MARCH-2024

STD:12 - BUSINESS MATHEMATICS

21. $(A,B) \sim \begin{pmatrix} 3 & -2 & 6 \\ 0 & 0 & -2 \end{pmatrix}$
$P(A) \neq P(A|B)$

22. $\int \frac{1}{2}(1-\cos 2x)\,dx$
$= \frac{1}{2}\left(x - \frac{\sin 2x}{2}\right) + c$

23. $P = 122 - 5x - 2x^2$
$P_0 = 122 - 5(20) - 2(20)^2$ — 2

24. $\frac{dy}{dx} = e^{ax+by} \Rightarrow e^{-by}dy = e^{ax}dx$
$\Rightarrow \frac{e^{ax}}{a} = -\frac{e^{-by}}{b} + c$ — 2

25. $= \Delta(e^{x+h} - e^x) = \Delta e^x(e^h - 1)$
$= (e^h - 1)^2 e^x$

26. $p = 1/5, q = 4/5, n = 25$
$P(X=x) = 25C_x \left(\frac{1}{5}\right)^x \left(\frac{4}{5}\right)^{25-x}$

27. $n = 50 \quad \bar{x} = 6.3 \quad \sigma = 6$
$SE = \sqrt{\frac{n^2}{2n}} = 0.6$

28. It is general tendency of time series to increase or decrease or stagnates during a long period of time. — 2

29. The transportation Problem is to determine the amount to be transported from each origin to each destinations such that the total transportation cost is minimized. — 2

30. $V(X) = E(X^2) - [E(X)]^2$
$V(X) = E(X^2)$

III
31. $(A\ B)\begin{pmatrix} 0.9 & 0.1 \\ 0.3 & 0.7 \end{pmatrix} = (A\ B)$
$0.9A + 0.3B = A$
$A = 75\% \quad B = 25\%$

32. $\int \frac{1}{\sqrt{x+1}+\sqrt{x-1}} \times \frac{\sqrt{x+1}-\sqrt{x-1}}{\sqrt{x+1}-\sqrt{x-1}}\,dx$
$\int \frac{\sqrt{x+1}-\sqrt{x-1}}{2}\,dx$
$= \frac{1}{3}\left[(x+1)^{3/2} - (x-1)^{3/2}\right] + c$

33. $P = \tan x, Q = \cos^3 x, I.F = \sec x$
$y(I.F) = \int Q.(I.F)\,dx + c$
$= \frac{1}{2}\left(x + \frac{\sin 2x}{2}\right) + c$

34. $\Delta^4 U_0 = (E-1)^4 U_0$
$= U_4 - 4U_3 + 6U_2 - 4U_1 + U_0$
$\Delta^4 U_0 = 0$

35. Maximin $(40, -20, -40) = 40$ S_1
Minimax $(60, 10, 150) = 10$ S_2 — 3

36. $p = 0.4, q = 0.6, n = 5$
(i) $P(X=1) = 0.2592$
(ii) $P(X \geq 1) = 0.9222$

37. $n = 100 \quad \bar{x} = 7.4 \quad S = 1.2$
$S.E = \frac{\sigma}{\sqrt{n}} = \frac{1.2}{\sqrt{100}} = 0.12$
$\bar{x} - z_{\alpha/2}\frac{\sigma}{\sqrt{n}} \leq \mu \leq \bar{x} + z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$
$7.165 \leq \mu \leq 7.635$

38. $UCL = \bar{\bar{x}} + 3\frac{\sigma}{\sqrt{n}} = 0.534$
$CL = \bar{\bar{x}} = 0.532$
$LCL = \bar{\bar{x}} - 3\frac{\sigma}{\sqrt{n}} = 0.5293$

39. $f(x) = F'(x) = \begin{cases} 4k(x-1)^3 & 1 \leq x \leq 3 \\ 0 & \text{otherwise} \end{cases}$
$k = \frac{1}{16}$
$f(x) = \frac{1}{4}(x-1)^3, \quad 1 \leq x \leq 3$

40. $A = -\int_{-3}^{-1}(x+1)\,dx + \int_{-1}^{3}(x+1)\,dx$
$= 10$ Sq. units

IV
A1
a. $x+y+z = 8500$
$2x+3y+6z = 38000$
$x+y-z = 0$
$\Delta = -2 \neq 0, \Delta x = -500$
$\Delta y = -8000 \quad \Delta z = -8500$
$x = 250, y = 4000 \quad z = 4250$ — 3

b. $\Sigma y = 1186, N = 7, \Sigma x^2 = 28$
$\Sigma xy = 92$ — 2
$a = \frac{\Sigma y}{n} = 169.428$
$b = \frac{\Sigma xy}{\Sigma x^2} = 3.2857$
$y = ax + b, \quad y = 169.428 + 3.2857x$

42 a. $= \frac{A}{x+1} + \frac{B}{(x+1)^2} + \frac{C}{x-3}$
$= \frac{1}{x+1} - \frac{2}{(x+1)^2} + \frac{3}{x-3}$ — 2
$= \int \frac{dx}{x+1} - 2\int \frac{dx}{(x+1)^2} + 3\int \frac{dx}{x-3}$
$= \log|x+1| + 3\log|x-3| + \frac{2}{x+1} + c$

b. $\mu = 68 \quad \sigma = 3 \quad Z = \frac{x-\mu}{\sigma}$ — 2
(i) $P(X > 72) = 1.33$
$= 0.0918 \times 500 = 45.9$
(ii) $P(X < 64) = -1.33$
$0.0918 \times 500 = 45.9$
(iii) $P(65 < X < 71) = P(-1 < Z < 1)$
$= 0.6826 \times 500 = 341.37$

43 a. $C(x) = 50x + \frac{x^2}{100} + 200$
$R(x) = 60x$
$P = R - C \Rightarrow P = 10x - \frac{x^2}{100} - 200$
$\frac{d^2P}{dx^2} = \frac{-1}{50} < 0$
Max profit $P = 10(500) - \frac{500^2}{100} - 200$
$= 2300$

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b.

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

Total Demand = T. supply = 17
cost = 2+15+1+30+45+9 = 102 — 3

44 a. $\frac{dy}{dx} = \frac{y^2 - 2xy}{x^2 - 2xy}, \quad y = vx \Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$
$x\frac{dv}{dx} = \frac{3v^2 - 3v}{1-2v} \Rightarrow \int \frac{(2v-1)dv}{v^2-v} = -\int \frac{dx}{x}$
$(y^2 - xy)x = c$

b. $\Sigma P_0 q_0 = 1220, \Sigma P_0 q_1 = 1600, \Sigma P_1 q_0 = 1784$
$\Sigma P_1 q_1 = 1784 \quad P_{01}^F = 110.206$
$P_{01} \times P_{10} = 1$, $P_{01} \times Q_{10} = \frac{1784}{1220}$

45 a. $I = \int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x}dx, \quad I = \int \frac{\cos x}{\cos x + \sin x}dx$
$2I = \int_0^{\pi/2} dx \Rightarrow 2I = \pi/2, \quad I = \pi/4$

b.

x	y	∇y	$\nabla^2 y$	$\nabla^3 y$
0	1			
1	2	1		
2	4	2	1	
3	7	3	1	0
4	11	4	1	0
5	16	5	1	0
6	22	6	1	0
7	29	7		

$y = y_n + \frac{n}{1!}\nabla y_n + \frac{n(n+1)}{2!}\nabla^2 y_n + \cdots$
$x_n = 7, \quad h = 1 \quad n = x - 7$
$y = \frac{1}{2}(x^2 + x + 2)$ — 2

46 a. $k = 1/10$
$P(X < 6) = \frac{81}{100}$
$P(X \geq 6) = \frac{19}{100}$
$P(0 < x < 5) = 4/5$, $P(x \leq x_e) > 1/2$ is 4

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46 b.

$n = 400 \quad \bar{x} = 67.47$

$\mu = 67.39 \quad \sigma = 1.30$

$H_0 : \mu = 67.39$ — 1

$H_1 : \mu = 67.39$ — 1

$|z| = 1.2308 < 1.96$ — 2

H_0 is accepted — 1

47. a.

$3m^2 + m - 14 = 0$ — 1

$CF = Ae^{-7/3x} + Be^{2x}$ — 1

$PI_1 = -\frac{4}{14} = \frac{-2}{7}$ — 1

$PI_2 = xe^{-7/3x}$ — 1

$Y = CF + PI_1 + PI_2$

$Y = Ae^{-7/3x} + Be^{2x} - \frac{2}{7} + xe^{-7/3x}$ — 1

b.

$n = 4 \quad p = 0.18 \quad q = 0.82$ — 1

$P(X = x) = {}^nC_x p^x q^{n-x}$ — 1

(i) $P(X = 1) = 0.3969$ — 1

(ii) $P(x \geq 0) = 0.45212$ — 1

(iii) $P(X \leq 2) = 0.9797$ — 1

PART-I

1	a	259. units
2	c	$(e-1)$ sq-units
3	a	0.0613
4	c	0.0547
5	c	$2x+3$
6	d	1
7	b	1 or 0
8	b	Equal to $m+n-1$
9	a	A has atleast one minor of order r which does not vanish
10	b	$\left(\frac{-\Delta_1}{\Delta_2}, \frac{-\Delta_1}{\Delta_3}\right)$
11	a	Harper
12	d	Sufficient
13	d	$-\cos x + c$
14	c	$\frac{\sqrt{\pi}}{2}$
15	b	7
16	a	one
17	a	2 and 1
18	d	$Y = \sin x + c$, c is arbitrary constant
19	a	Four
20	a	$\bar{x}$ - chart