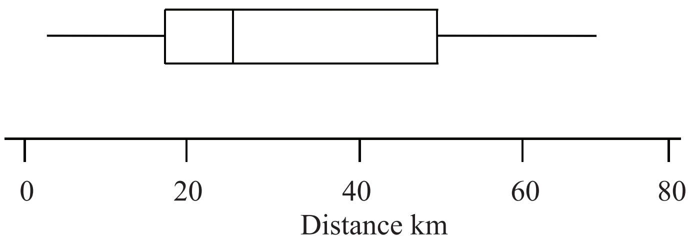
Question	Answer	Marks	Guidance
1	$\Sigma(x-10) = 186 - 12 \times 10 = 66$	**B1**	Correct answer
	$\dfrac{\Sigma(x-10)^2}{12} - \left(\dfrac{\Sigma(x-10)}{12}\right)^2 = 4.5^2$	**M1**	Consistent substituting in the correct coded variance formula OR Valid method for Σx^2 then expanding $\Sigma(x-10)^2$, 3 terms with at least 2 correct
	$\Sigma(x-10)^2 = 606$	**B1**	Correct answer
		3	

Question	Answer	Marks	Guidance
2(i)	LQ = 18, Median = 25, UQ = 50	**B1**	median correct
		**B1**	LQ and UQ correct
		B1	Quartiles and median plotted as box graph with linear scale min 3 values
		B1ft	Whiskers drawn to correct end points with linear scale, not thr' box, not joining at top or bottom of box. Ft their UQ and LQ. Whiskers must be with ruler If scale non-linear or non-existent SCB1if all 5 data values (quartiles and end points) have values shown and all are correct numerically and fulfil the 'box' and 'whiskers ruled line' requirements
		B1	Label to include 'distance or travelled' and 'km,' allow 'total km', linear scale, numbered at least 5 – 70.
		5	

Question	Answer	Marks	Guidance
2(ii)	$1.5 \times IQR = 48$ **Method 1** $LQ - 48 = -ve$, (i.e. < 0) $UQ + 48 = 98$ (i.e. > 70)	**M1**	Attempt to find $1.5 \times$ their IQR and add to UQ **or** subt from LQ
	hence no outliers	**A1**	Correct conclusion from correct working, need both ends. No need to state comparisons.
	Method 2 $LQ - 5 = 13$ (< 48) $70 - UQ = 20$ (< 48)	**M1**	Compare their $1.5 \times IQR$ ($= 48$) $>$ gap (20) between UQ and max 70 **or** LQ and min 5
	Hence no outliers	**A1**	Correct conclusion from correct working, need both ends. No need to state comparisons
		2	

Question	Answer	Marks	Guidance
3(i)	$P(RB) + P(BR) = \frac{4}{12} \times \frac{8}{11} + \frac{8}{12} \times \frac{4}{11}$ oe	M1	Multiply 2 probs together and summing two 2-factor probs, unsimplified, condone replacement
	$P(\text{diff colours}) = \frac{64}{132}$ $(\frac{16}{33})$ (0.485) oe	A1	Correct answer
	Method 2 $1 - P(BB) - P(RR) = 1 - \frac{4}{12} \times \frac{3}{11} - \frac{8}{12} \times \frac{7}{11}$	M1	Multiply 2 probs together and subtracting two 2-factor probs from 1, unsimplified, condone replacement
	$P(\text{diff colours}) = \frac{64}{132}$ $(\frac{16}{33})$ oe	A1	Correct answer
	Method 3 $P(\text{diff colours}) = \frac{({}^4C_1 \times {}^8C_1)}{{}^{12}C_2}$	M1	Multiply 2 combs together and dividing by a combination
	$= \frac{16}{33}$	A1	Correct answer
		2	
3(ii)	Number of red socks: 0, 1, 2 Prob: $\frac{14}{33}$, $\frac{16}{33}$, $\frac{3}{33}$	B1	Prob distribution table drawn, top row correct, condone additional values with $p = 0$ stated
		B1	P(0) or P(2) correct to 3sf (need not be in table)
		B1	All probs correct to 3sf, condone P(0) and P(2) swapped if correct
		3	

Question	Answer	Marks	Guidance
3(iii)	$E(X) = 1 \times \frac{16}{33} + 2 \times \frac{3}{33} = \frac{16}{33} + \frac{6}{33} = \frac{22}{33}\ (\frac{2}{3})$	B1ft	ft their table if 0, 1, 2 only, $0 < p < 1$
		1	

Question	Answer	Marks	Guidance
4(a)	$z_1 = 2.4$	B1	± 2.4 seen accept 2.396
	$z_2 = -0.5$	B1	± 0.5 seen
	$2.4 = \frac{36800 - \mu}{\sigma}$	M1	Either standardisation eqn with z value, not 0.5082, 0.7565, 0.0082, 0.6915, 0.3085, 0.6209, 0.0032 or any other probability
	$-0.5 = \frac{31000 - \mu}{\sigma}$	M1	Sensible attempt to eliminate μ or σ by substitution or subtraction from their 2 equations (z-value not required), need at least 1 value stated
	σ = 2000 μ = 32000	A1	Both correct answers
		5	
4(b)	$P(X < 3\mu) = P\left(z < \frac{3\mu - \mu}{(4\mu/3)}\right)$ or $P = \left(z < \frac{(9\sigma/4) - (3\sigma/4)}{\sigma}\right)$	M1	Standardise, in terms of one variable, accept σ^2 or $\sqrt{\sigma}$
	$P(z < \frac{6}{4})$	M1	$\frac{6}{4}$ or $\frac{6}{4\sigma}$ seen
	= 0.933	A1	Correct final answer
		3	

Question	Answer	Marks	Guidance
5(i)	P(4, 5, 6) = $^{15}C_4(0.22)^4(0.78)^{11}$ + $^{15}C_5(0.22)^5(0.78)^{10}$ +	M1	One binomial term $^{15}C_x p^x(1-p)^{15-x}$ $0 < p < 1$
	$^{15}C_6(0.22)^6(0.78)^9$	A1	Correct unsimplified expression
	= 0.398	A1	Correct answer
		3	
5(ii)	$\mu = 145 \times 0.22 = 31.9$ $\sigma^2 = 145 \times 0.22 \times 0.78 = 24.882$	B1	Correct unsimplified mean and variance
	$P(x > 26) = P\left(z > \frac{26.5 - 31.9}{\sqrt{24.882}}\right) = P(z > -1.08255)$	M1	Standardising must have sq rt
		M1	25.5 or 26.5 seen as a cc
	$= \Phi(1.08255)$	M1	Correct area Φ, must agree with their μ
	= 0.861	A1	Correct final answer accept 0.861, or 0.860 from 0.8604 not from 0.8599
		5	

Question	Answer	Marks	Guidance
6(i)	P(SLL) = (0.3)(0.55)(0.55) = 0.09075 ($\frac{363}{4000}$)	M1	P(SLL), P(SRR), P(SSL) or P(SSR) seen
	P(SRR) = (0.3)(0.15)(0.15) = 0.00675 ($\frac{27}{4000}$)	A1	Two correct options 0.09075 or 0.00675 can be unsimplified
	Total = $^3C_1 \times$ P(SLL) + $^3C_1 \times$ P(SRR) = 0.27225 + 0.02025	M1	Summing 6 prob options not all identical
	Prob = 0.293 accept 0.2925 ($\frac{117}{400}$)	A1	Correct answer
		4	
6(ii)	$P(SSS \mid \text{all same dir}^n) = \frac{P(SSS\ and\ same\ dir^n)}{P(same\ direction)}$	B1	$(0.3)^3$ oe seen on its own as num or denom of a fraction
		M1	Attempt at P(*SSS*+*LLL*+*RRR*) seen anywhere
	$= \frac{0.3 \times 0.3 \times 0.3}{(0.15)^3 + (0.55)^3 + (0.3)^3}$	A1	$(0.15)^3 + (0.55)^3 + (0.3)^3$ oe seen as denom of a fraction
	= 0.137 ($\frac{108}{787}$)	A1	Correct answer
		4	

Question	Answer	Marks	Guidance
7(i)	$\frac{9!}{2!2!} = 90720$	B1	Must see 90720
		1	
7(ii)	**Method 1** ↑ * * * * * A	B1	5! seen multiplied (arrangement of consonants allowing repeats)
	No. arrangements of consonants × ways of inserting vowels =	B1	${}^6P_4$ oe (i.e. 6 × 5 × 4 × 3, ${}^6C_4$ × 4!) seen mult (allowing repeats) no extra terms
	$\frac{5!}{2!}$ $\times \frac{{}^6P_4}{2!}$	B1	Dividing by at least one 2! (removing at least one set of repeats)
	Answer $\frac{{}^6P_4}{2!} \times \frac{5}{2} = 10\,800$	B1	Correct final answer
		4	
7(iii)	${}^5C_3 = 10$	M1	${}^5C_x$ or ${}^5P_x$ seen alone, x = 2 or 3
		A1	Correct final answer not from ${}^5C_2$
		2	

Question	Answer	Marks	Guidance
7(iv)	**Method 1** Considering separate groups	**M1**	Considering two scenarios of MME or EEM or MMEE with attempt, may be probs or perms
	MME** = ${}^5C_2$ = 10 MEE** = ${}^5C_2$ = 10 MMEE* = ${}^5C_1$ = 5	**M1**	Summing three appropriate scenarios from the four need ${}^5C_x$ seen in all of them
	ME*** = ${}^5C_3$ = 10 see **(iii)** Total = 35	**A1**	Correct final answer
	Method 2 Considering criteria are met if ME are chosen	**M1**	${}^7C_x$ only seen, no other terms
		M1	${}^xC_3$ only seen, no other terms
	ME *** = ${}^7C_3$ = 35	**A1**	Correct final answer
		3	