ANSWER KEY

SECOND YEAR HIGHER SECONDARY EXAMINATION MARCH 2022

PART-~~I~~/II/III

SUBJECT: STATISTICS

CODE NO: SY 32 VERSION: ____

60 SCORES 2 HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1		(a) 0	1	1
2		(b) 1	1	1
3		(d) Walter A. Schewhart	1	1
4		(c) $E(x)=4$ and $V(x)=4$	1	1
5.		(a) 1	1	1
6.		(d) Sampling	1	1
7.		(b) 15, 15	1	1
8		(d) 124.9	1	1
9		(c) 1.75	1	1
10.		$3x^2+1$	1	1
11.		(d) 16	1	1
12.		(b) 12	1	1
13.		$Z_1 = 1.44$	1	1
14		(i) – (d), (ii) – (c), (iii) – (b), (iv) – (a)	$\frac{1}{2} \times 4$	2
15.		$UCL = \bar{\bar{x}} + A_2\bar{R} = 16.2 + 0.577 \times 7.4 = 20.47$ $LCL = \bar{\bar{x}} - A_2\bar{R} = 16.2 - 0.577 \times 7.4 = 11.93$ [If $CL = \bar{\bar{x}} = 16.2$ only, give 1 score]	$\frac{1}{2}+\frac{1}{2}$ $\frac{1}{2}+\frac{1}{2}$	2.
16	(a)	Type I error – definition	1	2
	(b)	Type II error – definition	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
17		$y-\bar{y} = b_{yx}(x-\bar{x})$	½	2
		$y-27 = -1.5(x-53)$	½	
		when $x=60$, $y-27 = -1.5(60-53)$	½	
		$y = 16.5$	½	
18		Point estimation – Definition / Example / Explanation	1	2
		Interval estimation – Definition / Example / Explanation	1	
19.		$Z = \frac{X-\mu}{\sigma} = \frac{X-68}{\sigma} \sim N(0,1)$	½	2
		$P(X>72) = P\left(Z > \frac{72-68}{\sigma}\right) = 0.1587$	½	
		$\frac{4}{\sigma} = 1$	½	
		$\sigma = 4$	½	
20		Solving the equations	1	2
		$\bar{x}=1$, $\bar{y}=2$	½+½	
21	(a)	$\int 8\,dx = 8x+C$ / $8x$	1	3
	(b)	$\int_0^1 (x+1)\,dx = \left[\frac{x^2}{2}+x\right]_0^1$	1	
		$= \left(\frac{1}{2}+1\right)-(0)$	½	
		$= 1.5$	½	
22		$\mu = 50$, $\sigma = 10$	½	3
		$Z = \frac{X-\mu}{\sigma} = \frac{X-50}{10}$ ~~$\sim N(0,1)$~~	½	
		$P(X<70) = P\left(Z < \frac{70-50}{10}\right) = P(Z<2)$	1	
		$= 0.5 + 0.4772 = 0.9772$	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
23.	(a)	Population mean = 12.2	1	
	(b)			

S/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
	Total	122

E(sample mean) $= \frac{122}{10} = 12.2$

$= $ Population mean

$1\frac{1}{2}$ | 3

$\frac{1}{2}$

24						

Year	No. of books	3 yearly Moving Total	3 yearly Moving average
2015	15	—	—
2016	28	73	24.33
2017	30	86	28.67
2018	28	84	28
2019	26	86	28.67
2020	32	—	—

(3 yearly moving total only give 2 scores)

3 | 3

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
25.		R_1 | R_2 | $d=R_1-R_2$ | d^2 4 | 3 | 1 | 1 2.5 | 4 | −1.5 | 2.25 5 | 1 | 4 | 16 1 | 5 | −4 | 16 2.5 | 2 | 0.5 | 0.25 | | | 35.5 [Tied ranks need not be considered]	1½	
		$CF = \sum \frac{m^3-m}{12} = \frac{2^3-2}{12} = 0.5$	½	3
		$\rho = 1 - \frac{6(\Sigma d^2 + CF)}{n^3-n}$	½	
		$= 1 - \frac{6(35.5+0.5)}{5^3-5} = -0.8$	½	
26.		$F(x) = P(X \le x) = \int_{-\infty}^{x} f(x)\,dx$	2	
		$= \begin{cases} 0, & x<0 \\ x^2, & 0<x<1 \\ 1, & x \ge 1 \end{cases}$	1	3
27.		$R'(x) = 22 - 2x$	1	
		$R''(x) = -2$	½	
		$R'(x) = 0 \Rightarrow x = 11$	1	3
		Maximum value at $x=11 = 121$	½	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
28.		$b_{xy} = 1.09$	$2\frac{1}{2}$	
		[Using any relevent formula)		
		$x - \bar{x} = b_{xy}(y - \bar{y})$	1	4.
		$x - 6.14 = 1.09\,(y - 4)$	$\frac{1}{2}$	
29.	(a)	$P(1 \le x \le 2) = \frac{1}{6} + \frac{2}{6} = \frac{3}{6} = 0.5$	1	
	(b)	$E(x) = \sum x P(x)$	$\frac{1}{2}$	
		$= 1 \times \frac{1}{6} + 2 \times \frac{2}{6} + 3 \times \frac{3}{6} = \frac{14}{6}$	$\frac{1}{2}$	
		$= 2.33.$		4.
	(c)	$E(x^2) = \sum x^2 P(x) = 6$	1	
		$V(x) = E(x^2) - (E(x))^2$	$\frac{1}{2}$	
		$= 6 - (2.33)^2 = 0.5711$	$\frac{1}{2}$	
		[if $E(x) = \frac{14}{6}$, $V(x) = 6 - \left(\frac{14}{6}\right)^2 = 0.55$]		
30.	(a)	4 condetions $(4 \times \frac{1}{2} = 2)$	2	
	(b)	$np = 6$, $npq = 3.6$	$\frac{1}{2} + \frac{1}{2}$	
		$q = \frac{npq}{np} = \frac{3.6}{6} = 0.6$	$\frac{1}{2}$	4.
		$p = 1 - q = 1 - 0.6 = 0.4$	$\frac{1}{2}$	
31	(a)	Assignable factors		
		— Definition / Examples/	1	
		Explanation		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
	(b)		$4 \times \frac{1}{2} = 2$	4.
		$F < F_{\alpha}$, Accept H_0	1	
32.	(a)	Identification procedure	1	
		Regression line of Y on X – $y - x = 5$	$\frac{1}{2}$	
		Regression line of X on Y – $16x = 9y - 94$	$\frac{1}{2}$	
	(b)	$b_{yx} = 1$, $b_{xy} = \frac{9}{16}$	$\frac{1}{2} + \frac{1}{2}$	4.
	(c)	$r = \pm\sqrt{b_{yx} \times b_{xy}} = \frac{+3}{4}$	$\frac{1}{2} + \frac{1}{2}$	
33.		Expected frequencies – 24.8, 15.2, 37.2, 22.8	$4 \times \frac{1}{2} = 2$	4.
		$\chi^2 = \sum \frac{(O-E)^2}{E} = 1.81$	1+1	
34		$\Sigma x = 46$, $\Sigma Y = 35$, $\Sigma XY = 320$, $\Sigma x^2 = 474$, $\Sigma Y^2 = 265$	$2\frac{1}{2}$	
		$r = \frac{n\Sigma xy - \Sigma x \times \Sigma y}{\sqrt{n\Sigma x^2 - (\Sigma x)^2} \times \sqrt{n\Sigma y^2 - (\Sigma y)^2}}$	1	
		$= \frac{5 \times 320 - 46 \times 35}{\sqrt{5 \times 474 - 46^2} \times \sqrt{5 \times 265 - 35^2}}$	1	

Source	df	SS	MSS	F	$F_{0.05}$
Between	3	18	6	1.2	4.07
Within	8	40	5		
Total	11	58			

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$= \frac{-10}{\sqrt{254} \times \sqrt{100}}$	1	6.
		$= -0.063$	½	
		$(\text{Cov}(x,y) = -0.4,\ \sigma_x = 3.19,\ \sigma_y = 2,\ r = -0.063)$		
35	(a)			

P_0	P_1	$I = \frac{P_1}{P_0} \times 100$
48	48	109.1
38	40	105.3
48	54	112.5
		326.9

1

Simple AM Index No $= \frac{\Sigma I}{n}$ ½

$= \frac{326.9}{3} = 108.97$ ½

(b)

P_0	q_0	P_1	q_1	P_0q_0	P_1q_0
2	20	5	15	40	100
4	4	8	5	16	32
1	10	2	12	10	20
5	5	10	6	25	50
				91	202

2

6

Laspeyre's IN $= \frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100$ 1

$= \frac{202}{91} \times 100 = 221.98$ 1

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
36.	(a)	$V(T_1) = V(2X_1 - 2X_2 + X_3)$	½	
		$= 4\sigma^2 + 4\sigma^2 + \sigma^2 = 9\sigma^2$	½	
		$V(T_2) = V(3X_1 - X_2 - X_3)$	½	
		$= 9\sigma^2 + \sigma^2 + \sigma^2 = 11\sigma^2$	½	
		$V(T_1) < V(T_2)$	½	
		$\therefore T_1$ is more efficient than T_2	½	
	(b)	$H_0: \mu = 50, \quad H_1: \mu \neq 50$	½	6
		$n = 144, \ s = 20, \ \bar{x} = 55, \ \alpha = 0.05$	½	
		$Z = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$	1	
		$= \frac{55 - 50}{20/\sqrt{144}} = 3$	½	
		$\lvert Z \rvert = 3 > Z_{\alpha/2}$. Reject H_0	½