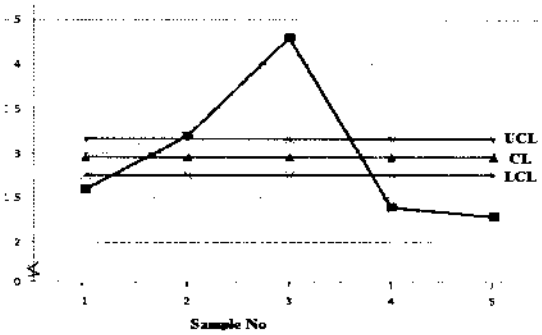
ANWSER KEY

SECOND YEAR HIGHER SECONDARY EXAMINATION – MARCH 2025

CODE No: SY 432 PART III SUBJECT: STATISTICS SCORES: 60

Qn No	Sub Qns	Answer key/ value points	Score	Total Score
1		(d) Income and Expenditure OR (c) Height and distance	1	1
2		(b) Nature	1	1
3		(a) 2	1	1
4		(d) All of the above OR (a) consistent OR(b) sufficient OR(c) efficeint	1	1
5		(b) $\frac{x^{-11}}{-11}+C$	1	1
6		(b) (ii) is true	1	1
7		$\bar{x}+\bar{y}=-3 \quad -------(1)$ $5\bar{x}-\bar{y}=-16 \quad -------(2)$ $(1)+(2) \Rightarrow 6\bar{x}=-19 \Rightarrow \bar{x}=\frac{-19}{6}$ $(2)-5\times(1) \Rightarrow -6\bar{y}=-1 \Rightarrow \bar{y}=\frac{1}{6}$	1 1	2
8		$\frac{dy}{dx}=6x^5+144x^2+24$	2	2
9		$\sum p(x)=1$ $0.2+0.3+k+0.3=1 \Rightarrow k=0.2$ (give 2 score for finding the value of k without writing property of pmf)	1 1	2
10		(i) – (2), (ii) – (3), (iii) – (4), (iv) – (1)	$4\times\frac{1}{2}$	2
11		Normality, Homogeneity, Additivity, Independence	$4\times\frac{1}{2}$	2
12		The moment estimate of population mean = Sample Mean $=\frac{35+45+40+42+39+55+63}{7}=45.57$ (Estimating Population mean without using formula may also consider and give 2 score)	$\frac{1}{2}$ $1\frac{1}{2}$	2
13		$\sum x=105, \sum y=173, \sum x^2=2575, \sum y^2=7291, \sum xy=3485$ $r=\frac{n\sum xy-(\sum x)(\sum y)}{\sqrt{\left(n\sum x^2-(\sum x)^2\right)\times\left(n\sum y^2-(\sum y)^2\right)}}$ $=\frac{5\times3485-105\times173}{\sqrt{\left(5\times2575-(105)^2\right)\times\left(5\times7291-(173)^2\right)}}=-0.21$ (Also consider the formula $r=\frac{Cov(x,y)}{\sigma_x\times\sigma_y}$ $Cov(x,y)=-29.6, \sigma_x=8.6, \sigma_y=16.2$ and $r=-0.21$)	1 1 1	3
14		1 score each for each definition	3×1	3
15		<table><tr><td>Source</td><td>d,f</td><td>S.S</td><td>M.S.S</td><td>F</td><td>$F_{0.01}$</td></tr><tr><td>Between</td><td>16</td><td>466.8</td><td>29.18</td><td>4. 63</td><td>3.62</td></tr><tr><td>Error</td><td>14</td><td>88.2</td><td>6.3</td><td></td><td></td></tr><tr><td>Total</td><td>30</td><td>555</td><td></td><td></td><td></td></tr></table>(Give ½ score of table value for atleast one correct value)	$6\times\frac{1}{2}$	3

16		$\sum p_0 = 208, \sum p_1 = 227$ Simple Aggregate Index Number = $\frac{\sum p_1}{\sum p_0} \times 100 = \frac{227}{208} \times 100 = 109.13$	1 $1+\frac{1}{2}+\frac{1}{2}$	3
17		<table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>P(x)</td><td>0.1</td><td>0.3</td><td>0.1</td><td>0.2</td><td>0.1</td><td>0.2</td></tr><tr><td>F(x)</td><td>0.1</td><td>0.4</td><td>0.5</td><td>0.7</td><td>0.8</td><td>1</td></tr></table> (Give 1 score for definition of cdf)	3	3
18		(i) $P(-1.2 < Z < 1.2) = 2 \times 0.3849 = 0.7698$ (ii) $P(0 < Z < 2.3) = 0.4893$ (iii) $P(Z < -1.6) = 0.5 - 0.4452 = 0.0548$	1 1 1	3
19		$\bar{x} = 76, \quad s = 12, n = 100$ 99% confidence interval for the population mean is given by $(\bar{x} - \frac{s}{\sqrt{n}} z_{\alpha/2}, \bar{x} + \frac{s}{\sqrt{n}} z_{\alpha/2}) = (76 - \frac{12}{\sqrt{100}} \times 2.58, 76 + \frac{12}{\sqrt{100}} \times 2.58)$ $= (72.904, \quad 79.096)$ *Note: Taking standard deviation as s or σ can be admissible* *Finding C.I by taking table value as 1.96 give 3 score*	$\frac{1}{2}$ 1+1 $\frac{1}{2}$	3
20		<table><tr><td>Year</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td></tr><tr><td>sales</td><td>2480</td><td>1694</td><td>3706</td><td>1531</td><td>2642</td><td>3124</td><td>1234</td><td>3531</td><td>2345</td><td>3124</td></tr><tr><td>5 yr mov total</td><td></td><td></td><td>12053</td><td>12697</td><td>12237</td><td>12062</td><td>12876</td><td>13358</td><td></td><td></td></tr><tr><td>5 yr mov average</td><td></td><td></td><td>2410.6</td><td>2539.4</td><td>2447.4</td><td>2412.4</td><td>2575.2</td><td>2671.6</td><td></td><td></td></tr></table> *(5 yr moving total values are not compulsory)*	2+2	4
21		To find $\sum d^2 = 58$ $\rho = 1 - \frac{6\sum d^2}{n^3 - n} = 1 - \frac{6 \times 58}{10^3 - 10} = 0.65$ correlation is positive	$1\frac{1}{2}$ 1+1 $\frac{1}{2}$	4
22	(i)	(c) less than 30	1	
	(ii)	$2x - 5y + 33 = 0 \quad ------(1) \qquad 30x - 9y - 108 = 0 \quad -------(2)$ Let us assume that eqn (1) be the regression line of Y on X and eqn (2) be that of X on Y. Now eqn (1) becomes, $5y = 2x + 33 \rightarrow y = \frac{2}{5}x + \frac{33}{5} \quad \therefore b_{yx} = \frac{2}{5}$ Similarly eqn (2) becomes, $30x = 9y + 108 \Rightarrow x = \frac{9}{30}y + \frac{108}{30} \quad \therefore b_{xy} = \frac{9}{30}$ $b_{yx} \times b_{xy} = \frac{2}{5} \times \frac{9}{30} = \frac{18}{150} < 1$ So our assumption is right. Hence the regression line of Y on X is $2x - 5y + 33 = 0$	1 1 $\frac{1}{2}$ $\frac{1}{2}$	4

23		$\overline{\overline{x}} = \frac{\sum \overline{x}}{m} = \frac{14.8}{5} = 2.96, \quad \overline{R} = \frac{\sum R}{m} = 0.28$ $LCL = \overline{\overline{x}} - A_2\overline{R} = 2.96 - 0.729 \times 0.28 = 2.76$ $UCL = \overline{\overline{x}} + A_2\overline{R} = 2.96 + 0.729 \times 0.28 = 3.16$  The process is out of control (proper explanation of conclusion without diagram give 1 score)	$\frac{1}{2}$ 1 1 1 $\frac{1}{2}$	4
24		H_0: Performance and age groups are independent H_1: They are not independent The observed values are 180, 220, 270, 330 The test statistic is $\chi^2 = \sum\left(\frac{(O-E)^2}{E}\right) = 107.74$ Here $\chi^2 = 107.74 > \chi^2_\alpha = 3.84$ So we reject H_0. Hence the performance is depends on age groups.	$\frac{1}{2}$ 1 $1+\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	4
25		$P(X < 35) = 0.07 \quad \Rightarrow P\left(Z < \frac{35-\mu}{\sigma}\right) = 0.07$ $\Rightarrow \frac{35-\mu}{\sigma} = -1.48 \quad \Rightarrow \mu - 1.48\sigma = 35 - - - - - (1)$ $P(X < 63) = 0.89 \quad \Rightarrow P\left(Z < \frac{63-\mu}{\sigma}\right) = 0.89$ $\Rightarrow \frac{63-\mu}{\sigma} = 1.23 \quad \Rightarrow \mu + 1.23\sigma = 63 - - - - - (2)$ Solving (1) an (2) we get, $\mu = 50.29, \quad \sigma = 10.33$	$\frac{1}{2}$ 1 $\frac{1}{2}$ 1 1	4
26		$\sum p_0q_0 = 844, \sum p_0q_1 = 1073, \sum p_1q_0 = 911, \sum p_1q_1 = 1154$ (i) Laspeyre's IN$= \frac{\sum p_1q_0}{\sum p_0q_0} \times 100 = \frac{911}{844} \times 100 = 107.94$ (ii) Paache's IN $= \frac{\sum p_1q_1}{\sum p_0q_1} \times 100 = \frac{1154}{1073} \times 100 = 107.55$ (iii) Fisher's IN $= \sqrt{L \times P} = \sqrt{107.94 \times 107.55} = 107.74$	2 $\frac{1}{2}+\frac{1}{2}$ $\frac{1}{2}+\frac{1}{2}$ $\frac{1}{2}+\frac{1}{2}$	5

27	(i)	(b) Seasonal variation	1	5
	(ii)	True	1	
	(iii)			

Sl No	1	2	3	4	5	6	7	8	9	10	
Samples	(3,4)	(3,5)	(3,6)	(3,9)	(4,5)	(4,6)	(4,9)	(5,6)	(5.9)	(6,9)	**Total**
Sample Mean	3.5	4	4.5	6	4.5	5	6.5	5.5	7	7.5	**54**

1

$E(\bar{x})$ = Mean of sample means = $\frac{54}{10} = 5.4$ — $\frac{1}{2}$

μ = Population mean = $\frac{3+4+5+6+9}{5} = \frac{27}{5} = 5.4$ — 1

$E(\bar{x}) = \mu$, So Sample mean is unbiased for Population mean — $\frac{1}{2}$

28	(i)	(a) $E(X) = \sum xp(x) = 5\times\frac{3}{15} + 6\times\frac{2}{15} + 0\times\frac{7}{15} + 1\times\frac{2}{15} + 2\times\frac{1}{15} = \frac{31}{15} = 2.07$	$\frac{1}{2}+\frac{1}{2}$	5
		(b) $E(X^2) = \sum x^2 p(x) = 5^2\times\frac{3}{15} + 6^2\times\frac{2}{15} + 0^2\times\frac{7}{15} + 1^2\times\frac{2}{15} + 2^2\times\frac{1}{15} = \frac{153}{15} = 10.2$	$\frac{1}{2}+\frac{1}{2}$	
		(c) $V(X) = E(X^2) - (E(X))^2 = 10.2 - (2.07)^2 = 5.92$	$\frac{1}{2}+\frac{1}{2}$	
	(ii)	$np = 9, \quad npq = 6 \quad \Rightarrow q = \frac{6}{9} = \frac{2}{3}, \quad p = \frac{1}{3}, \quad n = 27$	$\frac{1}{2}$	
		$p(x) = nC_x p^x q^{n-x}, x = 0,1,...,n$	$\frac{1}{2}$	
		$= 27C_x \left(\frac{1}{3}\right)^x \left(\frac{2}{3}\right)^{27-x}, x = 0,1,...,27$	$\frac{1}{2}$	
		$P(X=2) = 27C_2 \times \left(\frac{1}{3}\right)^2 \times \left(\frac{2}{3}\right)^{25}$	$\frac{1}{2}$	
		OR give 2 score for correct pmf, $P(x) = 27C_x \left(\frac{1}{3}\right)^x \left(\frac{2}{3}\right)^{27-x}, x = 0,1,...,27$		

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