Question Number	Scheme	Marks
	SchemeTotal in School = $(15 \times 30) + 150 = 600$ random sample of $\frac{30}{600} \times 40$ = 2 from each of the 15 classes random sample of $\frac{150}{600} \times 40$ 	Marks B1 M1 A1 A1 B1 B1 B1 (7)

Question Number	Scheme		Ma	arks
2. (a)	E(R) = 20 + 10 = 30		B1	(1)
(b)	Var(R) = 4 + 0.84, = 4.84		M1, A1	(2)
(C)	R ~ N(30, 4.84)	(Use of normal with their (a),(b))	B1ft	(-)
	$P(28.9 < R < 32.64) = P(R < 32.64) - P(R < 28.9)$ $= P\left(Z < \frac{32.64 - 30}{2.2}\right) - P\left(Z < \frac{28.9 - 30}{2.2}\right)$	Stand their $\sigma$ and $\mu$	M1	
	= P( Z < 1.2) - P(Z < - 0.5)		A1, A1	
	= 0.8849 - ( 1 - 0.6915)	Correct area	M1	
	= 0.8849 - 0. 3085 = 0.5764	(accept AWRT 0.576)	A1	(6)
				9

3. (a)	$\widehat{\mu} = \frac{82 + 98 + 140 + 110 + 90 + 125 + 150 + 130 + 70 + 110}{10}$	M1	
	$\mu = 110.5$ 10	A1	
	$\hat{\sigma}^2 = \frac{1}{9} (128153 - 10 \times 110.5^2)$ 128153	B1	
	= 672.28 (AWRT 672)	M1 A1	(5)
(b)	95% confidence limits are (condone use of 5 instead of 25) (for 1.96)	M1 B1 A1√	
	110.5 $\pm 1.96 \times \frac{25}{\sqrt{10}}$		
	95% conf. lim. = AWRT(95, 126)	A1 A1	(5)
(c)	Number of intervals $= \frac{95}{100} \times 15$ = 14.25 (Allow 14 or 14.3 if method is clear)	M1 A1	
			(2)
			12

$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Image: Note accept in the interval of the image: Note accept and the image: Note accept	$\overline{Accept}$ Not accept       Total         Males       170 (180)       110 (100)       280         Females       280 (270)       140 (150)       420         Totals       450       250       700         Image: Totals       450       0.5556       100         Image: Totals       0.5556       100       1.0000         280       270       0.3704       0.6667         Image: Version of the state			ween gender ance are asso	and acceptance	2	B1
Males       170 (180)       110 (100)       280         Females       280 (270)       140 (150)       420         Totals       450       250       700       Kates       Kates         O       E $(O - E)^2$ Expected       W1 //         Image: Totals       450       250       700       Kates       M1 //         Image: Totals       450       250       700       Kates       M1 //         Image: Totals       450       250       700       Kates       M1 //         Image: Totals       450       0.5556       M1 //       M1 //       M1 //         Image: Totals       270       0.3704       M1 //       M1 //       M1 //         Image: Totals       2.59       (Yates' 2.34)       (Condone use of Yates')       M1 //         Image: Vertex is no association between a persons gender and their acceptance (of the offer       M1 //       M1 //	Males       170 (180)       110 (100)       280         Females       280 (270)       140 (150)       420         Totals       450       250       700       Values       M1 A         O       E $(O - E)^2$ Expected       Values       M1 A         O       E $(O - E)^2$ Expected       Values       M1 A         O       E $(O - E)^2$ Expected       Values       M1 A         D       100       0.5556       Expected       Values       M1 A $280$ 270       0.3704       Output       M1 A       M1 A $V = 1; (5\%) = 3.841$ (Condone use of Yates')       M1 A       M1 A $3.841 > 2.59$ . There is insufficient evidence to reject Ho       M1 A       M1 A         There is no association between a persons gender and their acceptance (of the offer       M1 A	Males       170 (180)       110 (100)       280         Females       280 (270)       140 (150)       420       Values         Totals       450       250       700       Values       M1.         O       E $(O - E)^2$ E       (O - E)^2       M1.         Image: Interval and the Image: Interval and		r und uccept		ented		
Females       280 (270)       140 (150)       420       Label Control of the state of the sta	Females       280 (270)       140 (150)       420         Totals       450       250       700         O       E $(O - E)^2$ Values         170       180       0.5556         110       100       1.0000         280       270       0.3704         140       150       0.6667 $v = 1; (5\%) = 3.841$ (Condone use of Yates')         3.841 > 2.59. There is insufficient evidence to reject Ho       M1         There is no association between a persons gender and their acceptance (of the offer       M1	Females       280 (270)       140 (150)       420         Totals       450       250       700         O       E $(O - E)^2$ Values         170       180       0.5556         110       100       1.0000         280       270       0.3704         140       150       0.6667 $v = 1; (5\%) = 3.841$ (Condone use of Yates')         3.841 > 2.59. There is insufficient evidence to reject Ho       M1         There is no association between a persons gender and their acceptance (of the offer       M1		Accept	Not accept	Total		
Permares       250 (270)       140 (130)       420       Values         Totals       450       250       700       Values $O$ $E$ $(O - E)^2$ $E$ $Values$ $170$ 180       0.5556 $110$ $100$ $1.0000$ $280$ 270 $0.3704$ $140$ $150$ $0.6667$ $V = 1; (5\%) = 3.841$ (Condone use of Yates')       M1 $A$ $S.841 > 2.59$ . There is insufficient evidence to reject Ho       M1 $A_1$	Permates       280 (270)       140 (130)       420       Values         Totals       450       250       700       Values $O$ $E$ $(O - E)^2$ $E$ $(O - E)^2$ $E$ 170       180       0.5556       100       1000       1.0000         280       270       0.3704       140       150       0.6667 $v = 1; (5\%) = 3.841$ (Condone use of Yates')       M1 $A$ B1; 1         3.841 > 2.59. There is insufficient evidence to reject Ho       M1 $A_1\sqrt{A_1}$ A1 $\sqrt{A_1}$	Permates       280 (270)       140 (130)       420       Values         Totals       450       250       700       Values $O$ $E$ $(O - E)^2$ $E$ $(O - E)^2$ $E$ 170       180       0.5556       110       1000       1.0000         280       270       0.3704       140       150       0.6667 $V = 1; (5\%) = 3.841$ (Condone use of Yates')       M1       B1; 1         3.841 > 2.59. There is insufficient evidence to reject Ho       M1       A1 $$	Males			280	Expected	M1 A
Totals       450       250       700 $O$ $E$ $(O - E)^2$ $E$ 170       180       0.5556         110       100       1.0000         280       270       0.3704         140       150       0.6667 $v = 1; (5\%) = 3.841$ (Condone use of Yates')         3.841 > 2.59. There is insufficient evidence to reject Ho       M1         There is no association between a persons gender and their acceptance (of the offer       M1	Iotals       450       250       700         Iotals       450       250       700         Iotals       450       250       700         Iotals       Iotals       Iotals       Iotals       Iotals         Iotals       Iotals       Iotals       Iotals       Iotals       Iotals         Iotals       Iotals       Iotals       Iotals       Iotals       Iotals       Iotals         Iotals       Iotals       Iotals       Iotals       Iotals       Iotals       Iotals       Iotals         Iotals	Iotals       450       250       700         Iotals       450       250       700         Iotals       450       250       700         Iotals       Iota	Females	280 (270)	140 (150)	420		
$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1 $$	$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1\sqrt{A1\sqrt{brev}})	$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1\sqrt{A1\sqrt{brack}})	Totals	450	250	700	Values	
$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1 $$	$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1\sqrt{A1\sqrt{brev}})	$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1\sqrt{A1\sqrt{brack}})						
$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1 $$	$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1\sqrt{A1\sqrt{brev}})	$\frac{(O-E)}{E}$ $\frac{170  180  0.5556}{110  100  1.0000}$ $\frac{280  270  0.3704}{140  150  0.6667}$ $\sum \frac{(O-E)^2}{E} = 2.59  (Yates' 2.34) \qquad (Condone use of Yates')$ $v = 1; (5\%) = 3.841$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho}$ There is no association between a persons gender and their acceptance (of the offer A1\sqrt{A1\sqrt{brack}})	0		E	$(\mathbf{O} \mathbf{F})^2$		
$170$ $180$ $0.5556$ $110$ $100$ $1.0000$ $280$ $270$ $0.3704$ $140$ $150$ $0.6667$ $\Sigma \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34)       (Condone use of Yates') $v = 1; (5\%) = 3.841$ M1 $3.841 > 2.59$ . There is insufficient evidence to reject Ho       M1         There is no association between a persons gender and their acceptance (of the offer       M1	$170$ $180$ $0.5556$ $110$ $100$ $1.0000$ $280$ $270$ $0.3704$ $140$ $150$ $0.6667$ M1 $\mu$ $\sum \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34) $\nu = 1; (5\%) = 3.841$ 3.841 > 2.59. There is insufficient evidence to reject Ho         There is no association between a persons gender and their acceptance (of the offer	$170$ $180$ $0.5556$ $110$ $100$ $1.0000$ $280$ $270$ $0.3704$ $140$ $150$ $0.6667$ M1 $\cdot$ $\sum \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34) $v = 1; (5\%) = 3.841$ 3.841 > 2.59. There is insufficient evidence to reject Ho         There is no association between a persons gender and their acceptance (of the offer	Ũ		-	$\frac{(O-E)}{E}$		
$110$ $100$ $1.0000$ $280$ $270$ $0.3704$ $140$ $150$ $0.6667$ $\sum \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34)(Condone use of Yates') $v = 1; (5\%) = 3.841$ B1; I $3.841 > 2.59$ . There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerM1	$110$ $100$ $1.0000$ $280$ $270$ $0.3704$ $140$ $150$ $0.6667$ $\sum \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34)(Condone use of Yates') $v = 1; (5\%) = 3.841$ B1; I $3.841 > 2.59$ . There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerM1	$110$ $100$ $1.0000$ $280$ $270$ $0.3704$ $140$ $150$ $0.6667$ $\sum \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34)(Condone use of Yates') $v = 1; (5\%) = 3.841$ B1; T $3.841 > 2.59$ . There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerM1	170		180	0.5556		
1401500.6667 $\sum \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34)(Condone use of Yates') $v = 1; (5\%) = 3.841$ M1 A3.841 > 2.59. There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerM1	1401500.6667 $\sum \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34)(Condone use of Yates') $v = 1; (5\%) = 3.841$ B1; I $3.841 > 2.59$ . There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerM1	1401500.6667 $\sum \frac{(O-E)^2}{E} = 2.59$ (Yates' 2.34)(Condone use of Yates') $v = 1; (5\%) = 3.841$ M1 $3.841 > 2.59$ . There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerM1						
$\sum \frac{(O-E)^2}{E} = 2.59  (\text{Yates' } 2.34) \qquad (\text{Condone use of Yates'}) \qquad \text{M1} \\ \nu = 1; (5\%) = 3.841 \qquad \text{B1; I} \\ 3.841 > 2.59. \text{ There is insufficient evidence to reject Ho} \qquad \text{M1} \\ There is no association between a persons gender and their acceptance (of the offer A1$	$\sum \frac{(O-E)^2}{E} = 2.59  (\text{Yates' } 2.34) \qquad (\text{Condone use of Yates'}) \qquad \text{M1}$ $v = 1; (5\%) = 3.841 \qquad \text{B1}; 1$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho} \qquad \text{M1}$ There is no association between a persons gender and their acceptance (of the offer $A1$	$\sum \frac{(O-E)^2}{E} = 2.59  (\text{Yates' } 2.34) \qquad (\text{Condone use of Yates'}) \qquad \text{M1}$ $v = 1; (5\%) = 3.841 \qquad \text{B1}; 1$ $3.841 > 2.59. \text{ There is insufficient evidence to reject Ho} \qquad \text{M1}$ There is no association between a persons gender and their acceptance (of the offer $A1\sqrt{1}$						
v = 1; (5%) = 3.841B1; I $3.841 > 2.59$ . There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerA1 $$	v = 1; (5%) = 3.841B1; I $3.841 > 2.59$ . There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerA1 $$	v = 1; (5%) = 3.841B1; $1$ $3.841 > 2.59$ . There is insufficient evidence to reject HoM1There is no association between a persons gender and their acceptance (of the offerA1 $$	140		150	0.6667		
			There is no	o association				

5. (a)	$\mu_b$ = mean mark of boys, $\mu_g$ = mean mark of girls.			
	$ \begin{aligned} \mathbf{H}_0 &: \mu_b &= \mu_g \\ \mathbf{H}_1 &: \mu_b &\neq \mu_g \end{aligned} $	both	B1	
	$z = \frac{53 - 50}{\sqrt{\frac{144}{80} + \frac{144}{80}}}$		M1 A1	
	= 1.58 Critical region $z \ge 1.96$ 1.58 < 1.96 insufficient evidence to reject Ho. No diff. between mean scores of boys and girls.		A1 B1 M1 A1	(7)
(b)	$ \begin{array}{l} \mathrm{H}_{0}: \mu_{b} \ = \mu_{g} \\ \mathrm{H}_{1}: \mu_{b} \ < \mu_{g} \end{array} $		B1	
	$z = -\frac{62 - 59}{\sqrt{\frac{36}{80} + \frac{36}{80}}}$		M1	
	= 3.16		A1	
	Critical region $z \ge 1.6449$ (accept 1.645)		B1	
	3.16 > 1.6449 sufficient evidence to reject H <sub>0</sub> . the mean mark for boys is less than the mean mark of the girls.		A1	
				(5)
(c)	Girls have improved more than boys or girls performed better than boys after 1 year		B1	
				(1)
				13

6. (a)	r = 27.07, s = 18.04,	M1 A1 B1	
	t = 0.11 using tables or 0.12 using totals	B1 ft	(4)
(b)	Ho : A Poisson model Po(2) is a suitable model.bothH1 : A Poisson model Po(2) is not a suitable model.both	B1	
	Amalgamate data	M1	
	$\sum \frac{(O-E)^2}{E} = 3.28$ (awrt)	M1 A1	
		B1	
	v = 6 - 1 = 5 $\chi_5^2 (5\%) = 11.070$ (follow through their degrees of freedom)	B1ft	
	3.25 < 11.070 There is insufficient evidence to reject $H_0$ , <u>Po(2) is a suitable model.</u>	A1ft	(7)
(c)	The expected values, and hence $\sum \frac{(O-E)^2}{E}$ would be different,	B1 B1	(2)
	and the degrees of freedom would be 1 less.	2.	(-)
			13

			to be norn	nally distrib	uted			B1	
	20-29	30-39	40-49	50-59	60-69	70+	]		
Rank x	5	6	4	3	1	2	_	M1 A1	
Rank y	6	5	4	1	3	2	_		
<u>d</u>	1	1	0	2	2	0		dM1 (dep	
$d^2$	1	1	0	4	4	0		on rankir attempt)	ng
$\sum d^2 = 1$	0					(follow th	nrough their rankings)	A1 ft	
$s_s = 1 - \frac{6}{n}$	$\frac{0}{6\sum d^2} d^2 = \frac{1}{(n^2 - 1)} = \frac{1}{2}$	$1 - \frac{60}{210} =$	= 0.714			$\left(\frac{5}{7} \text{ or } a\right)$	awrt 0.714)	M1 A1	
$H_0: \rho = 0$								B1	
$_1: \rho \neq 0$ (								B1	
		lue = 0.885	57 (or 0.828	6)				B1√ M1	
.714 < 0.8 lo evidence	e to reject I	$H_0$ ;	on dootho fr		annincic a	nd lung can	oor	A1	
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