SECOND YEAR HIGHER SECONDARY EXAMINATION MARCH 2019

SUBJECT : STATISTICS

CODE. NO: SY 32

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
1		(i) – (b) (ii) – (d) (iii) – (a) (iv) – (c)	½ each	2
2	(a)	(iii) 0.99	1	
	(b)	(i) Normal	1	2
3	(a)	Definition	1	
	(b)	Definition	1	2
4	(i)	$P[X>4] = \frac{5}{15}$ or $\frac{1}{3}$ or $P[X=5]$	1	
	(ii)	$P[0<x<2] = \frac{1}{15}$ or $P[X=1]$	1	2
5		Any four Properties	½ each	2
6		1. Assignable causes of variations or Treatment or Between sample variations 2. Chance or random or error or irregular variations	1 each	2
7		Out of control or control chart only (1 mark)	2	2

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8		$b_{yx} = 9/4 = 2.25$ $b_{xy} = 6/25 = 0.24$ $r = I\sqrt{b_{xy} x b_{yx}}$ $= \sqrt{\frac{54}{100}} = \pm 0.7348$	1 1 ½ ½	3
9	(a)	(i) 46	1	3
	(b)	$E(x) = \int_0^1 x f(x)\,dx$ $= \int_0^1 x \cdot 3x^2\,dx = \int_0^1 3x^3\,dx$ $= 3\left[\frac{x^4}{4}\right]_0^1$ $= 3/4$	½ ½ ½ ½	
10	(a)	(i) 15	1	3
	(b)	$P[10 < X < 15] = P\left[\frac{10-8}{4} < \frac{X-M}{\sigma} < \frac{15-8}{4}\right]$ $= P[0.5 < Z < 1.75]$ $= 0.4599 - 0.1915$ $= 0.2684$	1 ½ ½	
11		$H_0: M = 16345$, $H_1: M \neq 16345$ $\bar{x} = 15500$, $n = 100$, $S = 1245$, $\alpha = 0.05$ The test statistic is $Z = \frac{\bar{x} - M_0}{S/\sqrt{n}} \sim N(0,1)$	½ ½ ½	

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
		$Z = \frac{15500 - 16345}{\frac{1245}{10}} = -6.787$	½	
		$\therefore \lvert Z \rvert = 6.787 > Z_{\alpha/2} = 1.96$,	½	3
		Reject H_0.	½	
		(The claims cannot be accepted)		
		[Full score for correct judgement using one-tailed test. For one-tailed, $Z_\alpha = 1.645$]		
12		Missing values are		
		d.f = 12 SS = 190, MSS = 11.67	2	
		F = 8.14 (½ score each)		
		Here F = 8.14 > 3.88	½	3
		∴ Reject H_0. (The effects of fertilisers are not equal)	½	
13		$CL = \bar{\bar{x}} = \frac{\Sigma \bar{x}}{m} = \frac{62.52}{20} = 3.126$	½	
		$\bar{R} = \frac{\Sigma R}{m} = \frac{0.18}{20} = 0.009$	½	
		$LCL = \bar{\bar{x}} - A_2 \bar{R} = 3.12$	1	3
		$UCL = \bar{\bar{x}} + A_2 \bar{R} = 3.13$	1	

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14		$\Sigma P_1 q_0 = 977$, $\Sigma P_0 q_0 = 709$	1	
		Consumer price Index $= \frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100$	1	3
		$= \frac{977}{709} \times 100 = 137.8$	1	
		(For proper identification of P_0, P_1, q_0 give $\frac{1}{2}$ mark each)		
15				

x	y	x^2	y^2	xy
17	40	289	1600	680
47	45	2209	2025	2115
23	25	529	625	575
48	45	2304	2025	2160
35	20	1225	400	700
170	175	6556	6675	6230

2

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{n\Sigma x^2 - (\Sigma x)^2} \times \sqrt{n\Sigma y^2 - (\Sigma y)^2}}$$ 1

$$= \frac{5 \times 6230 - 170 \times 175}{\sqrt{5 \times 6556 - (170)^2} \times \sqrt{5 \times 6675 - (175)^2}}$$ $\frac{1}{2}$

$$= \underline{\underline{0.43}}$$ $\frac{1}{2}$

4

(Full score for calculation using Rank correlation)

[$cov(x,y) = 56$, $\sigma_x^2 = 155.2$, $\sigma_y^2 = 110$]

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
16	(a)	(ii) $-\frac{1}{2}$	1	
	(b)	$C'(x) = 20 - \frac{500}{x^2}$	$\frac{1}{2}$	
		$C''(x) = \frac{1000}{x^3}$	$\frac{1}{2}$	
		$C'(x) = 0 \Rightarrow 20 - \frac{500}{x^2} = 0$	$\frac{1}{2}$	4
		$\Rightarrow x = \pm 5$		
		$C''(5) > 0 \therefore x = 5$ is a point of minimum.	$\frac{1}{2}$	
		$\therefore$ Minimum cost $= 20 \times 5 + \frac{500}{5} + 12$		
		$= 212$	1	
		[For Correct procedure give full score - 3 marks]		
17	(a)	(ii) 2	1	
	(b)	x - no. of defective items, $x \sim$ Binomial		
		$n = 5, \quad p = 0.1$		
		$f(x) = {}^nC_x\, p^x q^{n-x}, \quad x = 0, 1, 2 \cdots n$	$\frac{1}{2}$	
		$= {}^5C_x (0.1)^x (0.9)^{5-x}, \quad x = 0, 1, \cdots 5$	$\frac{1}{2}$	4
		(i) $P[X = 3] = {}^5C_3 (0.1)^3 (0.9)^2 = 0.0081$	1	
		(ii) $P[X \geq 1] = 1 - P[X = 0] = 0.40951$	1	
		[Identification as Binomial distribution give 1 score]		
		[attempting the problem using poisson Probability give $\frac{1}{2}$ score]		

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
18	(a)	(ii) chi-square with 1 d.f	1	
	(b)			

Sample No	Sample	Sample mean
1	(8,9)	8.5
2	(8,13)	10.5
3	(8,15)	11.5
4	(8,16)	12
5	(9,13)	11
6	(9,15)	12
7	(9,16)	12.5
8	(13,15)	14
9	(13,16)	14.5
10	(15,16)	15.5
		122

1+1

Mean of Sample mean $= \frac{122}{10}$ ½

$= 12.2$ ½

(Calculation of Population mean give 1 score)

4

19. $V(T_1) = V\left(\frac{x_1+x_2+x_3+x_4}{4}\right) = \frac{4\sigma^2}{16} = \sigma^2/4$ 1

$V(T_2) = V\left(\frac{2x_1+2x_2+x_3}{5}\right) = \frac{9\sigma^2}{25}$ 1

$V(T_1) < V(T_2)$ 1

$\therefore T_1$ is more efficient than T_2 1

4

Qn No	Sub Qns	Answer Key/Value Points	Score	Total

20

Year	Production	3 yearly Moving Total	3 yearly Moving Average
2011	60	–	–
2012	72	207	69
2013	75	212	70.67
2014	65	220	73.33
2015	80	230	76.67
2016	85	260	86.67
2017	95	–	–

Score: 2+2 | Total: 4

21 (a) It considers both current year and base year values.
or
It is free from bias
or
It is the GM of Laspeyre's and Paasche's Index numbers.

Score: 1

(b)

Commodities	P_0	q_0	P_1	q_1	P_0q_0	P_0q_1	P_1q_0	P_1q_1
A	2	40	5	75	80	150	200	375
B	4	16	8	40	64	160	128	320
C	1	10	2	24	10	24	20	48
D	5	25	10	60	125	300	250	600
					279	634	598	1343

Score: 2

Qn No	Sub Qns	Answer Key/Value Points	Score	Total
		Fisher's I.N $= \sqrt{\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1}} \times 100$	1	
		$= \sqrt{\frac{598}{279} \times \frac{1343}{634}} \times 100$	½	5
		$= 213.07$	½	
		OR $L = 214.34$ (1) $F = \sqrt{L \times P}$ (1) $P = 213.83$ (1)		
22	(a)	(ii) 1	1	
	(b)	Average of I group $= \frac{216}{3} = 72$	1	
		Average of II group $= \frac{330}{3} = 110$	1	5
		Drawing graph [Trend calculation using any other methods give 3 score]	2	
23		$x \rightarrow$ scores of the students. $\mu = 42, \sigma = 24$		
		a) $P[X > 50] = P[Z > 0.33] = 0.3707$	1	
		No. of students = 371	½	
		b) $P[30 < X < 54] = P[-0.5 < Z < 0.5] = 0.383$	1½	
		No. of students = 383	½	5
		c) $P[X < 40] = P[Z < -0.083] = 0.4681$	1	
		No. of students = 468	½	
		[For any two correct answers give full score]		