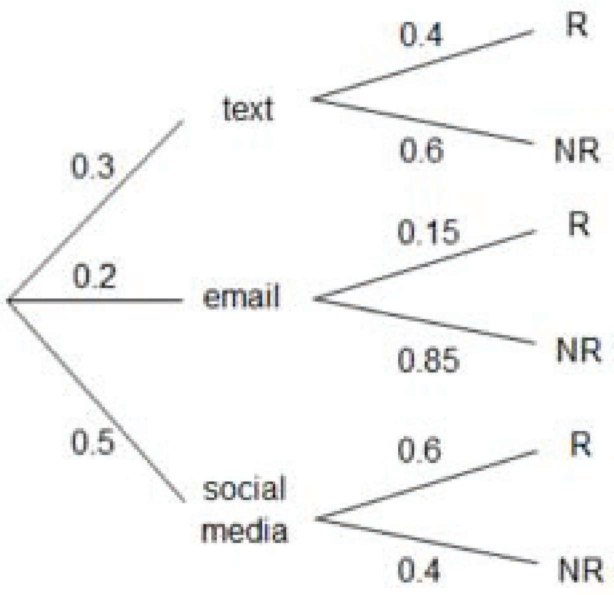
Question	Answer	Marks	Guidance
1(i)	$P(79 < X < 91) = P\left(\frac{79-85}{6.8} < Z < \frac{91-85}{6.8}\right)$ $= P(-0.8824 < Z < 0.8824)$	**M1**	Using ± standardisation formula for either 79 or 91, no continuity correction
	$= \Phi(0.8824) - \Phi(-0.8824)$ $= 0.8111 - (1 - 0.8111)$	**M1**	Correct area ($\Phi - \Phi$) with one +ve and one –ve z-value or $2\Phi - 1$ or $2(\Phi - 0.5)$
	$= 0.622$	**A1**	Correct answer
		3	
1(ii)	$z = -1.751$	**B1**	± 1.751 seen
	$-1.751 = \frac{t-85}{6.8}$	**M1**	An equation using ± standardisation formula with a z-value, condone σ^2 or $\sqrt{\sigma}$
	$t = 73.1$	**A1**	Correct answer
		3	

Question	Answer	Marks	Guidance
2(i)		**B1**	Fully correct labelled tree with correct probabilities for ‘Send’
		B1	Fully correct labelled branches with correct probabilities for the ‘reply’
		2	

Question	Answer	Marks	Guidance
2(ii)	$\mathrm{P}(email \mid NR) = \frac{\mathrm{P}(\text{email} \cap \text{NR})}{\mathrm{P}(\text{NR})} = \frac{0.2 \times 0.85}{0.3 \times 0.6 + 0.2 \times 0.85 + 0.5 \times 0.4}$	M1	P(email) × P(NR) seen as numerator of a fraction, consistent with *their* tree diagram
	$= \frac{0.17}{0.18 + 0.17 + 0.2} = \frac{0.17}{0.55}$	M1	Summing three appropriate 2-factor probabilities, consistent with *their* tree diagram, seen anywhere 0.55 oe (can be unsimplified) seen as denom of a fraction
	$= 0.309, \frac{17}{55}$	A1	
		A1	Correct answer
		4	

Question	Answer	Marks	Guidance
3(i)	9! × 2	B1	9! seen multiplied by $k \geqslant 1$, no addition
	= 725760	B1	Exact value
		2	
3(ii)	Eg $(K_1K_2K_3K_4K_5)$ A A A (U_1U_2) A	B1	2! or 5! seen mult by k > 1, no addition (arranging Us or Ks)
	= 5! × 2! × 6!	B1	6! Seen mult by k > 1, no addition (arranging AAAAKU)
	= 172800	B1	Exact value
		3	

Question	Answer	Marks	Guidance
4(i)	M(8) W(4) 4 2 in $^8C_4 \times {}^4C_2 = 420$ ways 5 1 in $^8C_5 \times {}^4C_1 = 224$ ways 6 0 in $^8C_6 \times {}^4C_0 = 28$ ways	**B1**	One unsimplified product correct
		M1	Summing the number of ways for 2 or 3 correct scenarios (can be unsimplified), no incorrect scenarios
	Total 672 ways	**A1**	Correct answer
		3	

Question	Answer	Marks	Guidance
4(ii)	Total number of selections = ${}^{12}C_6$ = 924 (A)	M1	${}^{12}C_x$ – (subtraction seen), accept unsimplified
	Selections with males together = ${}^{10}C_4$ = 210 (B)	A1	Correct unsimplified expression
	Total = (A) – (B) = 714	A1	Correct answer
	Alternative method for question 4(ii)		
	No males + Only male 1 + Only male 2 = ${}^{10}C_6 + {}^{10}C_5 + {}^{10}C_5$	M1	${}^{10}C_x + 2 \times {}^{10}C_y$, $x \neq y$ seen, accept unsimplified
	= 210 + 252 + 252	A1	Correct unsimplified expression
	= 714	A1	Correct answer
	Alternative method for question 4(ii)		
	Pool without male 1 + Pool without male 2 – Pool without either male	M1	$2 \times {}^{11}C_x - {}^{10}C_x$
	= ${}^{11}C_6 + {}^{11}C_6 - {}^{10}C_6$ = 462 + 462 – 210	A1	Correct unsimplified expression
	= 714	A1	Correct answer
		3	

Question	Answer	Marks	Guidance
5(i)	$P(0, 1, 2) = (0.66)^{14} + {}^{14}C_1(0.34)(0.66)^{13} + {}^{14}C_2(0.34)^2(0.66)^{12}$	**M1**	Binomial term of form ${}^{14}C_x p^x(1-p)^{14-x}$ $0 < p < 1$ any p, $x \neq 14,0$
	$= 0.0029758 + 0.02146239 + 0.071866$	**A1**	Correct unsimplified answer
	$= 0.0963$	**A1**	Correct answer
		3	
5(ii)	Mean $=600 \times 0.34 = 204$, Var $= 600 \times 0.34 \times 0.66 = 134.64$	**B1**	Correct unsimplified np and npq (or sd = 11.603 or Variance = 3366/25)
	$P(< 190) = P\left(z < \frac{189.5 - 204}{\sqrt{134.64}}\right) = P(z < -1.2496)$	**M1**	Substituting *their* μ and σ, (no σ^2 or $\sqrt{\sigma}$) into the Standardisation Formula with a numerical value for *'189.5'*. Condone ± standardisation formula
		M1	Using continuity correction 189.5 or 190.5 within a Standardisation formula
	$= 1 - \Phi\ (1.2496)$	**M1**	Appropriate area Φ from standardisation formula P(z<….) in final solution, (<0.5 if z is –ve, >0.5 if z is +ve)
	$= 1 - 0.8944 = 0.106$	**A1**	Correct final answer
		5	

Question	Answer	Marks	Guidance
6(i)	score: 1, 2, 3, 4, 6, 9 prob: $\frac{3}{15}$, $\frac{4}{15}$, $\frac{4}{15}$, $\frac{1}{15}$, $\frac{2}{15}$, $\frac{1}{15}$	B1	Probability distribution table with correct scores, allow extra score values if probability of zero stated
		B1	2 probabilities (with correct score) correct
		B1	3 or more correct probabilities with correct scores
		B1	**FT** $\Sigma p = 1$, at least 4 probabilities
		4	
6(ii)	mean $= \frac{(3+8+12+4+12+9)}{15} = \frac{48}{15}$ (3.2)	B1	
	Var $= \frac{(3+16+36+16+72+81)}{15} - (\textit{their}\ 3.2)^2$	M1	**FT** Substitute *their* attempts at scores in correct var formula, must have "– mean^2" (condone probabilities not summing to 1)
	$= \frac{224}{15} - 3.2^2 = 4.69 \left(\frac{352}{75}\right)$	A1	
		3	
6(iii)	Score of 4, 6, 9	M1	Identifying relevant scores from *their* mean and *their* table
	Prob $\frac{4}{15}$ (0.267)	A1	Correct answer **SC** B1 for 4/15 with no working
		2	

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Question	Answer	Marks	Guidance
7(i)	Thaters School | | Whitefay Park School 8 | 3 | 8 3 | 4 | 5 7 8 8 7 6 4 2 | 5 | 3 6 6 6 2 1 | 6 | 1 4 6 9 5 | 7 | 3 5 8 | 8 | 3	B1	Correct stem can be upside down, ignore extra values,
		B1	Correct Thaters School labelled on left, leaves in order from right to left and lined up vertically, no commas
		B1	Correct Whitefay Park School labelled on same diagram on right hand side in order from left to right and lined up vertically, no commas
	Key 8 | 4 | 5 represents 48 minutes for Thaters School and 45 minutes for Whitefay Park School.	B1	**FT** Correct key for *their* diagram, need both teams identified and 'minutes' stated at least once here or in leaf headings or title. **SC** If 2 separate diagrams drawn, **SCB1** if both keys meet these criteria
		4	
7(ii)	LQ = 50 UQ = 61.5	B1	Both quartiles correct
	IQ range = 61.5 – 50 = 11.5	B1	**FT** $61 \leqslant UQ \leqslant 62 - 48 \leqslant LQ \leqslant 52$
		2	
7(iii)	$\Sigma(x-60)^2 = (-15)^2 + (-13)^2 + (-7)^2 + (-4)^2 + (-4)^2 + 1^2 + 4^2 + 6^2 + 9^2 + 13^2 + 23^2 + 15^2 + 18^2$	M1	Summing squares with at least 5 correct unsimplified terms
	= 1856	A1	Exact value
		2	

Question	Answer	Marks	Guidance
7(iv)	Var = mean of coded squares – (coded mean)^2 $= \frac{\sum(x-60)^2}{13} - \left(\frac{\sum(x-60)}{13}\right)^2$	M1	Using two coded values in correct formula (variance or sd)
	Var $= \frac{\textit{their}\,1856}{13} - \left(\frac{46}{13}\right)^2$ = 130	A1	Correct answer **SC** if correct variance obtained by another method give **SCB1**
		2	