

Question	Answer	Marks	Guidance
1(i)	Median = 51 UQ = 57.5, LQ = 40	B1	
	IQR = UQ – LQ	M1	$55 \leq \text{UQ} \leq 62 - 38 \leq \text{LQ} \leq 45$
	17.5	A1	NFWW
		3	
1(ii)	Result will be disproportionately affected by 110	B1	Affected by an extreme/large value There is a large outlier ...contains outliers such as 110... Not 'mean affected by extreme values'
		1	

Question	Answer	Marks	Guidance
2(i)	$0.4x + 0.6 \times 2x = 0.36$ or $0.4(1 - x) + 0.6(1 - 2x) = 0.64$	M1	$0.4a + (1 - 0.4)b = 0.36$ or 0.64 , a, b terms involving x
	$1.6x = 0.36$ $x = 0.225$	A1	Fully justified by algebra AG
		2	

Question	Answer	Marks	Guidance
2(ii)	$P(H L) = \frac{0.4(1-x)}{1-0.36} = \frac{0.4 \times (1-0.225)}{0.64} = \frac{0.4 \times 0.775}{0.4 \times 0.775 + 0.6 \times 0.55}$	M1	Correct numerical numerator of a fraction. Allow unsimplified.
		M1	Denominator 0.36 or 0.64. Allow unsimplified.
	$\frac{31}{64}$ or 0.484	A1	
		3	

Question	Answer	Marks	Guidance
3(i)	0.5 2.4 3 1.4 0.4	M1	At least 3 frequency densities calculated (frequency \div class width) e.g. $\left(\frac{10}{20}, \frac{10}{19} \text{ or } \frac{10}{19.5}\right)$ may be read from graph using <i>their</i> scale, 3SF or exact
	All heights correct on graph.	A1	
	Bar ends of 9.5, 29.5, 39.5, 59.5, 89.5	B1	
	Axes labelled: Frequency density (fd) and speed/km h ⁻¹ (or appropriate title). Linear scales $9.5 \leq$ horizontal axis \leq 89.5, $0 \leq$ vertical axis \leq 3, 5 bars with no gaps	B1	
		4	

Question	Answer	Marks	Guidance
3(ii)	$\frac{19.5 \times 10 + 34.5 \times 24 + 44.5 \times 30 + 54.5 \times 14 + 74.5 \times 12}{90}$ <p style="text-align: center;"><i>their 90</i></p> $= \frac{195 + 828 + 1335 + 763 + 894}{90}$ $= \frac{4015}{90} \text{ or } \frac{803}{18}$	M1	Uses at least 4 midpoint attempts (e.g. 19.5 ± 0.5). Allow unsimplified expression.
	$44 \frac{11}{18}$ or 44.6 (km h ⁻¹)	A1	Final answer not an improper fraction NFWW
		2	

Question	Answer	Marks	Guidance
4(i)	$P(8, 9, 10) = {}^{10}C_8 0.66^8 0.34^2 + {}^{10}C_9 0.66^9 0.34^1 + 0.66^{10}$	M1	Correct binomial term, ${}^{10}C_a 0.66^a (1-0.66)^b$ $a+b = 10, 0 < a, b < 10$
		A1	Correct unsimplified expression
	0.284	B1	CAO
		3	

Question	Answer	Marks	Guidance
4(ii)	$np = 0.66 \times 150 = 99$ $npq = 0.66 \times (1 - 0.66) \times 150 = 33.66$	B1	Accept evaluated or unsimplified μ, σ^2 numerical expressions, condone $\sigma = \sqrt{33.66} = 5.8017$ or 5.802 CAO
	$P(X > 84) = P\left(Z > \frac{84.5 - 99}{\sqrt{33.66}}\right)$	M1	\pm Standardise, $\frac{x - \text{their } 99}{\sqrt{\text{their } 33.66}}$, condone σ^2, x a value
		M1	84.5 or 83.5 used in <i>their</i> standardisation formula
	$(= P(Z > -2.499))$	M1	Correct final area
	0.994	A1	Final answer (accept 0.9938) SC if no standardisation formula seen, B2 $P(Z > -2.499) = 0.994$
		5	

Question	Answer	Marks	Guidance														
5(i)	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>x</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>p</td> <td>$\frac{1}{12}$</td> <td>$\frac{1}{12}$</td> <td>$\frac{3}{12}$</td> <td>$\frac{2}{12}$</td> <td>$\frac{3}{12}$</td> <td>$\frac{2}{12}$</td> </tr> </table>	x	-1	0	1	2	3	4	p	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{3}{12}$	$\frac{2}{12}$	$\frac{3}{12}$	$\frac{2}{12}$	B1	Table with correct values of x , at least 1 probability, all probabilities ≤ 1
	x	-1	0	1	2	3	4										
	p	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{3}{12}$	$\frac{2}{12}$	$\frac{3}{12}$	$\frac{2}{12}$										
		B1	2 probabilities correct, may not be in table														
		B1	2 more probabilities correct, may not be in table														
	B1	All correct, values in table SC1 No more than 1 correct probability and at least 5 probabilities summing to 1 in table															
	4																
5(ii)	$[E(X)] = \left(\frac{-1+0+3+4+9+8}{12} \right) = \frac{23}{12}$	M1	May be implied by use in variance. Allow unsimplified expression														
	$[\text{Var}(X)] = \frac{1+0+3+8+27+32(=71)}{12} - \left(\frac{23}{12} \right)^2$	M1	Appropriate variance formula using <i>their</i> $E(X)^2$														
	2.24 or $\frac{323}{144}$ or $2\frac{35}{144}$	A1	CAO														
		3															

Question	Answer	Marks	Guidance
6(i)	$P(X < 45) = P\left(Z < \frac{45 - 40}{8}\right)$ $= P(Z < 0.625)$	M1	\pm Standardise, no continuity correction, σ^2 or $\sqrt{\sigma}$, formula must be seen
	0.734(0)	A1	CAO
		2	
6(ii)	$1 - 2(1 - (i)) = 2(i) - 1 = 2((i) - 0.5)$	M1	Use result of part (i) or recalculated to find area OE
	0.468	A1ft	$0 < \text{FT from (i)} < 1$ or correct.
		2	
6(iii)	$P(X < 10) = 48/500 = 0.096$ $z = -1.305$	B1	$z = \pm 1.305$
	$P(X > 24) = 76/500 = 0.152$ $z = 1.028$	B1	$z = \pm 1.028$
	$10 - \mu = -1.305\sigma$ $24 - \mu = 1.028\sigma$	M1	Form 1 equation using 10 or 24 with μ, σ, z -value. Allow continuity correction, not $\sigma^2, \sqrt{\sigma}$
	$14 = 2.333\sigma$	M1	OE Solve two equations in σ and μ to form equation in one variable
	$\sigma = 6.[00], \mu = 17.8[3]$	A1	CAO, WWW
		5	

Question	Answer	Marks	Guidance
7(i)	6! = 720	B1	Evaluated
		1	
7(ii)	Total no of arrangements: $\frac{9!}{2!3!} = 30240$	B1	Accept unevaluated
	No with Ts together = $\frac{8!}{3!} = 6720$	B1	Accept unevaluated
	With Ts not together: 30 240 – 6720	M1	correct or $\frac{9!}{m} - \frac{8!}{n}$, m, n integers > 1 or <i>their</i> identified total – <i>their</i> identified Ts together
	23 520	A1	CAO
	Alternative method for question 7(ii)		
	$\frac{7!}{3!} \times \frac{8 \times 7}{2}$	B1	$7! \times (k > 0)$ in numerator, cannot be implied by 7P_2 , etc.
		B1	$3! \times (k > 0)$ in denominator
		M1	$\frac{\textit{their } 7!}{\textit{their } 3!} \times {}^8C_2$ or 8P_2
	23 520	A1	CAO
		4	

Question	Answer	Marks	Guidance
7(iii)	Number of arrangements = $\frac{7!}{3!}$ Probability = $\frac{\text{their } \frac{7!}{3!}}{\text{their } \frac{9!}{3!2!}} = \frac{840}{30240}$	M1	$\frac{\text{their identified number of arrangements with T at ends}}{\text{their identified total number of arrangements}}$ $\frac{7!}{9!}$ or $\frac{m}{n}$, m, n integers > 1
	$\frac{1}{36}$ or 0.0278	A1	Final answer
		2	
7(iv)	OOT__ ${}^4C_2 = 6$ OOTT_ ${}^4C_1 = 4$ OOOT_ ${}^4C_1 = 4$ OOOTT = 1	M1	4C_x seen alone or ${}^4C_x \times k \geq 1$, k an integer, $0 < x < 4$
		A1	${}^4C_2 \times k$, $k = 1$ oe or ${}^4C_1 \times m$, $m = 1$ oe alone
		M1	Add 3 or 4 identified correct scenarios only, accept unsimplified
	(Total) = 15	A1	CAO, WWW Only dependent on 2nd M mark
		4	