ANSWER KEY

SECOND YEAR HIGHER SECONDARY SAY/IMP EXAMINATION JUNE 2023

PART-~~I/II~~/III

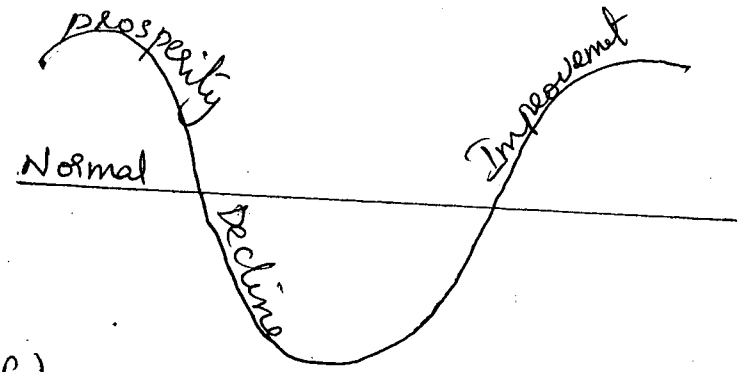
SUBJECT: Statistics

CODE NO: S 2232 VERSION: ~~A~~

60 SCORES 2 HOURS

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
1		x | y | R_1 | R_2 | $d=R_1-R_2$ | d^2 70 | 63 | 3 | 4 | −1 | 1 64 | 75 | 4 | 3 | 1 | 1 58 | 60 | 5 | 5 | 0 | 0 84 | 92 | 2 | 1 | 1 | 1 91 | 85 | 1 | 2 | −1 | 1 $\Sigma d^2 = 4$ $n=5$ $\rho = 1-\frac{6\Sigma d^2}{n(n^2-1)}$ $= 1-\frac{6\times 4}{5(5^2-1)}$ $= 0.8$	1½ ½ ½ ½	3
2		$\Sigma x = 24$, $\Sigma y = 36.6$ Reg. eqn of Y on X is $y-\bar{y} = \frac{n\Sigma xy-\Sigma x\cdot\Sigma y}{n\Sigma x^2-(\Sigma x)^2}(x-\bar{x})$ $y-6.1 = \frac{6\times 209-24\times 36.6}{6\times 156-(24)^2}(x-4)$ Also Consider $Cov(x,y) = 10.43$ $V(x) = 10$ $b_{yx} = 1.04$	½ 1 ½	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		$y - 6.1 = 1.04(x-4)$	1	3
3	(i)	(b) discrete	1	
	(ii)	Properties of distribution function (Any two)	2	3
4	(i)	(c) 31	1	
	(ii)	$f(x) = \begin{cases} 0 & \text{if } x \le 0, x \ge 1 \\ 4x^3 & \text{if } 0 < x < 1 \end{cases}$	2	3
5		Properties (any six) of Normal curve	3	3
6	(i)	$P(-2<Z<3) = P(-2<Z<0) + P(0<Z<3)$	1	
		$= 0.4772 + 0.4987$	½	
		$= 0.9759$	½	
	(ii)	(a) mean = 25, variance = 25	1	3
7	(i)	(a) <	1	
	(ii)	Unbiasedness, consistency, efficiency, sufficiency	2	3
8	(i)	(d) $E(t) \to 0, V(t) \to 0$	1	
	(ii)	$E(T_1) = \mu + \mu - \mu = \mu$	1	3
		$E(T_2) = E\left(\frac{X_1 + X_2}{2}\right) = \frac{1}{2}(\mu+\mu) = \mu$	1	
		$\therefore$ Both T_1 and T_2 are unbiased for μ.		

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
9	(i)	(b) F	1	
	(ii)	Normality, Homogeneity, Independence, Additivity	2	3
10		Source | SS | df | M.SS | F | Fa. Between | 40 | 2 | 20 | 3.33 | 3.89 Within error | 72 | 12 | 6 | | Total | 112 | 14 | | | Calculated value < Table value 3.33 < 3.89. Accept Ho.	2½ ½	3
11	(i)	Seasonal variation	1	
	(ii)	 (OR) Any Suitable Explanation of Cyclical Variation. Prosperity (Boom), Decline Depression, Improvement	2	3
12	(i)	(a) GM.	(1)	
	(ii)	Commodity | Price 2014 (p_0) | Price 2017 (p_1) A | 35 | 51 B | 105 | 122 C | 10 | 18 D | 61 | 60 E | | Total | 230 | 475 441 | | 726	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		Simple aggregate Index number $= \frac{\Sigma P_1}{\Sigma P_0} \times 100$ $= \frac{726}{441} \times 100 = 164.6$	½ ½	3
13		show $2x - y + 1 = 0$ is Reg. eqn of X on Y $3x - 2y + 7 = 0$ is Reg. eqn of Y on X $\bar{x} = 5, \bar{y} = 11$ On putting $x = 2$, y becomes 6.5	1½ 1½ 1	4
14	(i)	(b) $7x^6$	1	
	(ii)	$\left[\frac{4x^4}{4} + \frac{3x^3}{3} + \frac{2x^2}{2} + x\right]_0^2$ $= 2^4 + 2^3 + 2^2 + 2 =$ $= 30$	1 1 1	4
15	(i)	(c) Poisson distribution	1	
	(ii)	mean, $np = 8$ —— (1) variance $npq = 4$ —— (2) solving get $n = 16, p = \frac{1}{2}, q = \frac{1}{2}$ $f(x) = {}^{16}C_x \left(\frac{1}{2}\right)^{16}, x = 0, 1, 2 \ldots 16$ $P(x = 2) = {}^{16}C_2 \left(\frac{1}{2}\right)^{16} = 0.0018$	½ 1½ ½ ½	4

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
16	(i)	a) Normal Distribution - Symmetic about mean	½	
		b) F distribution - Reciprocal of the r.v also follow the same distribution OR (Positively skewed)	½	
		c) Chisquare distribution - positively skewed	½	
		d) Student't distribution - Symmetic about zero	½	
	(ii)			

Sample No	Samples.	Sample mean $\bar{x}$
1	5,7	6
2	5,8	6.5
3	5,9	7
4	7,8	7.5
5	7,9	8
6	8,9	8.5
	Total	43.5

1

Mean of Sample means $= \frac{43.5}{6}$

$= 7.25$

1 — 4

17		Definition of		
		a) Type I error	1	
		b) Type II error	1	4
		c) Power of the test	1	
		d) Critical region	1	

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score

18

Year	Income	4 yrly moving total	4 yrly moving average	4 yrly moving average centered
2002	120			
2003	129	501	125.25	125.5
2004	130	503	125.75	125.9
2005	122	504	126	127.4
2006	122	515	128.75	129.4
2007	130	520	130	132
2008	141	536	134	
2009	127			
2010	138			

Score: 4 — Total Score: 4

19 (i) (C) −1 and +1 — Score: 1

(ii)

X	Y	XY	X^2	Y^2
22	33	726	484	1089
37	35	1295	1369	1225
28	37	1036	784	1369
31	42	1302	961	1764
34	45	1530	1156	2025
35	40	1400	1225	1600
40	32	1280	1600	1024
25	50	1250	625	2500
252	314	9819	8204	12596

Score: 2

$n = 8$

$$r = \frac{n\Sigma xy - \Sigma x \cdot \Sigma y}{\sqrt{n\Sigma x^2 - (\Sigma x)^2}\sqrt{n\Sigma y^2 - (\Sigma y)^2}}$$ — Score: 1

$$= \frac{8 \times 9819 - 252 \times 314}{\sqrt{8 \times 8204 - (252)^2}\sqrt{8 \times 12596 - 314^2}} = 0.268$$ — Score: 1

Total Score: 5

(OR) $r = Cov(x, y) / \sigma_x \cdot \sigma_y$ Formula should be considered.

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
20	(i)	np chart	1	
	(ii)	mean $\overline{\overline{x}} = \frac{421}{10} = 42.1$		
		$\overline{R} = \frac{38}{10} = 3.8$	1	
		$A_2 = 0.577$		
		$C.L = \overline{\overline{x}} = 42.1$		
		$UCL = \overline{\overline{x}} + A_2\overline{R}$		
		$= 42.1 + 0.577 \times 3.8$	1	
		$= 44.29$		
		$LCL = \overline{\overline{x}} - A_2\overline{R}$		
		$= 42.1 - 0.577 \times 3.8$		
		$= 39.91$	1	
		Process is out of control regarding process mean since three sample points fall beyond the control limits.	1	5
21				

Commodity	Base Year p_0	q_0	Current p_1	q_1	p_0q_0	p_0q_1
A	3	40	5	75	120	225
B	5	15	6	40	75	200
C	2	16	2	22	32	44
D	5	22	12	50	110	250
				Total	337	719

1

C

Qn. No	Sub Qns	Answer Key/Value Points	Score	Total Score
		P_1q_0 | P_1q_1 200 | 375 90 | 240 32 | 44 264 | 600 586 | 1259	1	
		Laspeyre's price index $L = \frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100$ $= \frac{586}{337} \times 100 = 173.88$	1	
		Paasche's price index $P = \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1} \times 100$ $= \frac{1259}{719} \times 100 = 175.1$	1	
		Fisher's price index Number $= \sqrt{\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1}} \times 100$ $= \sqrt{173.88 \times 175.1}$ $= 174.49$	1	5

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