Class : 12

FIRST REVISION EXAMINATION, JANUARY - 2025
BUSINESS MATHEMATICS AND STATISTICS

Time Allowed : 3.00 Hours]　　　　　　　　　　　　　　[Max. Marks : 90

PART – I　　　　　　　　　　　　　　20 x 1 = 20

1. Answer all the questions by choosing the correct answer from the given 4 alternatives

2. Write question number, correct option and corresponding answer

3. Each question carries 1 mark

1. If $A = \begin{pmatrix} 2 & 0 \\ 0 & 8 \end{pmatrix}$, then $\rho(A)$ is

   (a) 0　　　　　(b) 1　　　　　(c) 2　　　　　(d) n

2. If $\frac{a_1}{x} + \frac{b_1}{y} = c_1, \frac{a_2}{x} + \frac{b_2}{y} = c_2, \Delta_1 = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}, \Delta_2 = \begin{vmatrix} b_1 & c_1 \\ b_2 & c_2 \end{vmatrix} \Delta_3 = \begin{vmatrix} c_1 & a_1 \\ c_2 & a_2 \end{vmatrix}$ then (x,y) is

   (a) $\left(\frac{\Delta_2}{\Delta_1}, \frac{\Delta_3}{\Delta_1}\right)$　　(b) $\left(\frac{\Delta_3}{\Delta_1}, \frac{\Delta_2}{\Delta_1}\right)$　　(c) $\left(\frac{\Delta_1}{\Delta_2}, \frac{\Delta_1}{\Delta_3}\right)$　　(d) $\left(\frac{-\Delta_1}{\Delta_2}, \frac{-\Delta_1}{\Delta_3}\right)$

3. $\int 2^x dx$ is

   (a) $2^x \log 2 + c$　　(b) $2^x + c$　　(c) $\frac{2^x}{\log 2} + c$　　(d) $\frac{\log 2}{2^x} + c$

4. $\int \frac{2x^3}{4+x^4} dx$ is

   (a) $\log|4 + x^4| + c$　　(b) $\frac{1}{2}\log|4 + x^4| + c$　　(c) $\frac{1}{4}\log|4 + x^4| + c$　　(d) $\log\left|\frac{2x^3}{4+x^4}\right| + c$

5. Area bounded by the curve $y = e^{-2x}$ between the limits $0 \le x \le \infty$ is

   (a) 1 sq.units　　(b) $\frac{1}{2}$ sq.unit　　(c) 5 sq.units　　(d) 2 sq.units

6. If the marginal revenue $MR = 35 + 7x - 3x^2$, then the average revenue AR is

   (a) $35x + \frac{7x^2}{2} - x^3$　　(b) $35x + \frac{7x^2}{2} - x^2$　　(c) $35 + \frac{7x^2}{2} + x^2$　　(d) $35 + 7x + x^2$

7. The differential equation $\left(\frac{dx}{dy}\right)^3 + 2y^{\frac{1}{2}} = x$ is

   (a) of order 2 and degree 1　　(b) of order 1 and degree 3　　(c) of order 1 and degree 6　　(d) of order 1 and degree 2

8. The particular integral of the differential equation is $\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 16y = 2e^{4x}$

   (a) $\frac{x^2 e^{4x}}{2!}$　　(b) $\frac{e^{4s}}{2!}$　　(c) $x^2 e^{4x}$　　(d) xe^{4x}

9. $E \equiv$

   (a) $1 + \Delta$　　(b) $1 - \Delta$　　(c) $1 + \nabla$　　(d) $1 - \nabla$

10. For the given points (x_0, y_0) and (x_1, y_1) the Lagrange's formula is

    (a) $y(x) = \frac{x - x_1}{x_0 - x_1} y_0 + \frac{x - x_0}{x_1 - x_0} y_1$　(b) $y(x) = \frac{x_1 - x}{x_0 - x_1} y_0 + \frac{x - x_0}{x_1 - x_0} y_1$　(c) $y(x) = \frac{x - x_1}{x_0 - x_1} y_1 + \frac{x - x_0}{x_1 - x_0} y_0$　(d) $y(x) = \frac{x_1 - x}{x_0 - x_1} y_1 + \frac{x - x_0}{x_1 - x_0} y_0$

11. Demand of products per day for three days are 21,19,22 units and their respective probabilities are 0.29,0.40,0.35. Profit per unit is 0.50 paisa then expected profits for three days are

    (a) 21,19,22　　(b) 21.5,19.5,22.5　　(c) 0.29,0.40,0.35　　(d) 3.045,3.8,3.85

12. If $p(x) = \frac{1}{10}, c = 10$, then E(X) is

    (a) zero　　(b) $\frac{6}{8}$　　(c) 1　　(d) -1

13. If Z is a standard normal variate, the proportion of items lying between $Z = -0.5$ and $Z = -3.0$ is

    (a) 0.4987　　(b) 0.1915　　(c) 0.3072　　(d) 0.3098

14. An experiment succeeds twice as often as it fails. The chance that in the next six trials, there shall be at least four successe

    (a) 240/729   (b) 489/729   (c) 496/729   (d) 251/729

15. Any statistical measure computed from sample data is known as

    (a) parameter   (b) statistic   (c) infinite measure   (d) uncountable measure

16. An estimator is a sample statistic used to estimate a

    (a) population parameter   (b) biased estimate   (c) sample size   (d) census

17. Factors responsible for seasonal variations are

    (a) Weather   (b) Festivals   (c) Social customs   (d) All the above

18. Cost of living at two different cities can be compared with the help of

    (a) Consumer price index   (b) Value index   (c) Volume index   (d) Un-weighted index

19. In a degenerate solution number of allocations is

    (a) equal to m + n − 1   (b) not equal to m + n − 1   (c) less than m + n − 1   (d) greater than m + n − 1

20. In an assignment problem involving four workers and three jobs, total number of assignments possible are

    (a) 4   (b) 3   (c) 7   (d) 12

PART – II

                                                                     7 x 2 = 14

1. Answer any 7 questions
2. Each question carries 2 marks
3. Question number 30 is compulsory

21. Evaluate $\int \left(x + \frac{1}{x}\right)^2 dx$

22. If $MR = 20 - 5x + 3x^2$, find total revenue function.

23. Solve: $ydx - xdy = 0$

24. Prove that $\nabla\Delta = \Delta - \nabla$

25. Two coins are tossed simultaneously. Getting a head is termed as success. Find the probability distribution of the number of successes.

26. Verify the following statement: The mean of a Binomial distribution is 12 and its standard deviation is 4.

27. A server channel monitored for an hour was found to have an estimated mean of 20 transactions transmitted per minute. The variance is known to be 4 . Find the standard error.

28. Mention two branches of statistical inference?

29. Fit a trend line by the method of freehand method for the given data

Year	2000	2001	2002	2003	2004	2005	2006	2007
Sales	30	46	25	59	40	60	38	65

30. What is the Assignment problem?

PART – III

                                                                     7 x 3 = 21

1. Answer any 7 questions
2. Each question carries 3 marks
3. Question number 40 is compulsory

31. Show that the equations $x + y = 5, 2x + y = 8$ are consistent and solve them.

32. Evaluate $\int \frac{1}{\sqrt{x+2}-\sqrt{x-2}} dx$

33. Evaluate $\int x^3 e^x dx$

34. The marginal cost function of a product is given by $\frac{dC}{dx} = 100 - 10x + 0.1x^2$ where x is the output. Obtain the total and the average cost function of the firm under the assumption, that its fixed cost is Rs. 500 .

35. Find the differential equation of the family of curves $y = \frac{a}{x} + b$ where a and b are arbitrary constants

36. Solve $x\frac{dy}{dx} + 2y = x^4$

37. Construct a forward difference table for $y = f(x) = x^3 + 2x + 1$ for $x = 1,2,3,4,5$

38. If $p(x) = \begin{cases} \frac{x}{20}, & x = 0,1,2,3,4,5 \\ 0, & \text{otherwise} \end{cases}$ Find (i) $P(X < 3)$ and (ii) $P(2 \leq 4)$

39. If x is a binomially distributed random variable with $E(x) = 2$ and $van(x) = 4/3$ Find $P(x = 5)$

40. Calculate the cost of living index by aggregate expenditure method:

Commodity	Weights	Price (Rs.)	
	2010	2010	2015
P	80	22	25
Q	30	30	45
R	25	42	50
S	40	25	35
T	50	36	52

PART – IV

1. Answer all the questions $7 \times 5 = 35$

2. Each question carries 5 marks

41. (a) Investigate for what values of ' a ' and 'b' the following system of equations $x + y + z = 6, x + 2y + 3z = 10,$

$x + 2y + az = b$ have (i) no solution   (ii) a unique solution   (iii) an infinite number of solutions.

(OR)

(b) Evaluate $\int_{2}^{5} \frac{\sqrt{x}}{\sqrt{x}+\sqrt{7-x}} dx$

42. (a) Find the area bounded by the curve $y = x^2$ and the line $y = 4$

(OR)

(b) The demand equation for a products is $x = \sqrt{100 - p}$ and the supply equation is $x = \frac{p}{2} - 10$. Determine the consumer's

surplus and producer's surplus, under market equilibrium.

43. (a) Solve the differential equation $y^2 dx + (xy + x^2)dy = 0$

(OR)

(b) Suppose that the quantity demanded $Q_4 = 13 - 6P + 2\frac{dp}{dt} + \frac{d^2p}{dt^2}$ and quantity supplied $Q_s = -3 + 2p$, where p is the

price. Find the equilibrium price for market clearance.

44. (a) Using Lagrange's interpolation formula find $y(10)$ from the following table:

x	5	6	9	11
y	12	13	14	16

(OR)

(b) A continuous random variable X has the following probability function

Value of X = x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

(i) Find k   (ii) Evaluate $p(x < 6), p(x \geq 6)$ and $p(0)$ (iii) If $P(X \leq x) \cdot \frac{1}{2}$, then find the minimum value of x.

45. (a) If the probability that an individual suffers a bad reaction from injection of a given serum is 0.001 , determines the probability that out of 2,000 individuals (a) exactly 3 , and (b) more than 2 individuals will suffer a bad reaction.

(OR)

(b) The average score on a nationally administered aptitude test was 76 and the corresponding standard deviation was 8 . In order to evaluate a state's education system, the scores of 100 of the state's students were randomly selected. These students had an average score of 72. Test at a significance level of 0.05 if there is a significant difference between the state scores and the national scores.

46. (a) Construct the Laspeyre's, Paasche's and Fisher's price index number for the following data. Comment on the result.

Commodities	Base Year		Current Year	
	Price	Quantity	Price	Quantity
Rice	15	5	16	8
Wheat	10	6	18	9
Rent	8	7	15	8
Fuel	9	5	12	6
Transport	11	4	11	7
Miscellaneous	16	6	15	10

(OR)

(b) Construct $\bar{X}$ and R charts for the following data:

Sample Number	Observations		
1	32	36	42
2	28	32	40
3	39	52	28
4	50	42	31
5	42	45	34
6	50	29	21
7	44	52	35
8	22	35	44

(Given for n = 3. A_2 = 0.58. D_3 = 0 and D_4 = 2.115)

47. (a) Find the optimal solution for the assignment problem with the following cost matrix.

		Area			
		1	2	3	4
	P	11	17	8	16
Salesman	Q	9	7	12	6
	R	13	16	15	12
	S	14	10	12	11

(OR)

(b) Explain Vogel's approximation method by obtaining initial feasible solution of the following transportation problem.

	D_1	D_2	D_3	D_4	Supply
O_1	2	3	11	7	6
O_2	1	0	6	1	1
O_3	5	8	15	9	10
Demand	7	5	3	2	

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