} \right]^m$ then $\frac{dy}{dx} =$

(a) $\frac{m}{\sqrt{x^2 + 4}}$

(b) $\frac{my}{\sqrt{x^2 + 4}}$

(c) $\frac{mx}{\sqrt{x^2 + 4}}$

(d) $\frac{my^2}{(x^2 + 4)^{3/2}}$

(e) $\frac{mxy}{\sqrt{x^2 + 4}}$

(2 marks)

[< Answer >](#)

15. If $f(x) = 5^x$, then the value of $\frac{f(x+1)}{f(x-1)}$ is

- (a) 10
- (b) 20
- (c) 25
- (d) 30
- (e) 35.

(2 marks)

[< Answer >](#)

16. The value of $\lim_{x \rightarrow -2} \frac{x^3 - 5x + 3}{x^2 + 1}$ is

- (a) 0
- (b) 1
- (c) -1
- (d) 1/2
- (e) 1/3.

(1 mark)

17. If the initial cost of a machine is Rs.15,000 and it loses 10% of its value each year, the value of the machine after 10 years would be (approximately) [< Answer >](#)

- (a) Rs.5,230
- (b) Rs.5,811
- (c) Rs.1,500
- (d) Rs.2,530
- (e) Rs.3,520.

(1 mark)

18. Which of the following is **true**? [< Answer >](#)

- (a) In a logarithmic function the logarithmic operation is applied on the dependent variable
- (b) In a logarithmic function the base of the logarithm is always 10
- (c) In a logarithmic function the independent variable cannot be negative
- (d) In a logarithmic function the base of the logarithm can be any real number
- (e) In a logarithmic function the independent variable can be zero.

(1 mark)

19. For a given rate of interest and principle the amount payable at maturity under compound interest is a function of [< Answer >](#)

- (a) The principle only
- (b) The rate of interest only
- (c) The number of years only
- (d) Both principle and rate of interest
- (e) Both principle and number of years.

(1 mark)

20. For any real number, the interval $(-\infty, a)$ represents the [< Answer >](#)

- (a) Set of all real numbers greater than **a**
- (b) Set of all real numbers greater than or equal to **a**
- (c) Set of all negative numbers less than **a**
- (d) Set of all negative numbers greater than **a**
- (e) Set of all real numbers less than **a**.

(1 mark)

21. A firm has the following revenue function for its product:

[< Answer >](#)

$$R = 8Q$$

Where, R = Revenue earned in a day

Q = Number of units of the product produced and sold in a day

The total cost of producing and selling the product on any day is given by the following function:

$$C = 1,26,000 + 60 \left(\frac{Q}{900} \right)^2$$

Where, C = The total cost of producing and selling the product in a day

Q = Number of units of the product produced and sold in a day

What is the number of units of the product that must be produced and sold by the firm in a day in order to maximize its daily profit?

- (a) 6,750 units
- (b) 12,500 units
- (c) 40,000 units
- (d) 54,000 units
- (e) 1,26,000 units.

(3 marks)

22. Which of the following is/are the basic requirement(s) of Linear Programming Problem technique?

[< Answer >](#)

- I. Decision variables and their relationship.
- II. Well-defined objective function.
- III. Presence of constraints or restrictions.
- IV. Alternative courses of action.
- V. Non-negative restriction.

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

(1 mark)

23. A company manufactures two products (A and B) and the profit per unit sold is Rs.300 and Rs.500 respectively.

[< Answer >](#)

Each product has to be assembled on a particular machine, each unit of product A takes 12 minutes of assembly time and each unit of product B takes 25 minutes of assembly time. The company estimates that the machine used for assembly has an effective working week of only 30 hours (due to maintenance/breakdown). Technological constraints mean that for every five units of product A produced at least two units of product B must be produced. The company wants to maximize the profit per week. In the framework of linear programming problem, which of the following would be a **true** representative of the objective function? [Assume the production of A is x units and that of B is y units]

- (a) $5x + 3y$
- (b) $12x + 25y$
- (c) $3x + 5y$
- (d) $12x + 30y$
- (e) $30x + 25y$.

(1 mark)

24. In the graphical method of solving linear programming problems if there is a unique optimal solution, then the [< Answer >](#)
optimal solution

- (a) Is always found at the center of the feasible region
- (b) Is always at the origin
- (c) Lies outside the feasible region
- (d) Is located at one of the corner points of the feasible region
- (e) Always lies on one of the two axes.

(1 mark)

25. Which of the following is **true** with regard to the simplex method of solving a linear programming problem [< Answer >](#)
(LPP) on profit maximization?

- (a) At the optimal solution the slack variables are always equal to zero
- (b) The constraints which contain ' $\leq$ ' are converted into equations by adding slack variables
- (c) There can be only one feasible solution to a LPP
- (d) The slack variables make positive contributions to profit
- (e) The slack variables can only assume the values 0 or 1.

(1 mark)

26. Which of the following conditions indicates the existence of multiple optimal solutions when a linear [< Answer >](#)
programming problem is solved by the graphical method?

- (a) One of the constraints is parallel to the horizontal axis
- (b) The objective function is parallel to the vertical axis
- (c) The objective function is parallel to one of the edges of the feasible region which is in the direction of optimal movement of the objective function
- (d) All the decision variables assume negative values
- (e) One of the decision variables assumes negative values.

(1 mark)

27. While plotting constraints on a graph paper, terminal points on both the axes are connected by a straight line [< Answer >](#)
because

- I. The constraints are linear equations or inequalities.
- II. The resources are limited in supply.
- III. The objective function is a linear function.

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

(1 mark)

28. Which of the following is **true** with regard to the simplex method of solving a linear programming problem on [< Answer >](#)
profit maximization?

- (a) It cannot be used when there are two decision variables
- (b) The values of the decision variables indicate whether the solution is optimal
- (c) The values of the slack variables indicate whether the solution is optimal
- (d) The occurrence of a negative value in the $(Z_j - C_j)$ row indicates that the profit can be improved further
- (e) The values in the $(Z_j - C_j)$ row indicate the variable to leave solution.

(1 mark)

29. Which of the following statements is/are **true** with respect to duality?

[< Answer >](#)

- I. The dual of the dual LP is again the primal problem.
 - II. If either the primal or the dual problem has an unbounded objective function value, the other problem has no feasible solution.
 - III. If either the primal or dual problem has a finite optimal solution, the other one also possesses the same and the optimal value of the objective function of the two problems are equal.
- (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)

30. Consider the following linear programming problem:

[< Answer >](#)

$$\text{Maximize } Z = 6x_1 + 3x_2$$

subject to the constraints

$$2x_1 + 3x_2 \leq 16$$

$$x_1 + x_2 \geq 12$$

$$x_1, x_2 \geq 0.$$

The feasible solution to the above linear programming problem is

- (a) (8, 0)
- (b) (6, 6)
- (c) (9, 3)
- (d) (10, 2)
- (e) It has no feasible solution.

(2 marks)

31. Consider the following linear programming problem:

[< Answer >](#)

$$\text{Maximize } Z = 3x_1 + 5x_2 + 4x_3$$

subject to the constraints

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

$$x_1, x_2, x_3 \geq 0.$$

Which of the following is **true** from the starting simplex table of above linear programming problem?

- (a) The incoming vector is x_1 and the outgoing vector is s_1
- (b) The incoming vector is x_2 and the outgoing vector is s_2
- (c) The incoming vector is x_3 and the outgoing vector is s_3
- (d) The incoming vector is x_2 and the outgoing vector is s_1
- (e) The incoming vector is x_3 and the outgoing vector is s_2 .

(2 marks)

32. Maximize $Z = 3x_1 + 2x_2 + 5x_3$

[< Answer >](#)

subject to the constraints

$$x_1 + 2x_2 + x_3 \leq 430$$

$$3x_1 + 2x_3 \leq 460$$

$$x_1 + 4x_2 \leq 420$$

$$x_1, x_2, x_3 \geq 0.$$

The value of Max.Z in the second simplex table of above linear programming problem is

- (a) 0
- (b) 230
- (c) 420
- (d) 1150
- (e) 1350.

(3 marks)

33. The dual of the following linear programming problem is

$$\text{Maximize } Z = 4x_1 + 2x_2$$

subject to the constraints

$$-x_1 - x_2 \leq -3$$

$$-x_1 + x_2 \leq -2$$

$$x_1, x_2 \geq 0.$$

(a) Maximize $Z = -3y_1 - 2y_2$

subject to the constraints

$$-y_1 - y_2 \geq 4$$

$$-y_1 + y_2 \leq 2$$

$$y_1, y_2 \leq 0.$$

(b) Maximize $Z = -3y_1 - 2y_2$

subject to the constraints

$$-y_1 - y_2 \leq 4$$

$$-y_1 + y_2 \leq 2$$

$$y_1, y_2 \leq 0.$$

(c) Minimize $Z = -3y_1 - 2y_2$

subject to the constraints

$$-y_1 + y_2 \geq 4$$

$$-y_1 - y_2 \geq 2$$

$$y_1, y_2 \geq 0.$$

(d) Minimize $Z = -3y_1 - 2y_2$

subject to the constraints

$$-y_1 - y_2 \geq 4$$

$$-y_1 + y_2 \geq 2$$

$$y_1, y_2 \geq 0.$$

(e) Minimize $Z = -3y_1 - 2y_2$

subject to the constraints

$$-y_1 - y_2 \leq 4$$

$$-y_1 + y_2 \geq 2$$

$$y_1, y_2 \leq 0.$$

(2 marks)

34. In real life, if there are no constraints, the profit in a linear programming problem can be

[< Answer >](#)

- (a) Maximized
- (b) Minimized
- (c) Infinitely increased
- (d) Indeterminate
- (e) Zero.

(1 mark)

35. Which of the following statements is/are **true**?

[< Answer >](#)

- I. Every primal has one and only one dual.
- II. The solution of dual provides all the essential information about the solution of the primal problem.
- III. It is always easier to solve the dual rather than a primal.

- (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)

36. The variance of a set of data is 16 and the arithmetic mean is 8. What is the coefficient of variation?

[< Answer >](#)

- (a) 10%
- (b) 20%
- (c) 30%
- (d) 40%
- (e) 50%.

(1 mark)

37. The geometric mean of 8 observations on a certain variable was calculated as 14.8. It was later discovered that one of the observations was wrongly recorded as 8.9 that was actually 9.8. What is the correct geometric mean?

[< Answer >](#)

- (a) 12.86
- (b) 13.47
- (c) 14.98
- (d) 15.40
- (e) 16.81.

(1 mark)

38. If the average deviation from the arithmetic mean is used as a measure of dispersion then, it will always indicate that the dispersion of the data set is

[< Answer >](#)

- (a) A positive value
- (b) A negative value
- (c) Either a positive or a negative value
- (d) Equal to zero
- (e) A multiple of the arithmetic mean.

(1 mark)

39. Quartiles and Percentiles are more appropriately measures of:

[< Answer >](#)

- (a) Central tendency
- (b) Variation
- (c) Position
- (d) Frequency
- (e) Ranges.

(1 mark)

40. If every item in a data set is decreased by the same quantity then the standard deviation of the resulting data set

[< Answer >](#)

- (a) Remains the same
- (b) Increases by the same quantity by which every data item is increased
- (c) Decreases by the same quantity by which every data item is increased
- (d) Increases by the square root of the same quantity by which every data item is increased
- (e) Decreases by the square root of the same quantity by which every data item is increased.

(1 mark)

41. It is required to compute the dispersion of a population. The observations from the population were grouped into class intervals and, the deviations of the class mid points from an assumed mean were computed. The following details are available:

[< Answer >](#)

Deviation of class mid point from assumed mean	Number of observations
-30	6
-20	18
-10	16
0	32
10	18
20	10
Total number of observations	100

The width of the class interval is 10. What is the variance of the population?

- (a) 174.75
- (b) 189.76
- (c) 191.00
- (d) 195.23
- (e) 198.21.

(2 marks)

42. In a group of 30 girls, the median score in quantitative methods is 80 while for a group of 20 boys, the same is 70. Which of the following related to the median score M_e for combined group of 50 candidates is **correct**?

[< Answer >](#)

- (a) $M_e = 75$
- (b) $M_e = 76$
- (c) $M_e = 150$
- (d) $M_e = 78$
- (e) As the 50 scores are not given, nothing can be concluded.

(1 mark)

43. Which of the following indicates that the distribution of data is skewed to the right?

[< Answer >](#)

- (a) Arithmetic Mean $>$ Median $>$ Mode
- (b) Median = Mode = Arithmetic Mean
- (c) Median = 0
- (d) Arithmetic Mean = 0
- (e) Standard Deviation = 0.

(1 mark)

44. When extreme values are present in a set of data, which of the following descriptive summary measures are most appropriate?

[< Answer >](#)

- (a) Coefficient of Variation and Range
- (b) Mean and Standard deviation
- (c) Median and Interquartile range
- (d) Mode and Variance
- (e) Mean and Mode.

(1 mark)

45. A unimodal distribution has

[< Answer >](#)

- (a) Four modes
- (b) Three modes
- (c) Two modes
- (d) One mode
- (e) More than four modes.

(1 mark)

46. The larger the spread of scores around the mean

[< Answer >](#)

- (a) The smaller the interquartile range
- (b) The smaller the standard deviation
- (c) The smaller the coefficient of variation
- (d) The larger the standard deviation
- (e) The smaller the variance.

(1 mark)

47. Consider the following distribution:

[< Answer >](#)

X:	-4	-3	-2	-1	0	1	2	3	4
f:	2	4	5	7	10	7	5	4	2

Which of the following statement(s) is/are the property(ies) of the above distribution?

- I. The mean of the distribution is zero.
- II. The distribution is symmetric.
- III. The distribution is unimodal.
- IV. The median of the distribution is zero.

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

(1 mark)

48. Which of the following is **not** a measure of central tendency?

[< Answer >](#)

- (a) Arithmetic mean
- (b) Harmonic mean
- (c) Median
- (d) Mode
- (e) Range.

(1 mark)

49. The following data relate to the sales of 100 companies:

[< Answer >](#)

Sales(Rs. Lakhs)	Below 50	50-52	52-54	54-56	56-58	58-60	60-62
No. of Companies	12	18	25	30	10	3	2

The value of the modal sales is

- (a) Rs.34.5 lakhs
- (b) Rs.44.6 lakhs
- (c) Rs.54.4 lakhs
- (d) Rs.66.6 lakhs
- (e) Rs.68.9 lakhs.

(1 mark)

50. The following distribution gives the pattern of overtime work per week done by 100 employees of a company.

[< Answer >](#)

Overtime (hrs.)	10-15	15-20	20-25	25-30	30-35	35-40
frequency	10	22	34	19	9	6

The first quartile from the above distribution is

- (a) 16.3
- (b) 18.4
- (c) 22.7
- (d) 26.0
- (e) 28.1.

(1 mark)

51. The frequency distribution of 220 workers of a xyz factory according to their average weekly income is given below. The coefficient of determination of the following frequency distribution is

[< Answer >](#)

Below 300	300 – 350	350 – 400	400 – 450	450 – 500	500 – 550	550 and above
10	18	45	65	58	15	9

- (a) 0.109
- (b) 0.091
- (c) 0.250
- (d) 0.282
- (e) 0.312.

(3 marks)

52. In a simultaneous throw of a pair of dice, what is the probability of getting a total more than 7?

[< Answer >](#)

- (a) $3/16$
- (b) $5/12$
- (c) $7/8$
- (d) $4/7$
- (e) $1/12$.

(1 mark)

53. If $P(A/B) = 0.62$, $P(B/A) = 0.7$ and $P(A) = 0.5$, then the value of $P(\bar{A}/\bar{B})$ is equal to

[< Answer >](#)

- (a) 0.79
- (b) 0.66
- (c) 0.53
- (d) 0.46
- (e) 0.35.

(3 marks)

54. The probability of solving a problem by three students X, Y and Z are $\frac{1}{4}$, $\frac{3}{7}$ and $\frac{2}{9}$ respectively. If all of them try independently then the probability that the problem could not be solved is

[< Answer >](#)

- (a) $1/3$
- (b) $1/4$
- (c) $1/5$
- (d) $2/5$
- (e) $3/7$.

(2 marks)

55. If A is an event, the conditional probability of A given A is equal to

[< Answer >](#)

- (a) 0
- (b) 0.4
- (c) 0.5
- (d) 0.8
- (e) 1.

(1 mark)

56. A bag contains 6 red marbles and 10 green marbles. From the bag, 2 marbles are drawn without replacement. The probability of drawing 1 red and then 1 green marble would be

[< Answer >](#)

- (a) $1/2$
- (b) $1/3$
- (c) $2/3$
- (d) $1/4$
- (e) $3/4$.

(1 mark)

57. Because a new medical procedure has been shown to be effective in early detection of an illness, a medical screening of the population is proposed. The probability that the test correctly identifies someone with the illness as positive is 0.99, and the probability that the test correctly identifies some one without the illness as negative is 0.95. The incidence of illness in the general population is 0.0001. You take the test, and the result is positive. What is the probability that you have the illness? (Round off your answer upto the third decimal) [< Answer >](#)

- (a) 0.002
- (b) 0.005
- (c) 0.995
- (d) 0.998
- (e) 0.949.

(3 marks)

58. Two dice are thrown together. What is the probability that the sum of the numbers on the two faces is divisible by 4 or 6? [< Answer >](#)

- (a) $1/2$
- (b) $1/3$
- (c) $5/12$
- (d) $7/15$
- (e) $7/18$.

(1 mark)

59. **A** and **B** are mutually exclusive and collectively exhaustive events. Both **A** and **B** are dependent on event **C**. [< Answer >](#)

$P(\mathbf{A} \text{ and } \mathbf{C}) = 0.48$, $P(\mathbf{B} \text{ and } \mathbf{C}) = 0.32$.

What is the probability of event **B** happening if event **C** happens?

- (a) 0.32
- (b) 0.40
- (c) 0.48
- (d) 0.60
- (e) 0.80.

(1 mark)

60. In which of the following cases the outcomes favorable for an event and the total number of outcomes must be known without performing the experiment? [< Answer >](#)

- (a) Marginal probabilities
- (b) Classical probabilities
- (c) Conditional probabilities
- (d) Posterior probabilities
- (e) Apriori probabilities.

(1 mark)

61. Which of the following is most appropriate if certain events are mutually exclusive and collectively exhaustive? [< Answer >](#)

- (a) The sum of the probabilities of the events will be less than 1
- (b) The sum of the probability of the events will be more than 1
- (c) The sum of the probabilities of the events will be equal to 1
- (d) Some of the events will definitely have zero probability
- (e) Each of the events has a zero probability.

(1 mark)

62. If A and B are any two events, the probability that exactly one of them occurs is given by

[< Answer >](#)

- (a) $P(A) + P(B) - 2P(AB)$
- (b) $P(A) + P(B) - P(AB)$
- (c) $P(\bar{A}) + P(\bar{B}) - 2P(\bar{A}\bar{B})$
- (d) $P(\bar{A}) + P(\bar{B}) - P(\bar{A}\bar{B})$
- (e) $P(\bar{A}B) + P(A\bar{B})$

(1 mark)

63. Three mangoes and five apples are placed in a box. If two fruits are chosen at random, the probability that one is a mango and the other is an apple is

[< Answer >](#)

- (a) $3/8$
- (b) $2/7$
- (c) $12/19$
- (d) $17/28$
- (e) $15/28$

(1 mark)

64. The three events A, B and C are mutually exclusive and exhaustive; if $P(B) = \frac{2}{5}P(A)$ and $P(C) = \frac{1}{2}P(B)$, then find $P(C)$.

[< Answer >](#)

- (a) $1/2$
- (b) $2/5$
- (c) $1/5$
- (d) $1/8$
- (e) $5/8$

(1 mark)

65. A study of an insurance company shows that the probability of an employee being absent on any given day is 0.2. Given that an employee is absent, the probability of that employee being absent a second day in succession is 0.5. Events A and B are dependent events because B cannot occur unless event A has occurred. The probability of an employee being absent on two successive days is

[< Answer >](#)

- (a) 0.01
- (b) 0.10
- (c) 0.15
- (d) 0.25
- (e) 0.35

(1 mark)

66. If A, B and C are three mutually exclusive events then the probability of their union is equal to

[< Answer >](#)

- (a) $P(A)P(B)P(C)$
- (b) $P(A)P(B|C)$
- (c) $P(A) + P(B) + P(C)$
- (d) $P(A) - P(B) - P(C)$
- (e) $P(A)P(B) + P(B)P(C) + P(C)P(A)$

(1 mark)

67. If an event B has occurred and it is known that $P(B) = 1$, the conditional probability $P(A/B)$ is equal to [< Answer >](#)

- (a) 0
- (b) 1
- (c) $P(A)$
- (d) $P(B)$
- (e) $P(A + B)$.

(1 mark)

68. To determine the appropriate width of each class interval in a grouped frequency distribution, we [< Answer >](#)

- (a) Take the square of the number of observations
- (b) Divide the number of desired class intervals by the range of the data
- (c) Take the square root of the number of observations
- (d) Divide the range of the data by the number of desired class intervals
- (e) Divide the range of data by 2.

(1 mark)

69. Which of the following measures can be determined graphically? [< Answer >](#)

- (a) Arithmetic mean
- (b) Geometric mean
- (c) Harmonic mean
- (d) Median
- (e) Standard deviation.

(1 mark)

70. The sum of all relative frequencies for any data set is equal to? [< Answer >](#)

- (a) -1 to +1
- (b) -1 to 0
- (c) 0 to 1
- (d) 1
- (e) -1.

(1 mark)

71. Which of the following is a geographical classification: [< Answer >](#)

- (a) Classification according to place, area and region
- (b) Classification according to lapse of time
- (c) Classification according to attributes of the subjects or items
- (d) Classification according to magnitude of numerical values
- (e) Classification according to attributes of subjects or items and magnitude of numerical values.

(1 mark)

72. The process of estimating values on graph line between known data points is called [< Answer >](#)

- (a) Interpolation
- (b) Extrapolation
- (c) Linear programming
- (d) Goal programming
- (e) Time series.

(1 mark)

73. Estimation in interpolation is:

[< Answer >](#)

- (a) More accurate than extrapolation
- (b) Less accurate than extrapolation
- (c) As accurate as extrapolation
- (d) It may be more or less accurate than extrapolation
- (e) Estimation is not possible in interpolation.

(1 mark)

74. The sales of the company during the year 2004 was Rs.30 lakhs and during the year 2006 was Rs.46 lakhs. The sales of the company during the year 2005 were not known. What is the estimated value of sales for the year 2005, using the interpolation method?

[< Answer >](#)

- (a) Rs.32 lakhs
- (b) Rs.35 lakhs
- (c) Rs.38 lakhs
- (d) Rs.40 lakhs
- (e) Rs.44 lakhs.

(1 mark)

75. A frequency distribution of weekly wages of 500 workers is given below:

[< Answer >](#)

Wages (Rs)	100-149	150-199	200-249	250-299	300-349	350-399
No. of workers:	21	80	175	158	55	11

Two workers are selected at random. Find the probability that the wages of both the workers are equal to or greater than Rs. 300.

- (a) $101/2,495$
- (b) $50/101$
- (c) $101/250$
- (d) $429/24,950$
- (e) $250/499$.

(1 mark)

Suggested Answers

Quantitative Methods – I (131): January 2007

1. Answer : (d)

[< TOP >](#)

Reason : According to the inverse property of addition, for every element a , there exists another element $-a$ such that the addition of the both gives us zero. The element $-a$ is referred to as the additive inverse of the element of the a . On a number line, an element and its additive inverse lie at equidistance from the origin.

Therefore (d) is the correct answer.

2. Answer : (e)

[< TOP >](#)

Reason : $f(x) = x^3 + 6x^2 + 11x + 6$

Putting $x = 1$, we get $f(1) = 1^3 + 6(1)^2 + 11(1) + 6 = 24$

$\therefore (x - 1)$ is not a factor of $x^3 + 6x^2 + 11x + 6$.

Putting $x = -1$, we get $f(-1) = (-1)^3 + 6(-1)^2 + 11(-1) + 6 = 0$

$\therefore (x + 1)$ is a factor of $x^3 + 6x^2 + 11x + 6$.

Dividing $x^3 + 6x^2 + 11x + 6$ by $x + 1$ we get

$x + 1 \mid x^3 + 6x^2 + 11x + 6 \quad (x^2 + 5x + 6)$

$$\begin{array}{r}
 \begin{array}{r} x^3 + x^2 \\ (-) \quad (-) \end{array} \\
 \hline
 5x^2 + 11x \\
 \begin{array}{r} 5x^2 + 5x \\ (-) \quad (-) \end{array} \\
 \hline
 6x + 6 \\
 \begin{array}{r} 6x + 6 \\ (-) \quad (-) \end{array} \\
 \hline
 0
 \end{array}$$

$$f(x) = (x + 1)(x^2 + 5x + 6)$$

$$= (x + 1)(x + 2)(x + 3)$$

Therefore (e) is the correct answer.

3. Answer : (b)

[< TOP >](#)

Reason : $49x^2 + 28x + 4 = 0$

In the above quadratic equation $a = 49$, $b = 28$ and $c = 4$. we now substitute these values in the formula

$$\begin{aligned}
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
 x &= \frac{-28 \pm \sqrt{28^2 - 4(49)(4)}}{2(49)} \\
 x &= \frac{-28 \pm 0}{98} = \frac{-2}{7}, \frac{-2}{7}
 \end{aligned}$$

Therefore (b) is the correct answer.

4. Answer : (e)

[< TOP >](#)

Reason : Given that $\frac{S_m}{S_n} = \frac{(n/2)[2a + (n-1)d]}{(n/2)[2a' + (n-1)d']} = \frac{5n+7}{8n+13}$

$$\text{Or, } \frac{a + [(n-1)/2]d}{a' + [(n-1)/2]d'} = \frac{5n+7}{8n+13} \dots\dots\dots(i)$$

$$\text{We have to find } \frac{T_{15}}{T'_{15}} = \frac{a + 14d}{a' + 14d'}$$

Choosing $(n-1)/2 = 14$ or $n = 29$ in relation (i), we get

$$\frac{T_{15}}{T'_{15}} = \frac{a + 14d}{a' + 14d'} = \frac{5(29) + 7}{8(29) + 13} = \frac{152}{245} .$$

5. Answer : (b)

[< TOP >](#)

Reason :

$$\frac{1}{2}x + \frac{1}{3}y - \frac{1}{3}z = -1 \dots\dots\dots(i)$$

$$\frac{1}{3}x + \frac{1}{2}y - \frac{1}{6}z = 4 \dots\dots\dots(ii)$$

$$\frac{1}{6}x - \frac{5}{6}y + \frac{1}{2}z = 3 \dots\dots\dots(iii)$$

By doing (i) + (ii) + (iii) we get

$$\left(\frac{1}{2} + \frac{1}{3} + \frac{1}{6} \right) x = (-1 + 4 + 3)$$

$$\text{Or, } x = 6$$

6. Answer : (d)

[< TOP >](#)

Reason :

$${}^{28}C_{2r} : {}^{24}C_{2r-4} = 225 : 11$$

$$\text{Or, } \frac{{}^{28}C_{2r}}{{}^{24}C_{2r-4}} = \frac{225}{11}$$

$$\text{Or, } 11 \times \frac{28!}{2r!(28-2r)!} = 225 \times \frac{24!}{(2r-4)!(28-2r)!}$$

$$\text{Or, } \frac{11 \times 25 \times 26 \times 27 \times 28}{225} = (2r-3)(2r-2)(2r-1)2r$$

$$\text{Or, } (2r-3)(2r-2)(2r-1)2r = \frac{11 \times 25 \times 26 \times 27 \times 28}{225} = \frac{11 \times 26 \times 27 \times 28}{9}$$

$$= 11 \times 26 \times 3 \times 28 = 11 \times 12 \times 13 \times 14$$

$$= 14(14-1)(14-2)(14-3)$$

$$\text{So, } 2r = 14$$

$$\text{Or, } r = 7$$

7. Answer : (d)

[< TOP >](#)

Reason : The given expression can be rewritten as,

$$\log_n \frac{4}{5} + \log_n \frac{5}{6} + \log_n \frac{6}{7} + \dots + \log_n \frac{n-1}{n}$$

$$= \log_n \left(\frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} \times \dots \times \frac{n-1}{n} \right)$$

$$= \log_n \left(\frac{4}{n} \right) = \log_n 4 - \log_n n^{-1}$$

$$= \log_n 2^2 - (-1)$$

$$= 2 \log_n 2 + 1$$

8. Answer : (b)

[< TOP >](#)

Reason :

$$\text{Let } \frac{\log x}{(y-z)} = \frac{\log y}{(z-x)} = \frac{\log z}{(x-y)} = k$$

$$\therefore \log x = k(y-z); \log y = k(z-x); \log z = k(x-y)$$

$$\therefore \log x^x y^y z^z = x \log x + y \log y + z \log z = xk(y-z) + yk(z-x) + zk(x-y) = 0$$

$$\text{So, } x^x y^y z^z = 1$$

9. Answer : (b)

[< TOP >](#)

Reason : Given that ${}^{4n}P_3 = 28 \cdot {}^{2n}P_2$

$$\text{or, } \frac{(4n)!}{(4n-3)!} = \frac{28 \cdot (2n)!}{(2n-2)!}$$

$$\text{or, } (4n)(4n-1)(4n-2) = 28 \cdot (2n)(2n-1)$$

$$\text{or, } 8n(4n-1)(2n-1) = 28(2n)(2n-1)$$

$$\text{or, } (4n-1) = 7$$

or, $n = 2$.

10. Answer : (e)

[<TOP>](#)

Reason :

Let the numbers be $(m - d)$, m , $(m + d)$

The sum of the three numbers is $3m = 15$

Or, $m = 5$

After adding 1, 4, 19 respectively in these numbers the numbers become

$(m-d+1)$, $(m+4)$ and $(m+d+19)$

Or, $(6-d)$, 9 , $(24+d)$

These numbers form a G.P.

So,

$$\frac{9}{(6-d)} = \frac{(24+d)}{9}$$

$$\text{Or, } 9^2 = (6-d)(24+d)$$

$$\text{Or, } 81 = 144 - 24d + 6d - d^2$$

$$\text{Or, } d^2 + 18d - 63 = 0$$

$$\text{Or, } d^2 + 21d - 3d - 63 = 0$$

$$\text{Or, } d(d + 21) - 3(d + 21) = 0$$

$$\text{Or, } (d - 3)(d + 21) = 0$$

So, $d = 3$ or -21 .

So, the highest number using 3 as common difference is 8

and the highest number using -21 as common difference is $5 - (-21) = 26$.

11. Answer : (d)

[<TOP>](#)

Reason : The equation of line must be $y = a + 5x$. Since $(-4, 6)$ falls on the line,

$$6 = a + 5(-4)$$

This implies $a = 26$

Therefore the equation of the line is $y = 26 + 5x$.

12. Answer : (a)

[<TOP>](#)

Reason : Given that,

$$f(x, y, z) = x^2(y - z) + y^2(z - x) + z^2(x - y)$$

$$f_x = 2x(y - z) - y^2 + z^2$$

$$f_y = x^2 + 2y(z - x) - z^2$$

$$f_z = -x^2 + y^2 + 2z(x - y)$$

$$\therefore f_x + f_y + f_z = 0$$

13. Answer : (d)

[<TOP>](#)

Reason : Given that

$$y = x + e^x$$

Differentiating w.r.t. y , we get

$$1 = \frac{dx}{dy} + e^x \frac{dx}{dy}$$

$$\text{or, } \frac{dx}{dy} = \frac{1}{(1 + e^x)} = (1 + e^x)^{-1}$$

$$\text{or, } \frac{d^2x}{dy^2} = \frac{-e^x}{(1 + e^x)^2} \times \frac{dx}{dy} = \frac{-e^x}{(1 + e^x)^2} \times \frac{1}{(1 + e^x)}$$

$$\therefore \frac{d^2x}{dy^2} = \frac{-e^x}{(1 + e^x)^3}.$$

14. Answer : (b)

[< TOP >](#)

Reason : The given function is,

$$\begin{aligned} y &= \left[x + \sqrt{x^2 + 4} \right]^m \\ \frac{dy}{dx} &= m \left(x + \sqrt{x^2 + 4} \right)^{m-1} \left(1 + \frac{x}{\sqrt{x^2 + 4}} \right) \\ &= m \frac{\left(x + \sqrt{x^2 + 4} \right)^m}{\sqrt{x^2 + 4}} \\ &= \frac{my}{\sqrt{x^2 + 4}} \end{aligned}$$

15. Answer : (c)

[< TOP >](#)

Reason : $f(x) = 5^x$ (1)

in (1) replacing x by $x + 1$ we get,

$$f(x + 1) = 5^{x+1} \text{(2)}$$

in (1) replacing x by $x - 1$ we get,

$$f(x - 1) = 5^{x-1} \text{(3)}$$

from (2) and (3)

$$\frac{f(x + 1)}{f(x - 1)} = \frac{5^{x+1}}{5^{x-1}} = \frac{5^x 5}{5^x 5^{-1}} = 5 \times 5 = 25$$

16. Answer : (b)

[< TOP >](#)

Reason : $\lim_{x \rightarrow -2} \frac{x^3 - 5x + 3}{x^2 + 1}$

$$\begin{aligned} &\frac{\lim_{x \rightarrow -2} (x^3 - 5x + 3)}{\lim_{x \rightarrow -2} (x^2 + 1)} \\ &= \frac{\lim_{x \rightarrow -2} (x^3 - 5x + 3)}{\lim_{x \rightarrow -2} (x^2 + 1)} \end{aligned}$$

$$\begin{aligned}
& \frac{\lim_{x \rightarrow -2} (X^3) - \lim_{x \rightarrow -2} 5(x) + \lim_{x \rightarrow -2} 3}{\lim_{x \rightarrow -2} (X^2) + \lim_{x \rightarrow -2} 1} \\
&= \frac{(-2)^3 - 5(-2) + 3}{(-2)^2 + 1} = \frac{-8 + 10 + 3}{4 + 1} = \frac{5}{5} = 1.
\end{aligned}$$

17. Answer : (b)

[< TOP >](#)

Reason : The sequence is: 15000, 13500, 12150, 10935,...

$$a = 15,000 \text{ and } r = 9/10$$

$$\text{Therefore, } T_{10} = ar^{n-1} = 15,000 (9/10)^9 = 5,811.$$

18. Answer : (c)

[< TOP >](#)

Reason : a. In a logarithmic function the logarithmic operation is applied on the independent variable.

b. In a logarithmic function the base of the logarithm may be any number other than 10.

c. In a logarithmic function the independent variable cannot be negative.

d. In a logarithmic function the base of the logarithm cannot be zero or negative numbers.

19. Answer : (c)

[< TOP >](#)

Reason : The amount payable under compound interest is given by :

$$A = P(1 + r)^n$$

Where,

A = Amount payable at the end of 'n' years

P = Principal

r = Rate of interest

N = Number of years.

If 'P' and 'r' are constant (i.e., given) then 'A' the amount payable becomes a function of 'n' (the number of years)

20. Answer : (e)

[< TOP >](#)

Reason : For any real number, the interval $(-\infty, a)$ represents the real numbers, x such that $-\infty < x < a$. This means, the set of all real numbers less than a.

21. Answer : (d)

[< TOP >](#)

Reason : Profit function, F = Revenue – Total cost

$$= R - C$$

$$= 8Q - \left[1,26,000 + 60 \left(\frac{Q}{900} \right)^2 \right]$$

$$F = 8Q - 60 \left(\frac{Q}{900} \right)^2 - 1,26,000$$

$$F' = 8 - 60 \times 2 \left(\frac{Q}{900} \right) \times \frac{1}{900}$$

$$\text{or } F' = 8 - \frac{Q}{6,750}$$

$$F' = 0 \Rightarrow 8 - \frac{Q}{6,750} = 0$$

$$\begin{aligned} & \frac{Q}{6,750} = 8 \\ \text{or } Q &= 8 \times 6,750 = 54,000 \end{aligned}$$

$$F'' = -\frac{1}{6,750}$$

$\therefore F''$ is negative for all values of Q .

At $Q = 54,000$, $F' = 0$ and $F'' < 0$

$\therefore$ The profit is maximum at $Q = 54,000$ units.

22. Answer : (e)

[< TOP >](#)

Reason : The following are the basic requirements of Linear Programming Problem technique when employed for optimization problems:

- I. Decision variables and their relationship.
- II. Well-defined objective function.
- III. Presence of constraints or restrictions.
- IV. Alternative courses of action.
- V. Non-negative restriction.

Therefore (e) is the correct answer.

23. Answer : (c)

[< TOP >](#)

Reason : The profit per unit sold is Rs.300 and Rs.500 for product A and product B respectively. The production of A is x units and that of B is y units. So, the profit function or objective function of the problem is $300x + 500y$ or $3x + 5y$.

24. Answer : (d)

[< TOP >](#)

Reason : In the graphical method of solving linear programming problems if there is a unique optimal solution, then the optimal solution is located at one of the corner points of the feasible region.

25. Answer : (b)

[< TOP >](#)

Reason : (a) At the optimal solution the slack variables need not be equal to zero.

- (b) The constraints which contain the $\leq$ sign are converted into equations by adding slack variables.
- (c) There can be more than one feasible solution to a LPP.
- (d) The slack variables make zero contribution towards profit.
- (e) The slack variables can only assume any non-negative value.

26. Answer : (c)

[< TOP >](#)

Reason : (a) and (b) are not the indicators of multioptimality.

(c) In the graphical method of solving a LPP the situation of multioptimality arises when the objective function is parallel to one of the edges of the feasible region which is in the direction of the optimal movement of the objective function.

(d) and (e) are not correct because they only assume non-negative values

27. Answer : (a)

[< TOP >](#)

Reason : While plotting constraints on a graph paper, terminal points on both the axes are connected by a straight line because the constraints are linear equations or inequalities. Therefore (a) is the correct answer.

28. Answer : (d)

[< TOP >](#)

Reason : The occurrence of a negative value in the $Z_j - C_j$ row indicates that the profit can be improved further. All other alternatives are false.

29. Answer : (e)

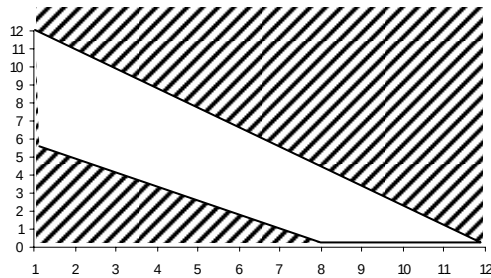
[< TOP >](#)

Reason : The statements I, II and III are the standard results on duality. Therefore (e) is the correct answer.

30. Answer : (e)

[< TOP >](#)

Reason :



It is clear from the figure that there is no point in the first quadrant which satisfies both the constraints. In other words, the set of the points satisfying one constraint includes none of the points satisfying the other. Thus the given linear programming problem has no feasible solution.

31. Answer : (d)

[< TOP >](#)

Reason :

$$\text{Maximize } Z = 3x_1 + 5x_2 + 4x_3$$

subject to the constraints

$$2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

$$x_1, x_2, x_3 \geq 0.$$

After introducing slack variables, constraint equations become

$$2x_1 + 3x_2 + s_1 = 8$$

$$2x_2 + 5x_3 + s_2 = 10$$

$$3x_1 + 2x_2 + 4x_3 + s_3 = 15$$

The starting simplex table

Basic variables	C_B	X_B	X_1	X_2	X_3	S_1	S_2	S_3	Min Ratio (X_B/X_2)
$\leftarrow S_1$	0	8	2	3	0	1	0	0	$8/3 \leftarrow$
S_2	0	10	0	2	5	0	1	0	$10/2$
S_3	0	15	3	2	0	0	0	1	$15/2$
$x_1 = x_2 = x_3 = 0$ $Z = C_B X_B = 0$			-3	-5*	-4	0	0	0	$\leftarrow \Delta_j$

Incoming
vector

Outgoing
vector

From the above table we can observe that the incoming vector is x_2 and the outgoing vector is s_1 , therefore (d) is the correct answer.

32. Answer : (d)

[< TOP >](#)

Reason :

Simplex Table 1

Basic variables	C_B	X_B	X_1	X_2	X_3	S_1	S_2	S_3	Min Ratio (B/ X_k)
S_1	0	430	1	2	1	1	0	0	430/1
$\leftarrow S_2$	0	460	3	0	$\leftarrow 2$	0	0	0	460/2 $\leftarrow$
S_3	0	420	1	4	0	0	0	1	—
$X_1 = X_2 = X_3 = 0$	$Z = 0$		-3	-2	-5*	0	0	0	$\leftarrow \Delta_j$

Simplex Table 2

$\leftarrow S_1$	0	200	-1/2	$\leftarrow 2$	0	1	-1/2	0	200/2 $\leftarrow$
$\rightarrow X_3$	5	230	3/2	0	1	0	1/2	0	—
S_3	0	420	1	4	0	0	0	1	420/4
$X_1 = X_2 = S_2 = 0$	$Z = 1150$		9/2	-2*	2	0	5/2	0	$\leftarrow \Delta_j$

Simplex Table 3

Form the above simplex table-II the Max. $Z=1150$. Therefore (d) is the correct answer.

33. Answer : (d)

[< TOP >](#)

Reason :

$$\text{Maximize } Z = 4x_1 + 2x_2$$

subject to the constraints

$$-x_1 - x_2 \leq -3$$

$$-x_1 + x_3 \leq -2$$

$$x_1, x_2 \geq 0.$$

The dual of the above linear programming problem is

Minimize $Z = -3y_1 - 2y_2$
 subject to the constraints
 $-y_1 - y_2 \geq 4$
 $-y_1 + y_2 \geq 2$
 $y_1, y_2 \geq 0$.

34. Answer : (c) [< TOP >](#)

Reason : In real life, if there are no constraints the profit in a linear programming problem can be infinitely increased.

35. Answer : (d) [< TOP >](#)

Reason : In linear programming, there is a unique dual (primal) problem associated with every primal (dual) problem. When a primal is solved, its associated dual is also solved simultaneously. Hence, the solution for a LP problem can be determined either by solving the original problem or the dual problem. In general, a maximization problem is easier to solve when compared to the minimization problem because in the former we have addition of slack variable where as in the later we have an additional of both surplus and artificial variables. But we cannot conclude that it is always easier to solve the dual rather than a primal because the dual could be either maximization or minimization problem.

36. Answer : (e) [< TOP >](#)

Reason : Standard deviation = $(\text{variance})^{1/2} = (16)^{1/2} = 4$

Coefficient of variation = $\frac{\text{Standard deviation}}{\text{Mean}} \times 100 = \frac{4}{8} \times 100 = 50\%$.

37. Answer : (c) [< TOP >](#)

Reason : Here, the geometric mean of 8 observations is 14.8 and hence, the product of all the observations will be $= 14.8^8$. Now, one of the observation was wrongly noted as 8.9 though it is actually 9.8.

Hence, the actual product is given by: $\frac{14.8^8 \times 9.8}{8.9} = 2534718836$ and correspondingly, the actual geometric mean is obtained as: $\sqrt[8]{2534718836} = 14.98$.

38. Answer : (d) [< TOP >](#)

Reason : (a) The average deviation from the arithmetic mean will never be greater than zero.
 (b) The average deviation from the arithmetic mean will never be less than zero.
 (c) The average deviation from the arithmetic mean can never be less than or greater than zero.
 (d) The sum of the deviations from the arithmetic mean is equal to zero. Hence the average deviation from the arithmetic mean will always indicate that the dispersion of the data set is equal to zero.
 (e) There is no reason why the average deviation from the arithmetic mean will be a multiple of the arithmetic mean.

39. Answer : (c) [< TOP >](#)

Reason : Quartiles and percentiles are measures of position.

40. Answer : (a) [< TOP >](#)

Reason : Standard deviation is independent of change of origin i.e., it remains unchanged even if all the items in the data set are increased or decreased by the same quantity.

41. Answer : (b) [< TOP >](#)

Reason : The variance of the population using assumed mean can be calculated as:

$$\sigma^2 = \left[\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N} \right)^2 \right] \times i^2$$

Deviations	$d = \frac{\text{Deviation}}{i}$	Frequency	d^2	fd^2	fd
-30	-3	6	9	54	-18
-20	-2	18	4	72	-36
-10	-1	16	1	16	-16
0	0	32	0	0	0
10	1	18	1	18	18
20	2	10	4	40	20
		100		200	-32

$$\begin{aligned} \text{Variance of the population} &= \left[\frac{\sum fd^2}{N} - \left(\frac{\sum fd}{N} \right)^2 \right] i^2 \\ &= \left[\frac{200}{100} - \left(\frac{-32}{100} \right)^2 \right] \times (10)^2 \\ &= 189.76. \end{aligned}$$

42. Answer : (e) [< TOP >](#)
Reason : The median score of the group of girls is 80 while that of the boys is 70. For the composite group, neither can we take the average of these two (that results 75) nor can we apply the formulae of composite median, as we used to do for the mean (that results 76) nor we can sum the two numbers. As the 50 scores are not given, nothing can be concluded.
43. Answer : (a) [< TOP >](#)
Reason : (a) indicates that the distribution is skewed to the right.
(b), (c) and (d) are incorrect indicators of skewness to the right.
(e) indicates that there is no variability in data.
44. Answer : (c) [< TOP >](#)
Reason : When extreme values are present in a set of data then Median and Interquartile range measures are most appropriate.
45. Answer : (d) [< TOP >](#)
Reason : A unimodal distribution has only one mode. A bimodal distribution has two modes and a multimodal distribution contains more than two modes.
46. Answer : (d) [< TOP >](#)
Reason : The smaller the spread of scores around the mean the smaller will be the interquartile range, the smaller the standard deviation, and smaller will be the coefficient of variation.
47. Answer : (e) [< TOP >](#)
Reason : The weighted arithmetic mean of the distribution is zero as all the values are in opposite sign in the same weighted proportion. Therefore, the distribution is symmetric in nature. As the observation zero occurs with highest frequency, it may be considered to be mode of the distribution. Hence, the option (e) is the answer.
48. Answer : (e) [< TOP >](#)
Reason : Arithmetic mean, Geometric mean, Harmonic mean median and mode are measures of central

tendency. Range is a measure of dispersion. Therefore (e) is the correct answer.

49. Answer : (c)

[< TOP >](#)

Reason :

Sales(Rs. Lakhs)	Below 50	50-52	52-54	54-56	56-58	58-60	60-62
No. of Companies	12	18	25	30	10	3	2

Since the maximum frequency 30 is in the class 54-56, therefore, 54-56 is the modal class.

$$\text{Mode} = L + \frac{\Delta_1}{\Delta_1 + \Delta_2} \times i$$

$$L = 54$$

$$\Delta_1 = (30 - 25) = 5$$

$$\Delta_2 = (30 - 10) = 20$$

$$i = 2$$

$$54 + \frac{5}{5 + 20} \times 2$$

$$\text{Mode} = 54.4$$

Hence the modal sales are Rs. 54.4 lakhs.

50. Answer : (b)

[< TOP >](#)

Reason :

Overtime(hrs.)	F	c.f.
10-15	10	10
15-20	22	32
20-25	34	66
25-30	19	85
30-35	9	94
35-40	6	100

$$Q_1 = \text{size of } \frac{N}{4} \text{ th observation} = \frac{100}{4} = 25 \text{ th observation}$$

Q_1 lies in the class 15-20

$$Q_1 = L + \left[\frac{\frac{N}{4} - F}{f_q} \right] \times W$$

$$Q_1 = 15 + \left[\frac{25 - 10}{22} \right] \times 5 = 18.4$$

51. Answer : (a)

[< TOP >](#)

Reason :

Weekly Income (Rs.)	No. of Workers	C.F.
Below 300	10	10
300 – 350	18	28
350 – 400	45	73
400 – 450	65	138
450 – 500	58	196
500 – 550	15	211

550 and above	9	220
	N = 220	

$$Q_1 = \text{Size of } \frac{N^{\text{th}}}{4} \text{ observation} = \frac{220}{4} = 55^{\text{th}} \text{ observation}$$

Q_1 lies in $(350 - 400)^{\text{th}}$ class.

$$Q_1 = L + \left[\frac{\frac{N}{4} - F}{f_q} \right] \times w = 350 + \left[\frac{55 - 28}{45} \right] \times 50 = 380$$

$$Q_3 = \text{Size of } \frac{3N^{\text{th}}}{4} \text{ observation} = \frac{3(220)}{4} = 165$$

Q_3 lies in the class 450 – 500.

$$Q_3 = L + \left[\frac{\frac{3N}{4} - F}{f_q} \right] \times w = 450 + \left[\frac{165 - 138}{58} \right] \times 50 = 473$$

$$\text{Coefficient of determination} = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{473 - 380}{473 + 380} = 0.109$$

52. Answer : (b)

[<TOP>](#)

Reason : Here $n(s) = 36$

Let E = Event of getting a total more than 7.

= $\{(2,6), (3,5), (3,6), (4,4), (4,5), (4,6), (5,3), (5,4), (5,5), (5,6), (6,2), (6,3), (6,4), (6,5), (6,6)\}$

$$\therefore P(E) = \frac{n(E)}{n(S)} = \frac{15}{36} = \frac{5}{12}$$

53. Answer : (b)

[<TOP>](#)

Reason : $P(A/B) = 0.62$, $P(B/A) = 0.7$ and $P(A) = 0.5$

We have

$$\begin{aligned}
 P(A \cap B) &= P(A)P(B/A) \\
 &= 0.5(0.7) \\
 &= 0.35
 \end{aligned}$$

$$\text{Again, } P(A \cap B) = P(B)P(A/B)$$

$$\text{or, } P(B) = \frac{P(A \cap B)}{P(A/B)} = \frac{0.35}{0.62} = 0.56$$

$$\begin{aligned}
 \therefore P(A \cup B) &= P(A) + P(B) - P(A \cap B) \\
 &= 0.5 + 0.56 - 0.35 \\
 &= 0.71
 \end{aligned}$$

$$\begin{aligned}
 \text{Now, } P(\bar{A} \cap \bar{B}) &= 1 - P(A \cup B) \\
 &= 1 - 0.71 \\
 &= 0.29
 \end{aligned}$$

$$\text{or, } P(\bar{B})P(\bar{A}/\bar{B}) = 0.29$$

$$\text{or, } P(\bar{A}/\bar{B}) = \frac{0.29}{P(\bar{B})} = \frac{0.29}{1 - P(B)} = \frac{0.29}{1 - 0.56} = \frac{0.29}{0.44} = 0.66$$

54. Answer : (a)

[< TOP >](#)

Reason : Let A, B and C denote the respective events that X, Y and Z can solve the given problem.

We have,

$$P(A) = \frac{1}{4}, P(B) = \frac{3}{7} \text{ and } P(C) = \frac{2}{9}$$

$$\therefore P(A^c) = 1 - P(A) = 1 - \frac{1}{4} = \frac{3}{4}$$

$$P(B^c) = 1 - P(B) = 1 - \frac{3}{7} = \frac{4}{7}$$

$$P(C^c) = 1 - P(C) = 1 - \frac{2}{9} = \frac{7}{9}$$

If they try to solve the problem, then the probability that the problem is not solved

$$= P(A^c \cap B^c \cap C^c)$$

$$= P(A^c) \cdot P(B^c) \cdot P(C^c) \quad [\because \text{events } A^c, B^c \text{ and } C^c \text{ are independent}]$$

$$= \left(\frac{3}{4}\right) \cdot \left(\frac{4}{7}\right) \cdot \left(\frac{7}{9}\right)$$

$$= \frac{1}{3}$$

55. Answer : (e)

[< TOP >](#)

Reason : If A is an event, the conditional probability of A given A is equal to 1.

Therefore (e) is the correct answer.

56. Answer : (d)

[< TOP >](#)

Reason : The probability of drawing 1 red and then 1 green marble

$$P(1 \text{ red and then } 1 \text{ green}) = (6P_1 \times 10P_2)/16P_2 = 1/4.$$

57. Answer : (a)

[< TOP >](#)

Reason : Let PI = the event that the test is positive and NI = the event that the test is negative.

Also, let D denote the event that subject has the illness and D^c the complementary event that the

subject does not have the illness. The following information has been provided in this problem:

$$P(\text{PI} \mid D) = 0.99 \text{ and therefore } P(\text{NI} \mid D) = 0.01$$

$$P(\text{NI} \mid D^c) = 0.95 \text{ and therefore } P(\text{PI} \mid D^c) = 0.05$$

$$P(D) = 0.0001 \text{ and therefore } P(D^c) = 0.9999$$

Our goal is to find $P(D \mid \text{PI})$. By the Bayes' theorem

$$P(D \mid \text{PI}) = \frac{P(D \text{ and PI})}{P(\text{PI})} = \frac{\{P(\text{PI} \mid D)P(D)\}}{\{P(\text{PI} \mid D)P(D) + P(\text{PI} \mid D^c)P(D^c)\}} = \frac{\{0.99 \times 0.0001\}}{\{0.99 \times 0.0001 + 0.05 \times 0.9999\}} = 0.002 \text{ (approx)}$$

58. Answer : (e)

[< TOP >](#)

Reason : $n(s) = 36$

Let E be the event that the sum of the numbers on the two faces is divisible by 4 or 6.

$$E = \{(1,3), (1,5), (2,2), (2,4), (2,6), (3,1), (3,3), (3,5), (4,2), (4,4), (5,1), (5,3), (6,2), (6,6)\}$$

$$n(E) = 14$$

$$\frac{n(E)}{n(S)} = \frac{14}{36} = \frac{7}{18}$$

$$\therefore n(E) = \frac{n(S)}{18} = 14$$

59. Answer : (b)

[< TOP >](#)

Reason : $P(A \text{ and } C) = 0.48$

$$P(B \text{ and } C) = 0.32$$

$$\therefore P(C) = P(A \text{ and } C) + P(B \text{ and } C) = 0.80$$

$$P(B \text{ and } C) = P(C) \cdot P(B/C)$$

$$\text{Or, } P(B/C) = \frac{P(B \text{ and } C)}{P(C)} = \frac{0.32}{0.80} = 0.40.$$

$$\text{Or, } P(B/C) = \frac{P(B \text{ and } C)}{P(C)} = \frac{0.32}{0.80} = 0.40.$$

60. Answer : (b)

[< TOP >](#)

Reason : As per the classical approach, the probability is the ratio of the number of equality likely possible outcomes favorable for an event to the total number of possible outcomes. If there are m possible outcomes that favor the occurrence of event A and there are n total possible outcomes, then the probability of the occurrence of event A is the ratio of m to n (m/n). The possible outcomes favorable for an event and total number of outcomes must be known without performing experiments.

61. Answer : (c)

[< TOP >](#)

Reason : If certain events are mutually exclusive and collectively exhaustive then only one of them can happen at a time and the entire sample space is divided among the two events. Hence, the sum of their probabilities will be equal to 1

62. Answer : (e)

[< TOP >](#)

Reason : $P(\bar{A}B) + P(A\bar{B})$ indicates the occurrence of at least any one of the two events. The first component indicate the probability of the occurrence of B but not A while the second component indicate the occurrence of A not B. Hence, the option (e) is happened to be the right choice.

63. Answer : (e)

[< TOP >](#)

Reason : Total number of ways two fruits can be picked from 8 fruits = $n(S) = {}^8C_2$

The total number of ways one mango and one apple is picked is $n(E) = {}^3C_1 \times {}^5C_1$

$$\text{Therefore the probability of the favorable event} = \frac{n(E)}{n(S)} = \frac{3 \times 5 \times 2}{8 \times 7} = \frac{15}{28}.$$

64. Answer : (d)

[< TOP >](#)

Reason : Since $P(C) = \frac{1}{2}P(B) \Rightarrow P(B) = 2P(C)$

Again, $P(B) = \frac{2}{5}P(A) \Rightarrow P(A) = \frac{5}{2}P(B) = \frac{5}{2} \cdot 2P(C) = 5P(C)$

by problem, the events A, B and C are mutually exclusive and exhaustive.

$$P(A \cup B \cup C) = 1$$

$$\text{or, } P(A) + P(B) + P(C) = 1 \quad (\because \text{events A, B and C are mutually exclusive})$$

$$\text{or, } 5P(C) + 2P(C) + P(C) = 1$$

$$\text{or, } 8P(C) = 1$$

$$\text{or, } P(C) = \frac{1}{8}$$

Therefore

Therefore (d) is the correct answer

65. Answer : (b)

[< TOP >](#)

Reason : The probability of an employee being absent on two successive days is

$$\begin{aligned} P(A \text{ and } B) &= P(A) \cdot P(B|A) \\ &= 0.2(0.5) \\ &= 0.1 \end{aligned}$$

Therefore, the probability of an employee being absent on two successive days is 0.1 or 10% of the time.

66. Answer : (c)

[< TOP >](#)

Reason : If A, B and C are three mutually exclusive events then the probability of their union is equal to $P(A) + P(B) + P(C)$.

67. Answer : (c)

[< TOP >](#)

Reason : If an event B has occurred and it is known that $P(B) = 1$, the conditional probability $P(A/B)$ is equal to $P(A)$.

68. Answer : (d)

[< TOP >](#)

Reason : To determine the appropriate width of each class interval in a grouped frequency distribution, we divide the range of the data by the number of desired class intervals.

69. Answer : (d)

[< TOP >](#)

Reason : The median can be determined graphically by drawing an ogive.

70. Answer : (d)

[< TOP >](#)

Reason : The sum of all relative frequencies for any data set should be equal to 1

71. Answer : (a)

[< TOP >](#)

Reason : The classification according to place, area or region comes under geographical classification. Therefore (a) is the **correct** answer

The classification according to lapse of time, e.g., weekly, monthly, yearly, etc., comes under chronological classification.

The classification according to attributes of the subjects or items, e.g., designation, qualification, knowledge etc., comes under qualitative classification.

The classification according to the magnitude of the numerical values, e.g., income, expenditure, weight, height etc., comes under quantitative classification.

72. Answer : (a)

[< TOP >](#)

Reason : The process of estimating values on graph line between known data points is called interpolation.

73. Answer : (a)

[< TOP >](#)

Reason : Estimation in interpolation is more accurate than extrapolation.

74. Answer : (c)

[< TOP >](#)

Reason : Sales during the year 2005 = $30 + \frac{46 - 30}{2006 - 2004} (2005 - 2004) = 38$ lakh.

75. Answer : (d)

[< TOP >](#)

Reason : Two workers can be selected at random from a group of 500 workers in ${}^{500}C_2 = \frac{500 \times 499}{2} = 250 \times 499$ ways. Therefore, number of equally likely event points in the sample space = 250×499 .

Let A denote the event that the wages of the selected workers are equal to or greater than Rs. 300. From the given frequency distribution we see that the wages of $55 + 11 = 66$ workers are equal to or greater than Rs. 300. Therefore, number of equally likely event points contained in

$$A = {}^{66}C_2 = \frac{66 \times 65}{2} = 33 \times 65.$$

Therefore by classical definition of probability we get, $P(A) = \frac{33 \times 65}{250 \times 499} = \frac{429}{24,950}$

Therefore (d) is the correct answer.

[< TOP OF THE DOCUMENT >](#)