Second Year Higher Secondary Examination, March 2017

Subject: STATISTICS **Code:5020**

No	Scoring Indicators	Split Score	Total Score
1(a)	(c)4	1	4
1(b)	Required area= $\int_x f(x)dx = \int_2^4 (2x^2+1)dx$ *Or* identifying as an application of definite integral $= \left(2\frac{x^3}{3}+x\right)_2^4$ $=\frac{112}{3}+2=\frac{118}{3}$=39.33sq.unit	1 1 1	
2	(b) Positive correlation	1	1
3	(see table below)		

Rank X	1	5	7	8	3	4	2	6	
Rank Y	2	4	8	6	3	5	1	7	
d=Rank X- Rank Y	-1	1	-1	2	0	-1	1	-1	
d^2	1	1	1	4	0	1	1	1	10

No	Scoring Indicators	Split Score	Total Score
3	(table above)	2	
	Rank correlation coefficient, $\rho = 1-\left[\frac{6\Sigma d^2}{n(n^2-1)}\right]$	1	
	$=1-\left[\frac{6x10}{8(64-1)}\right]=1-\left[\frac{60}{504}\right]=1-0.119=0.881$	1	4
	Correlation is high positive		
4	Any option give one score (translation error)	1	1
5	Regression equation x on y is given by $(x-\overline{x}) = r\frac{\sigma_x}{\sigma_y}(y-\overline{y})$ (any form of regression equation of X on Y give 1 score)	1	
	$(x-50)=0.7\times\frac{5}{2}(y-30)$	1	
	$(x-50)=1.75(y-30)$ *or* $x=1.75y-2.5$	1	3
6	(c) Discrete random variable	1	1
7	Given n=10 and p=0.25 q = 1-p=0.75	½	
	$P(X=x)=nC_x p^x q^{n-x}; X=0,1,2,3,....,n$	½	
	$P(X=x)=10C_x(0.25)^x(0.75)^{10-x}; X=0,1,2,3,....,10$	1	
	Mean=np=2.5	½	
	Variance=npq=1.875	½	3
OR			
8	(see table below)		

x	0	1	2	3	4	5	15
f	25	8	5	1	1	0	40
fx	0	8	10	3	4	0	25

No	Scoring Indicators	Split Score	Total Score
8	$\lambda=\frac{\Sigma fx}{\Sigma f}=\frac{25}{40}=0.625$	1	
	$P(x)=\frac{e^{-\lambda}\times\lambda^x}{x!}$ *where* $x=0,1,2,.....$	1	
	P(3 defective)=P(x=3)= $\frac{e^{-0.625}\times(0.625)^3}{3!}$ =0.02178 *Or* Writing pdf of poisson distribution. (3 Score)	1	3
9	(d)0	1	1
10	If f(x) is a pdf, we have $\int_0^2 f(x)dx=1$	½	
	ie , $\int_0^2 (kx-2)dx=1$	½	
	ie, $\left(k\frac{x^2}{2}+2x\right)_0^2=1$	1	
	(2k+4)-(0+0) = 1	½	
	k = 2.5	½	3

1/3

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<table>
<tr><th>No</th><th>Scoring Indicators</th><th>Split Score</th><th>Total Score</th></tr>
<tr><td>11</td><td>(a) Ten students are writing an exam and X is the number of students passing it
or
(b) X is the number of occurrences of brain cancer in a district per year</td><td>1</td><td>1</td></tr>
<tr><td>12</td><td>Any option give one score (representation of bracket is confusing)</td><td>.1</td><td>1</td></tr>
<tr><td>13</td><td>Given $\mu = 8 \; and \; \sigma = 3$
Let x represents life of television set
P(television sets having life < 6)=P(x<6)
= P($\frac{x-\mu}{\sigma} < \frac{6-8}{3}$)
= P($Z < -0.67$)
= 0.5- 0.2486=0.2514

Expected number of television sets having life less than 6= 10x 0.2514=2.514 $\approx$ 3</td><td>½

½

½

1

½</td><td>3</td></tr>
<tr><td>14</td><td>Any option give 1 score</td><td>1</td><td>1</td></tr>
<tr><td>15(a)</td><td>Any measurable function of population values is known as parameter.
Any two examples (½ score each)</td><td>1
1</td><td>2</td></tr>
<tr><td>15(b)</td><td>(a) Chi square distribution -- (1) mean equal to degrees of freedom
(b) Normal distribution -- (3) symmetric about mean
(c) F distribution -- (4)Used to test three or more means
(d) Students 't' distribution -- (2) mean always zero *or* (3) symmetric about mean</td><td>½
½
½
½</td><td>2</td></tr>
<tr><td>16</td><td><table><tr><td>NO</td><td>1</td><td>2</td><td>3</td></tr><tr><td>Samples</td><td>(2,3)</td><td>(2,4)</td><td>(3,4)</td></tr><tr><td>$\bar{x}$</td><td>2.5</td><td>3</td><td>3.5</td></tr></table>Mean of sample means = E($\bar{x}$)=9/3=3

Population mean, μ =9/3=3

Since E($\bar{x}$)= μ , sample mean is an unbiased estimator of population mean</td><td>½

½

½
½</td><td>2</td></tr>
<tr><td>17(a)</td><td>Sample mean</td><td>1</td><td rowspan="2">2</td></tr>
<tr><td>17(b)</td><td>Any option give one score</td><td>1</td></tr>
<tr><td>18</td><td>0.96</td><td>1</td><td>1</td></tr>
<tr><td>19</td><td>We set up, H_o: Interest shown by students to the two subjects are independent.
H_1: Interest shown by students to the two subjects are dependent.
Expected Frequencies 55.44, 28.56, 10.56, 5.44<table><tr><td>O</td><td>56</td><td>28</td><td>10</td><td>6</td><td></td></tr><tr><td>E</td><td>55.44</td><td>28.56</td><td>10.56</td><td>5.44</td><td></td></tr><tr><td>$(O-E)^2/E$</td><td>0.01</td><td>0.01</td><td>0.03</td><td>0.06</td><td>0.11</td></tr></table>Calculated value of chi square=0.11
Table value of Chi-square $= \chi^2_{[(2-1)(2-1),0.05]} = \chi^2_{[1,0.05]} = 3.84$
We accept H_o, since calculated value of chi square < Table value of Chi-square.
Or
If second column total is taken as 37,
Then Expected frequencies are 55.44,31.08,10.56,5.92
Calculated value of chi square=0.3416
We accept H_o, since calculated value of chi square < Table value of Chi-square.</td><td>½

1

1

½
½</td><td>4</td></tr>
</table>

No	Scoring Indicators	Split Score	Total Score
OR			

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We set up $H_0 : \mu = 4$ against $H_1 : \mu \neq 4$ — ½

x	2	5	4	3	4	3	3	5	3	4	36
x^2	4	25	16	9	16	9	9	25	9	16	138

$\bar{x} = \frac{36}{10} = 3.6$, — ½

$s = \sqrt{\frac{138}{10} - (3.6)^2} = \sqrt{13.8 - 12.96} = \sqrt{0.84} = 0.92$ — 1

Since size small and σ unknown, test statistic $t = \frac{\bar{x} - \mu}{s/\sqrt{n-1}} = \frac{3.6-4}{0.92/\sqrt{10-1}} = -3.91$ — ½+½

Table value, $t_{(n-1,\alpha/2)} = 2.262$ — ½

since ItI> table value of t, we reject Ho . Hence the belief is not correct — ½ — Total 4

No	Scoring Indicators	Split Score	Total Score
21	Any option give one score (translation error)	1	1
22(a)	(1) Normality (2)Homogeneity (3) Independence (4) Additivity (½ each)	2	4
22(b)	Assignable causes -- Treatment variation	½	
	Chance causes -- Random variation	½	
	ANOVA -- Several means *or* Treatment variation *or* Random variation	½	
	Test for variance -- Chi- square	½	
23	Any suitable definition.	1	1
24	(b) Variability	1	1
25	(d) Seasonal variation	1	1

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	2	3	1	5	2	4	6	1	1	2	
	4	2	1	4	3	3	4	2	2	2	
mean	3	2.5	1	4.5	2.5	3.5	5	1.5	1.5	2	27
Range	2	1	0	1	1	1	2	1	1	0	10

— ½

CL= $\bar{\bar{x}}$ = 27/10 =2.7 — ½

$\bar{R}$ = 10/10 =1 — ½

UCL= $\bar{\bar{x}}$ +$A_2 \bar{R}$ = 2.7+1.88×1=4.58 *or* UCL= $\bar{\bar{x}}$ +$A_2 \bar{R}$ = 2.7+0.308×1=3.008 — ½, ½

LCL = $\bar{\bar{x}}$ - $A_2 \bar{R}$ = 2.7- 1.88×1=0.82 or LCL = $\bar{\bar{x}}$ - $A_2 \bar{R}$ = 2.7- 0.308×1=2.392 — ½, ½ — Total 3

27

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Sales	170	231	261	267	678	302	299	298	340
Semi average	232.3					309.8			

— 2

Graph — 2 — Total 4

(Using graph paper is not compulsory)

28

(a) Understanding the past behaviour *or*

(b) Predicting future behaviour *or*

(c) Both (a) and (b) — 1 — Total 1

29

p_1	p_0	q_1	q_0	p_1q_1	p_1q_0	p_0q_1	p_0q_0
5	2	15	20	75	100	30	40
8	4	5	4	40	32	20	16
2	1	12	10	24	20	12	10
10	5	6	5	60	50	30	25
				199	202	92	91

— 2

Fishers Index Number= $\sqrt{\frac{\sum p_1q_1}{\sum p_0q_1} \times 100 . \frac{\sum p_1q_0}{\sum p_0q_0} \times 100} = \sqrt{\frac{199}{92} \times 100 \times \frac{202}{91} \times 100}$ — 1

$= \sqrt{2.163 \times 100 \times 2.22 \times 100} = 100\sqrt{4.80} = 219$ — 1 — Total 4

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