

SECOND YEAR HIGHER SECONDARY EXAMINATION MARCH 2023

PART III

SUBJECT: STATISTICS

CODE NO: SY- 532

VERSION:

SCORES: 60

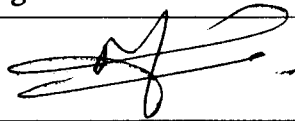


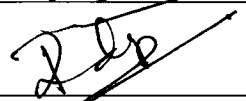

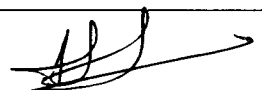
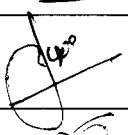
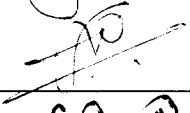
2 HOURS

Qn. No.	Sub Qns	Answer Key / Value Points	Score	Total Score
1		Explanation/graphical presentation of three types of correlation- Positive, Negative, Zero (for writing names only give 1/2 score each)	1+1+1	3
2	(a)	(iii)perpendicular OR (iv) intersect	1	3
	(b)	$b_{xy} = r \frac{\sigma_x}{\sigma_y}$ $1.5 = \frac{0.65 \times 4}{\sigma_y} \Rightarrow \sigma_y = 1.73$	1 1/2 + 1/2	
3		$E(X) = \sum xP(x)$ $= 0 \times 0.1 + 1 \times 0.3 + 2 \times 0.4 + 3 \times 0.2 = 1.7$ $E(X^2) = \sum x^2P(x)$ $= 0^2 \times 0.1 + 1^2 \times 0.3 + 2^2 \times 0.4 + 3^2 \times 0.2 = 3.7$ $V(X) = E(X^2) - (E(X))^2$ $= 3.7 - 1.7^2 = 3.7 - 2.89 = 0.81$	1/2 1/2 1/2 1/2 1/2	3
4	(a)	Definition of cdf.	1	3
	(b)	Any two properties of cdf (1 score each)	2	
5	(a)	(iv) 0.5	1	3
	(b)	Given mean $\mu = 28$, standard deviation $\sigma = 5$ $P(25 < X < 30) = P\left(\frac{25-28}{5} < \frac{X-28}{5} < \frac{30-28}{5}\right)$ $= P(-0.6 < Z < 0.4)$ $= P(0 < Z < 0.6) + P(0 < Z < 0.4)$ $= 0.2257 + 0.1554 = 0.3811$	1/2 1/2 1/2 1/2	
6	(a)	(ii) 2	1	3
	(b)	Any four properties of normal curve (1/2 score each)	$4 \times \frac{1}{2} = 2$	
7		$V(T_1) = V(2X_1 + 2X_2 - 3X_3) = 4V(X_1) + 4V(X_2) + 9V(X_3) = 4\sigma^2 + 4\sigma^2 + 9\sigma^2 = 17\sigma^2$ $V(T_2) = V(X_1 + 2X_2 - 2X_3) = V(X_1) + 4V(X_2) + 4V(X_3) = \sigma^2 + 4\sigma^2 + 4\sigma^2 = 9\sigma^2$ Here $V(T_2) < V(T_1)$. Hence T_2 the efficient estimator.	1 1 1	3

Qn, No.	Sub Qns	Answer Key / Value Points	Score	Total Score																						
8	(a)	(i) unbiased	1	3																						
	(b)	(ii) Moment estimate of $\mu = \bar{x}$ $= \frac{\sum x}{n} = \frac{201}{12} = 16.75$	1 $\frac{1}{2} + \frac{1}{2}$																							
9	(a)	Definition or Explanation of assignable causes	1	3																						
	(b)	Normality, homogeneity, independence, additivity	$4 \times \frac{1}{2} = 2$																							
10		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Source</th> <th>df</th> <th>SS</th> <th>MSS</th> <th>F</th> <th>F_α</th> </tr> </thead> <tbody> <tr> <td>Between</td> <td>8</td> <td><u>361.6</u></td> <td>45.2</td> <td rowspan="2"><u>12.91</u></td> <td rowspan="2">2.95</td> </tr> <tr> <td>Within</td> <td><u>11</u></td> <td><u>38.5</u></td> <td>3.5</td> </tr> <tr> <td>Total</td> <td>19</td> <td>400.1</td> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> <td style="text-align: center;">X</td> </tr> </tbody> </table> <p style="text-align: right; margin-right: 50px;">(4x 1/2)</p> <p>$F > F_{\alpha}$ so we reject null hypothesis</p>	Source	df	SS	MSS	F	F _α	Between	8	<u>361.6</u>	45.2	<u>12.91</u>	2.95	Within	<u>11</u>	<u>38.5</u>	3.5	Total	19	400.1	X	X	X	2 $\frac{1}{2} + \frac{1}{2}$	3
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Total	19	400.1	X	X	X																					
11	(a)	(iv) irregular variation	1	3																						
	(b)	Explanation of cyclical variation with or without diagram OR Definition of cyclical variation	2																							
12	(a)	(iv) current year quantity	1	3																						
	(b)	Any four uses of index numbers.	$4 \times \frac{1}{2} = 2$																							
13	(a)	Let $2x + 3y - 31 = 0$ -----(1), $5x + 4y - 28 = 0$ -----(2) Let us assume that eqn (1) is the regression line of Y on X and eqn (2) is the regression line of X on Y. Now eqn (1) becomes, $3y = -2x + 31 \Rightarrow y = \frac{-2}{3}x + \frac{31}{3} \quad \therefore b_{yx} = \frac{-2}{3}$ Similarly eqn (2) becomes, $5x = -4y + 28 \Rightarrow x = \frac{-4}{5}y + \frac{28}{5} \quad \therefore b_{xy} = \frac{-4}{5}$ Now $b_{yx} \times b_{xy} = \frac{-2}{3} \times \frac{-4}{5} = \frac{8}{15} < 1$ Our assumption is right. So the regression line of Y on X is $2x + 3y - 31 = 0$	1 1 $\frac{1}{2}$ $\frac{1}{2}$	4																						
	(b)	$r = \pm \sqrt{b_{yx} \times b_{xy}}$ $= \pm \sqrt{\frac{8}{15}} = \pm \sqrt{0.53} = -0.73$	$\frac{1}{2}$ $\frac{1}{2}$																							

Qn. No.	Sub Qns	Answer Key / Value Points	Score	Total Score																																		
14	(a)	$\frac{dy}{dx} = 12x^2 - 4x + 7$ $\frac{d^2y}{dx^2} = 24x - 4$	1 1	4																																		
	(b)	$\int_0^2 (x^2 - 2)dx = \left[\frac{x^3}{3} \right]_0^2 - [2x]_0^2$ $= \left(\frac{2^3}{3} - 0 \right) - (4 - 0)$ $= \frac{8}{3} - 4 = \frac{-4}{3} = -1.33$	1 $\frac{1}{2}$ $\frac{1}{2}$																																			
15	(a)	(ii) Poisson distribution	1	4																																		
	(b)	$np = 4, npq = 3$ $npq = 3 \Rightarrow 4 \times q = 3 \Rightarrow q = \frac{3}{4}$ $\therefore p = 1 - q = 1 - \frac{3}{4} = \frac{1}{4}$ Now, $np = 4 \Rightarrow n \times \frac{1}{4} = 4 \Rightarrow n = 4 \times 4 = 16$ The pdf is, $P(x) = nC_x p^x q^{n-x}, x = 0, 1, 2, \dots, n$ $= 16C_x \left(\frac{1}{4} \right)^x \left(\frac{3}{4} \right)^{16-x}, x = 0, 1, 2, \dots, 16$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$																																			
16	(a)	(i) $\chi_{(1)}^2$	1	4																																		
	(b)	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>Sl No</th> <th>Sample</th> <th>Sample Mean</th> </tr> </thead> <tbody> <tr><td>1</td><td>3,5</td><td>4</td></tr> <tr><td>2</td><td>3,7</td><td>5</td></tr> <tr><td>3</td><td>3,9</td><td>6</td></tr> <tr><td>4</td><td>3,11</td><td>7</td></tr> <tr><td>5</td><td>5,7</td><td>6</td></tr> <tr><td>6</td><td>5,9</td><td>7</td></tr> <tr><td>7</td><td>5,11</td><td>8</td></tr> <tr><td>8</td><td>7,9</td><td>8</td></tr> <tr><td>9</td><td>7,11</td><td>9</td></tr> <tr><td>10</td><td>9,11</td><td>10</td></tr> <tr> <td colspan="2">Total</td> <td>70</td> </tr> </tbody> </table> $E(\bar{X}) = \frac{\sum \bar{x}}{n} = \frac{70}{10} = 7$	Sl No		Sample	Sample Mean	1	3,5	4	2	3,7	5	3	3,9	6	4	3,11	7	5	5,7	6	6	5,9	7	7	5,11	8	8	7,9	8	9	7,11	9	10	9,11	10	Total	
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17	(a)	(iii) Chi – square test	1	4																																																		
	(b)	(i) Definition/Explanation of level of significance	1																																																			
		(ii) Definition/Explanation of power of a test (iii) Definition/Explanation of critical region	1 1																																																			
18		<table border="1"> <thead> <tr> <th>Year</th> <th>No. of deaths</th> <th>3 yearly moving total</th> <th>3 yearly moving average</th> </tr> </thead> <tbody> <tr> <td>2011</td> <td>175</td> <td></td> <td></td> </tr> <tr> <td>2012</td> <td>190</td> <td>550</td> <td>183.33</td> </tr> <tr> <td>2013</td> <td>185</td> <td>570</td> <td>190</td> </tr> <tr> <td>2014</td> <td>195</td> <td>560</td> <td>186.67</td> </tr> <tr> <td>2015</td> <td>180</td> <td>578</td> <td>192.67</td> </tr> <tr> <td>2016</td> <td>203</td> <td>580</td> <td>193.33</td> </tr> <tr> <td>2017</td> <td>197</td> <td>652</td> <td>217.33</td> </tr> <tr> <td>2018</td> <td>252</td> <td></td> <td></td> </tr> </tbody> </table>	Year	No. of deaths	3 yearly moving total	3 yearly moving average	2011	175			2012	190	550	183.33	2013	185	570	190	2014	195	560	186.67	2015	180	578	192.67	2016	203	580	193.33	2017	197	652	217.33	2018	252			2+2	4														
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19		$r = \frac{n \sum XY - \sum X \sum Y}{\sqrt{n \sum X^2 - (\sum X)^2} \times \sqrt{n \sum Y^2 - (\sum Y)^2}}$ <table border="1"> <thead> <tr> <th>X</th> <th>Y</th> <th>X²</th> <th>Y²</th> <th>XY</th> </tr> </thead> <tbody> <tr> <td>18</td> <td>12</td> <td>324</td> <td>144</td> <td>216</td> </tr> <tr> <td>28</td> <td>19</td> <td>784</td> <td>361</td> <td>532</td> </tr> <tr> <td>12</td> <td>21</td> <td>144</td> <td>441</td> <td>252</td> </tr> <tr> <td>25</td> <td>34</td> <td>625</td> <td>1156</td> <td>850</td> </tr> <tr> <td>22</td> <td>25</td> <td>484</td> <td>625</td> <td>550</td> </tr> <tr> <td>15</td> <td>20</td> <td>225</td> <td>400</td> <td>300</td> </tr> <tr> <td>7</td> <td>15</td> <td>49</td> <td>225</td> <td>105</td> </tr> <tr> <td>16</td> <td>14</td> <td>256</td> <td>196</td> <td>224</td> </tr> <tr> <td>$\sum X = 143$</td> <td>$\sum Y = 160$</td> <td>$\sum X^2 = 2891$</td> <td>$\sum Y^2 = 3548$</td> <td>$\sum XY = 3029$</td> </tr> </tbody> </table> $\therefore r = \frac{8 \times 3029 - 143 \times 160}{\sqrt{8 \times 2891 - (143)^2} \times \sqrt{8 \times 3548 - (160)^2}}$ $= \frac{1352}{\sqrt{2679} \times \sqrt{2784}} = 0.495$ <p>Alternative method: [Covariance = 21.13 (1 score), s.d(x) = 6.47 (½ score), s.d(y) = 6.6 (½ score), r = 0.495 (½ + ½ Score)]</p>	X	Y	X ²	Y ²	XY	18	12	324	144	216	28	19	784	361	532	12	21	144	441	252	25	34	625	1156	850	22	25	484	625	550	15	20	225	400	300	7	15	49	225	105	16	14	256	196	224	$\sum X = 143$	$\sum Y = 160$	$\sum X^2 = 2891$	$\sum Y^2 = 3548$	$\sum XY = 3029$	1 2 1 1	5
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Sl No	Name & School	Signature
1	Dr. Manoj K HSS Panangad, Mathilakam, Thissur	
2	Dr. Biju G V Govt V&HSS Vatiyoorkavu, Thiruvananthapuram	
3	Dr. Sajish Kumar M MNKM HSS Chittilencherry, Palakkad	
4	Vidya Ramachandran TD HSS Thuravoor, Alappuzha	
5	Smitha MS SN HSS Sreekandeswaram, Poochackal, Alappuzha	
6	Seby Jose P MSM HSS Kallingalparamba, Malappuram	
7	Jyothi B Govt HSS Korom, Payyannoor, Kannur	
8	Shanthi K Govt HSS Chayoth, Hosdurg, Kasargod	
9	Unnikrishnan E Shree Durga Parameswary AHSS, Dharmathadka Kasargod	