Question	Answer	Marks	Guidance
1	$0.8 \times 0.6 + 0.2(1-x) = 0.63$	**M1**	Equation of form 0.8 × A + 0.2 × B = C, A,B involving $1-x$ and 0.6 or 0.4 and C = 0.63 or 0.37
	$0.2x = 0.05$	**M1**	Correct unsimplified equation
	$x = 0.25$	**A1**	
	Alternative method for question 1		
	$0.8 \times 0.4 + 0.2x = 1 - 0.63$	**M1**	Equation of form 0.8 × A + 0.2 × B = C, A,B involving x and 0.6 or 0.4 and C = 0.63 or 0.37
	$0.2x = 0.05$	**M1**	Correct unsimplified equation
	$x = 0.25$	**A1**	
		3	

Question	Answer	Marks	Guidance
2(i)	$1-({}^{10}C_2\,0.42^8\,0.58^2+{}^{10}C_9\,0.42^9\,0.58^1+0.42^{10})$	**M1**	Binomial term of form ${}^{10}C_a p^a(1-p)^b$ $0<p<1$ any p, $0 \leqslant a,b \leqslant 10$
		A1	Correct unsimplified expression
	0.983	**A1**	
		3	
2(ii)	$1-\text{P}(0)>0.995$ $0.58^n<0.005$	**M1**	Equation or inequality involving 0.58^n or 0.42^n and 0.995 or 0.005
	$n>\dfrac{\log 0.005}{\log 0.58}$ $n>9.727$	**M1**	Attempt to solve using logs or Trial and Error. May be implied by their answer (rounded or truncated)
	$n=10$	**A1**	CAO
		3	

Question	Answer	Marks	Guidance
3(i)	$\sum x=60\times 20 \quad =1200$	**B1**	
	$\dfrac{\sum x^2}{20}-60^2=4^2$	**M1**	Correct variance formula used, condone = 4
	$\sum x^2=3616\times 20 \quad =72320$	**A1**	Exact value
		3	

Question	Answer	Marks	Guidance
3(ii)	$\sum x = 1200 + 550 = 1750$ $\sum x^2 = 72320 + 40500 = 112800$	**M1**	Summing both values of $\sum x$ and $\sum x^2$
	$\text{Mean} = \frac{their\,1750}{30} = 58.3$	**B1FT**	FT *their* 1750 (not 550 or 1200)/*their*(20+10), accept unsimplified
	$\text{Variance} = \frac{their\,112820}{30} - \left(\frac{their\,1750}{30}\right)^2 \quad (= 357.89)$	**M1**	substitute *their* Σx and Σx^2 into correct variance formula
	s.d. = 18.9	**A1**	
		4	

Question	Answer	Marks	Guidance
4(i)	$\frac{1}{4} + + p + p + \frac{3}{8} + 4p = 1$	**M1**	Unsimplified sum of probabilities equated to 1
	$p = \frac{1}{16}$	**A1**	If method FT from *their* incorrect **(i)**, expressions for E(X) and Var(X) must be seen unsimplified with all probabilities <1, condone not adding to 1
		2	

Question	Answer	Marks	Guidance
4(ii)	$[\mathrm{E}(X)] = -\frac{1}{4}+\frac{1}{16}+\frac{6}{8}+1=\frac{25}{16}$	**M1**	May be implied by use in Variance, accept unsimplified
	$[\mathrm{Var}(X)] = \frac{1}{4}+\frac{1}{16}+\frac{12}{8}+\frac{16}{4}-\left(their\,\frac{25}{16}\right)^2$	**M1**	Substitute into correct variance formula, must have '– their mean^2'
	$\frac{863}{256}$ or 3.37	**A1**	OE
		3	
4(iii)	$\mathrm{P}(X=2\|X>0) = \frac{\mathrm{P}(\mathrm{X}=2)}{\mathrm{P}(\mathrm{X}>0)} = \frac{\frac{3}{8}}{\frac{11}{16}}$	**M1**	Conditional probability formula used consistent with their probabilities
	$\frac{6}{11}$ or 0.545	**A1**	
		2	

Question	Answer	Marks	Guidance
5(i)	156 – 55 = 99	**B1**	98 ⩽ answer < 100
		1	
5(ii)	90% of 160 = 144	**M1**	144 seen, may be marked on graph
	(L =) 22	**A1**	
		2	
5(iii)	Median = 15.6 UQ = 18.8, LQ = 12.7	**B1**	15.5 < median < 15.8
	IQR = 18.8 – 12.7	**M1**	18.5 < UQ < 19 – 12.5 < LQ < 13
	6.1	**A1**	6.0 ⩽ IQR ⩽ 6.2
		3	
5(iv)	The Median higher for Ransha (1st set of data)	**B1**	Any correct comparison of central tendency, must mention median
	IQR lower for Ransha (1st set of data)	**B1**	Any correct comparison of spread, must refer to IQR
		2	

Question	Answer	Marks	Guidance
6(i)	$\frac{9!}{2!} = 181\,440$	**B1**	Exact value
		1	
6(ii)	Total no of ways = $\frac{12!}{2!4!} = 9\,979\,200$ (A)	**B1**	Accept unevaluated
	With Ss together = $\frac{11!}{4!} = 1\,663\,200$ (B)	**B1**	Accept unevaluated
	With Ss not together = (B) – (A)	**M1**	Correct or $\frac{12!}{m} - \frac{8!}{n}, m, n$ integers > 1 or *their* identified total – *their* identified Ss together
	8 316 000	**A1**	Exact value
	Alternative method for question 6(ii)		
	_ T _ E _ E _ P _ L _ E _ C _ H _ A _ E _	**B1**	$10! \times k$ in numerator k integer $\geqslant 1$
	$\frac{10!}{4!} \times \frac{11 \times 10}{2!}$	**B1**	$4! \times k$ in numerator k integer $\geqslant 1$
	$\frac{their\,10!}{their\,4!} \times {}^{11}C_2$ or ${}^{11}P_2$	**M1**	OE
	8 316 000	**A1**	Exact value
		4	

Question	Answer	Marks	Guidance
6(iii)	S E E E : 1	**M1**	${}^6C_x$ seen alone or times $K > 1$
	S E E _ : ${}^6C_1 = 6$ S E _ _ : ${}^6C_2 = 15$ S _ _ _ : ${}^6C_3 = 20$	**B1**	${}^6C_3$ or ${}^6C_2$ or ${}^6C_1$ alone
	Add 3 or 4 correct scenarios	**M1**	No extras
	Total = 42	**A1**	
		4	

Question	Answer	Marks	Guidance
7(i)	$P(46 < X < 53) = P\left(\frac{46-49.2}{2.8} < Z < \frac{53-49.2}{2.8}\right)$	**M1**	Using $\pm$ standardisation formula for either 46 or 53, no continuity correction, σ^2 or $\sqrt{\sigma}$
	$P(-1.143 < Z < 1.357)$	**A1**	Both standardisations correct unsimplified
	$\Phi(1.357) + \Phi(1.143) - 1$ $= 0.9126 + 0.8735 - 1$	**M1**	Correct final area
	0.786	**A1**	Final answer
		4	

Question	Answer	Marks	Guidance
7(ii)	$\frac{t-49.2}{2.8}=-1.406$	**B1**	± 1.406 seen
		M1	An equation using $\pm$ standardisation formula with a z-value, condone σ^2 or $\sqrt{\sigma}$
	45.3	**A1**	
		3	
7(iii)	$P(X<46)=0.1265$	**M1**	Calculated or ft from **(i)**
	$P(2PB<46)=3(1-0.1265)0.1265^2$	**M1**	$3(1-p)p^2$, $0<p<1$
	0.0419	**A1**	
		3	