Marking Scheme Applied Mathematics

Term - I Code-241

Section - A 1 c 5 O ₈ 11 = (5 × 11) mod 8 = 55 mod 8 = 7 2 a For distinct x, y > 0; AM > GM ⇒ $\frac{x+y}{2}$ > \sqrt{xy} ⇒ x + y > 2 \sqrt{xy} 3 c Let x be the speed of the stream ∴ 8 + x = 3(8 - x) ⇒ 4x = 16 ⇒ x = 4km/h 4 d Since 3[(x + 4)is true for x = 35 5 d adj(A) = A ^{n-1} ⇒ adj(A) = (-2)^2 = 4 6 a The summation of product of aij of 2 nd column with corresponding cij of 3 column = 0 7 c AB = 12 ⇒ A B = 12 ⇒ -4 A = 12 ⇒ A = -3 B = 12 8 a If Δ= 0 and at least (one of Δx, Δy, Δz) ≠ 0 The system of linear equations has no solution 9 9 c $C(x) = x^2 + 30x + 1500$ MC when 10 units are produced = C'(10) = ₹50 10 c $y = \frac{1}{x} ⇒ \frac{dy}{dx} = -\frac{1}{x^2} < 0$ for $(-∞, 0)$ and $(0, ∞)$ 11 b y = x ³ + x ⇒ $\frac{dy}{dx}$ = 3x² + 1 ⇒ $\frac{dy}{dx}$ x = 4 ∴ Equation to target is $y - 2 = 4(x - 1) \Rightarrow 4x - y = 2$ 12 b Expected number of votes=np = $\frac{70}{100}$ x 120000 = 84000 13 d	Q.N.	Correct	Hints/Solutions
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column =0 7			$ adj(A) = A ^{n-1} \Rightarrow adj(A) = (-2)^{n-2} = 4$ The supposition of product of x_1 of 2^{nd} column with corresponding x_2 of 2^{nd}
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8 a If $\Delta=0$ and at least $(one\ of\ \Delta_x,\ \Delta_y,\ \Delta_z)\neq 0$ The system of linear equations has no solution 9 c $C(x)=x^2+30x+1500$ $MC=C'(x)=2x+30$ $MC\ when 10\ units\ are\ produced=C'(10)=₹50$ 10 c $y=\frac{1}{x}\Rightarrow\frac{dy}{dx}=-\frac{1}{x^2}<0\ for\ (-\infty,0)and\ (0,\infty)$ 11 b $y=x^3+x\Rightarrow\frac{dy}{dx}=3x^2+1\Rightarrow\left(\frac{dy}{dx}\right)_{x=1}=4$ \therefore Equation to target is $y-2=4(x-1)\Rightarrow 4x-y=2$ 12 b Expected number of votes= $np=\frac{70}{100}\times120000=84000$ 13 d The total area under the normal distribution curve above the base line is 1 14 c $\sum p_i=1\Rightarrow 7k=1\Rightarrow k=\frac{1}{7}$ Now, $P(x\geq 3)=3k=\frac{3}{7}$ 15 b For Poisson distribution Mean = variance = $np=20000\times\frac{1}{10000}=2$ 16 d $\sum_{k=0}^{\infty}\frac{e^{-k}\lambda^k}{k_1}=$ Total probability = 1 17 b $p=0.05=\frac{1}{20}, q=\frac{19}{20}$ $P(x\geq 1)=1-P(0)=1-6_{c_0}(\frac{1}{20})^0(\frac{19}{20})^6=1-(\frac{19}{20})^6$ 18 c In Laspeyre's price index the weight are taken as base year quantities	7		
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11 b $y = x^3 + x \Rightarrow \frac{dy}{dx} = 3x^2 + 1 \Rightarrow \left(\frac{dy}{dx}\right)_{x=1} = 4$ \therefore Equation to target is $y - 2 = 4(x - 1) \Rightarrow 4x - y = 2$ 12 b Expected number of votes= $np = \frac{70}{100} \times 120000 = 84000$ 13 d The total area under the normal distribution curve above the base line is 1 14 c $\sum p_i = 1 \Rightarrow 7k = 1 \Rightarrow k = \frac{1}{7}$ Now, $P(x \ge 3) = 3k = \frac{3}{7}$ 15 b For Poisson distribution Mean = variance = $np = 20000 \times \frac{1}{10000} = 2$ 16 d $\sum_{k=0}^{\infty} \frac{e^{-\lambda k}}{k_1} = \text{Total probability} = 1$ 17 b $p = 0.05 = \frac{1}{20}, q = \frac{19}{20}$ $P(x \ge 1) = 1 - P(0) = 1 - 6c_0(\frac{1}{20})^0(\frac{19}{20})^6 = 1 - (\frac{19}{20})^6$ 18 c In Laspeyre's price index the weight are taken as base year quantities	10	С	
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18 c In Laspeyre's price index the weight are taken as base year quantities			20 20
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19 a $P_{01}^P = \frac{\sum p_1 q_1}{1} \times 100 = \frac{506}{1} \times 100 = 112.19$		C	In Laspeyre's price index the weight are taken as base year quantities
	19	а	$P_{01}^{P} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100 = \frac{506}{451} \times 100 = 112.19$
$\Sigma p_0 q_1$ 451 20 c Marshall- Edgeworth formula uses the arithmetic mean of the base and	20	C	
current year quantities.	20	•	

		Section –B
21	С	Since Vijay is faster by 4 secs.
		∴ he beats Samuel by = $\frac{100}{16}$ × 4 = 25 meters
22	b	∴ 876 (mod24) = 12
		∴ 8.40 PM will change to 8.40 AM after 12 hours, further after 30 minutes the time
		will be 9.10 AM
23	b	Let total capital be = x & let C's contribution = y , B's contribution = $\frac{x}{3}$, A's
		Contribution = $\frac{x}{3} + y$.
		Now (A+B+C)'s contribution = $x \Rightarrow x = 6y$
		hence their contribtions are $2y + y$: $2y$: y i. e., in the ratio 3 : 2 : 1
24	d	The relation R_m defined as $a \equiv b \pmod{m}$ is reflexive, symmetric and transitive
		∴ R _m is an equivalent relation
25	b	Time ratio = 2 : 3 : 4
		Profit sharing ratio = 6: 7: 8
		Investment ratio = $\frac{6}{2}$: $\frac{7}{3}$: $\frac{8}{4}$ ($\frac{Profit}{Time}$)
		= 9: 7:6
26	С	$2a+b+c-3d=b+c (\because a=d=0)$
		$= b + (-b)(\because c = -b)$ $= 0$
27	d	$3 \cdot 1 - a_{11}, 1 - a_{22} > 0$ and $ I - A > 0$ and it
		is true only for $\begin{pmatrix} 0.3 & 0.2 \\ 0.1 & 0.5 \end{pmatrix}$
		(0.1 0.5)
28	С	y = x has a sharp point at $x = 0$
		y = x is continuous but not differentiable at $x = 0$
29	а	$\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{2a}{2at} = \frac{1}{t} \Longrightarrow \frac{d^2y}{dx^2} = -\frac{1}{t^2} \times \frac{dt}{dx} = -\frac{1}{2at^3}$
30	С	$TC = VC + FC = x^2 + 2x + 10000$
		$AC = x + 2 + \frac{10000}{x}$
		$\frac{d(AC)}{dx} = 1 - \frac{10000}{x^2} = 0 \Rightarrow x = 100$
31	a	$\frac{dx}{\text{Prize }(x_i)} \frac{x^2}{p_i} \frac{x_i p_i}{x_i p_i}$
	-	$\frac{1}{500000} \frac{p_l}{\frac{1}{100000}} = \frac{50}{500000}$
		10000
		$0 \frac{9999}{10000} 0$
		So, $\sum x_i p_i = 50$
		Net expected gain = 50 - 100 = -50 So gain is -50
32	С	$P(r < 2) = P(0 \text{ or } 1) = 10_{C_0} (\frac{1}{2})^{10} + 10_{C_1} (\frac{1}{2})^{10} = \frac{1+10}{1024} = \frac{11}{1024}$
		$F(I < Z) = F(0 \ 0I \ I) = 10_{C_0} {\binom{-2}{2}} + 10_{C_1} {\binom{-2}{2}} - \frac{1024}{1024}$
	d	$n = 100, \ p = \frac{1}{10}, q = \frac{9}{10}$
33		10 - 10
		$\sigma = \sqrt{npq} = \sqrt{100 \times \frac{1}{10} \times \frac{9}{10}} = 3$
34	а	P(x > 518) = 1 - p(x < 518)
		= 1 - P(z < 1) = 1 - 0.8413
0.5	1_	= 0.1587
35	b	P(x < 54) = P(z < 1.5) = 0.9332
		= 0.9332 = 93.32 %
		- 75.52 70

36	b	$\frac{\sum P_1}{\sum P_0} \times 100 = \frac{340}{300} = 113.34$
37	b	$P_{01}^F = \sqrt{(P_{01}^L \times P_{01}^P)} = \sqrt{118.4 \times 117.5} = 117.95$
38	С	Since, $L: P = 28: 27$, $\therefore \frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_0 q_1}{\sum p_1 q_1} = \frac{28}{27}$
39	а	
		$\frac{\sum \left(\frac{p_1}{p_0}\right) (p_0 q_0)}{\sum (p_0 q_0)} \times 100$
40	d	Time reversal Test is satisfied by Fishers ideal index
41	а	C = -5% $d = 10%$ $m = 7%$
		(d-m): (m-c)=1:4
40		Quantity sold at 10 % profit = $\frac{4}{5} \times 250 = 200 \text{ Kg}$
42	d	Portion of cistern filled by both pipes in 1 hour = $\frac{1}{8} + \frac{1}{12} = \frac{5}{24}$.
		Time taken by both pipes to fill the cistern = 4 h 48 mints
		Time taken to fill tank due to leakage = 5 h
		Work done by leakage in 1 h= $\frac{5}{24} - \frac{1}{5} = \frac{1}{120}$
40		Time taken by leakage to empty the tank=120 h
43	а	$TR = px = \frac{75x - x^2}{3}$
		$P = TR - TC = \frac{75x - x^2}{3} - (3x + 100)$
		$\frac{dP}{dx} = 22 - \frac{2}{3}x = 0 \Longrightarrow x = 33$
44	d	$\frac{dx}{dx} = \frac{2}{3}x - 0 \longrightarrow x - 33$
44	u	$P(X \ge 1) = 1 - P(0) = 1 - \frac{e^{-2}(2)^0}{0!}$
45		$= 1 - e^{-2} = 0.8647$ $P (10 < x < 30)$
45	С	P(10 < X < 30) = P(-2.5 < Z < 2.5)
		= P(z < 2.5) - P(z < -2.5)
		= 0.9876
46	b	Since elements of technology matrix a_{ij} , represents units of sector i to
		produce 1 unit of sector j
		$\therefore \begin{pmatrix} 0.50 \\ 0.10 \end{pmatrix}$ is the technology matrix
47	С	$I - A = \begin{pmatrix} 0.50 & -0.25 \\ -0.10 & 0.75 \end{pmatrix} \Longrightarrow (I - A)^{-1} = \frac{20}{7} \begin{pmatrix} 0.75 & 0.25 \\ 0.1 & 0.5 \end{pmatrix}$
		7 (0.1
		$=\frac{1}{7}\begin{pmatrix} 15 & 5 \\ 2 & 10 \end{pmatrix}$
48	b	$=\frac{1}{7}\binom{15}{2} \qquad \qquad \frac{5}{10}$ System is viable if $ I-A >0$ and
		$1 - a_{11} > 0$, $1 - a_{22} > 0$
40		(-), 1 - 1 (15 5) (7000) (25000)
49	a	$X = (I - A)^{-1}D = \frac{1}{7} {15 \choose 2} {10 \choose 14000} = {25000 \choose 22000}$
50	d	Internal consumption=total production-external demand
		$=\binom{25000}{22000} - \binom{7000}{14000} = \binom{18000}{8000}$
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