Question Number	Scheme			
1a)	Allocate a number between 1 and N (or equiv) to each pupil.		M1	
	Use <u>random number tables</u> , <u>computer or calculator</u> to select 15 <u>differ</u> numbers between 1 and 120 (or equiv).	ent	B1	
	Pupils corresponding to these numbers become the sample.		B1	(3)
(b)	Allocate numbers $1 - 64$ to girls and $1 - 56$ to boys. Idea of different boys and girls	sets for	M1	(-)
	Select $\frac{64}{120} \times 15 = 8$ random numbers between 1 – 64 for girls	attempt find no	M1	
	Select 7 random numbers between $1 - 56$ for boys.	Both 7 and 8	A1	(3)
20)				
2a)	H ₀ : $\rho = 0$; H ₁ : $\rho > 0$	both and	B1	
	^p 5% CV – PMCC <u>0.6215</u>		M1	
	0.572 < 0.6215 / not in critical region / not significant		A1	
	No evidence of <u>positive</u> correlation		B1	
	Spearman <u>0.6429</u>		B1	(\mathbf{C})
(b)	Evidence of <u>positive</u> correlation		D1	(6)
	No evidence to suggest that as <u>Statistics marks increased</u> <u>Geography marks increased</u> .	Context and not correlation	B1	
	Evidence that students <u>ranked highly in Statistics were also</u> <u>ranked highly in Geography</u>	ranked		(2)

Question Number	Scheme	Marks
3a)	$H_0: \ \mu_A = \mu_B \ ; \ H_1: \ \mu_B > \mu_A $ both and μ	B1
	$z = \pm \frac{249 - 251}{\sqrt{\frac{2.5^2}{10} + \frac{2.3^2}{15}}}$ $= \pm 2.0227$ 249,251 accept $\sqrt{\frac{2.5 + 2.3}{15}} \text{ for M}$ awrt ± 2.0227	M1 A1 2 A1
	$CV = \pm 1.6449$ or $P(Z \ge 2.02) = 0.0212 - 0.0217$, or $P(Z \le 2.02) = 0.9788 - 0.9783$	B1
b)	$\begin{array}{c} -2.0227 < -1.6449 \text{or} 2.0227 > 1.6449 \text{,} \\ \text{or} 0.0212 - 0.0217 < 0.05 \text{comparison and consistency neede} \\ \text{or} 0.9788 - 0.9783 > 0.95 \end{array}$	M1
	There is evidence that the <u>mean amount of coffee</u> dispensed by B <u>is greater</u> than A. context	A1√ (7)
	Machine B amounts are normally distributed.	B1 (1)

Question Number	Scheme		Marks	
4a)	$\bar{x} = 75.3$		B1	
	$s^2 = \frac{1}{9} \left\{ 57455 - \frac{753^2}{10} \right\}$		M1	
	$= 83.78^{\circ}, 83\frac{71}{90}, 83.8$ awrt 83	1.8	A1	(3)
	1.	.96	B1	
b)	74.8 $\pm 1.96\sqrt{\frac{84.6}{100}}$ any z value, may u 75.3,83.8 for M	1se	$\begin{array}{l} M1\\ A1 \sqrt{ on \ z \ only} \end{array}$	
	(73.0, 76.6) awrt 73.0,7	6.6	A1, A1	
				(5)
c)	Journey times independent			
	Sample large enough to use central limit theorem any	2	B1,B1	
	Same distribution / population			(2)

Question Number	Scheme	Marks
5.	Never Sometimes Regularly Totals	M1 convert % to freq A1 (26, 91, 30, 132) A1 (143, 78)
	Males 30 132 78 240	B1 B1
	Females 26 143 91 260	M1 A1 at least 3sf
	56 275 169 500	B1; B1√
	H ₀ : No association (independent) between gender and exercise H1 : association (not independent) between gender and exercise	M1 A1
	Expected Values	A1√ (12)
	Never Sometimes Regularly Totals Males 26.88 132 81.12 240	
	Females 29.12 143	

EDEXCEL	. STATISTICS S3 (6685) – JUNE 2004	PROVISIONAL MARK SCHEME
	87.88	
	200	
	56	
	275	
	169	
	500	
	$\alpha = 0.05$ $v = 2$; CV $\chi^2 > 5.991$	
	$\Sigma \frac{(O-E)^2}{N} OR \Sigma \frac{O^2}{N} - N = 0.9271 \qquad \text{answers in } r$	range 0.90 – 0.95
	E E	
	Not in critical region – no evidence of association between	
	צרווערו מווע באבוניוצב	

Scheme			Marks			
<i>X</i> ~ B(3,1/6)			b 3,	oino 1/6	B1 B1	(2)
X Pro	bb	Expected freq	prob – must show we and use B(3,p) or ma implied by correct a	orking 1y be answer	M1	
$0 \qquad \left(\frac{5}{6}\right)$	$\left(\frac{5}{5}\right)^3$	144.68	expe	ected	M1	
1 3×	$\times \left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)$	86.81				
2 3:	$\times \left(\frac{5}{6}\right) \left(\frac{1}{6}\right)^2$	17.36	awrt 145,86.8,17.4,1.15	5/1.16	B2 (-1 ee)	
3	$\left(\frac{1}{6}\right)^3$	1.15 (1.16)				
H ₀ : Binomia H ₁ : Binomia	al model is a good al model is not a go	fit ood fit	both, no c	ditto	B1	
Amalgamate 3 with another group				M1		
$\alpha = 0.01 v = 2 ; CR \; \chi^2 > \underline{9.210}$			B1 ; B1√			
$\sum \frac{(O-E)^2}{E} OR \sum \frac{O^2}{E} - N = 8.6894$ answers in range 8.67 - 8.70 or			M1 A1			
Evidence that	t Binomial is a goo	od model.			A1√	(11)
	$X \sim B(3,1/6)$ $X \qquad Pro$ $0 \qquad \left(\frac{4}{6}\right)$ $1 \qquad 3^{2}$ $2 \qquad 3$ $3 \qquad \left(\frac{4}{6}\right)$ $H_{0} : Binomia$ $H_{1} : Binomia$ $H_{1} : Binomia$ $Amalgamate$ $\alpha = 0.01 v =$ $\sum \frac{(O-E)^{2}}{E} O$ answers in range 8. Evidence tha	$X \sim B(3,1/6)$ $X \qquad \text{Prob}$ $0 \qquad \left(\frac{5}{6}\right)^{3}$ $1 \qquad 3 \times \left(\frac{5}{6}\right)^{2} \left(\frac{1}{6}\right)$ $2 \qquad 3 \times \left(\frac{5}{6}\right) \left(\frac{1}{6}\right)^{2}$ $3 \qquad \left(\frac{1}{1}\right)^{3}$ $H_{0} : \text{Binomial model is a good}$ $H_{1} : \text{Binomial model is not a good}$ $H_{1} : \text{Binomial model is not a good}$ $Amalgamate 3 \text{ with another growth}$ $\alpha = 0.01 v = 2 ; \text{CR } \chi^{2} > 9.210$ $\sum \frac{(O-E)^{2}}{E} OR \sum \frac{O^{2}}{E} - N = 8.60$ answers in range 8.67 - 8.70 or Evidence that Binomial is a good	SchemeX~B(3,1/6)XProbExpected freq0 $\left(\frac{5}{6}\right)^3$ 144.681 $3 \times \left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)$ 86.812 $3 \times \left(\frac{5}{6}\right) \left(\frac{1}{6}\right)^2$ 17.363 $\left(\frac{1}{6}\right)^3$ 1.15 (1.16)H_0 : Binomial model is a good fitH_1 : Binomial model is not a good fitH_1 : Binomial model is not a good fit $Amalgamate 3$ with another group $\alpha = 0.01 \ v = 2$; CR $\chi^2 > 9.210$ $\Sigma \frac{(O-E)^2}{E} OR \Sigma \frac{O^2}{E} - N = 8.6894$ answers in range 8.67 - 8.70 orEvidence that Binomial is a good model.	SchemeX = B(3,1/6)Expected freqprob-must show w and use B(3,p) or main minipled by correct.0 $\left(\frac{5}{6}\right)^3$ 144.68expected freq1 $3 \times \left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)$ 86.81expected freq2 $3 \times \left(\frac{5}{6}\right) \left(\frac{1}{6}\right)^2$ 17.36aver 145.86.8,17.4,1.193 $\left(\frac{1}{6}\right)^3$ 1.15 (1.16)both, no of H_1 : Binomial model is a good fitHo : Binomial model is not a good fitboth, no of H_1 : Binomial model is not a good fitAmalgamate 3 with another group $\alpha = 0.01 \ v = 2$; CR $\chi^2 > 9.210$ $\sum \frac{(O-E)^2}{E} OR \le \frac{O^2}{E} - N = 8.6894$ answers in range 8.67 - 8.70 orEvidence that Binomial is a good model.	SchemeX = B(3,1/6)bino 3, 1/6XProbExpected freq implied by correct answer0 $\left(\frac{5}{6}\right)^3$ 144.681 $3 \times \left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)$ 86.812 $3 \times \left(\frac{5}{6}\right) \left(\frac{1}{6}\right)^2$ 17.363 $\left(\frac{1}{6}\right)^3$ 1.15 (1.16)H_0 : Binomial model is a good fit H_1 : Binomial model is not a good fitboth, no dittoAmalgamate 3 with another group $\alpha = 0.01 \ v = 2$; CR $\chi^2 > 9.210$ $\Sigma \frac{(O-E)^2}{E} OR \Sigma \frac{O^2}{E} - N = 8.6894$ answers in range 8.67 - 8.70 orEvidence that Binomial is a good model.	SchemeMarksX = B(3,1/6)bino 3, 1/6B1 B1X = ProbExpected freq mplet by correct answer mplet by correct answer M1M10 $\left(\frac{5}{6}\right)^3$ 144.68expected1 $3 \times \left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)$ 86.81M12 $3 \times \left(\frac{5}{6}\right)^2 \left(\frac{1}{6}\right)^2$ 17.36awrt 145.86.817.4.1.1571.163 $\left(\frac{1}{6}\right)^3$ 1.15 (1.16)B2 (-1 ee)3 $\left(\frac{1}{6}\right)^3$ 1.15 (1.16)B1Ho : Binomial model is a good fit

Question Number	Scheme		Marks	
6.c)	Estimate p Degrees of freedom reduced by 1		B1 B1	(2)
	Special case			
	Use of B(3,0.192) in part (b)			
	Expected frequencies		• • •	
	131.8785 94.01242		M1 M1	
	22.339 1.769		B0	
	H_0 : Binomial model is a good fit bo H_1 : Binomial model is not a good fit	th, no ditto	B1	
	Amalgamate 3 with another group		M1	
	$\alpha = 0.01$ v = 1 ; CR $\chi^2 > 6.635$		B1 ; B1√	
	$\Sigma \frac{(O-E)^2}{E} OR \Sigma \frac{O^2}{E} - N \text{in range 5.45 -5.50}$		M1 A1	
	Evidence that Binomial is a good model.		A1√	(11)

Question Number	Scheme	Marks
7a)	E(D) = E(A) - 3E(B) + 4E(C)	M1
	= 20	A1
	Var(D) = Var(A) + 9Var(B) + 16Var(C) Use of a ² Var X Adding 3 Var ie 4 +	M1 M1
	=341	A1
	P (D < 44) = P $\left(z < \frac{44 - 20}{\sqrt{341}}\right)$ standardising their mean and sd	M1, A1√
	= P (z < 1.30) awrt 1.30	A1
b)	= <u>0.9032</u>	A1 (9)
	E(X) = 20	B1
	Var(X) = Var(A) + 3Var(B) + 16 Var(C) + and 16 3 Var(B)	M1 M1
	= 287	A1
	P (X >0) = P $\left(z > \frac{-20}{\sqrt{287}}\right)$ standardising their mean and sd	M1
	= P(z > -1.18) awrt -1.18	A1
	= 0.8810	A1 (7)