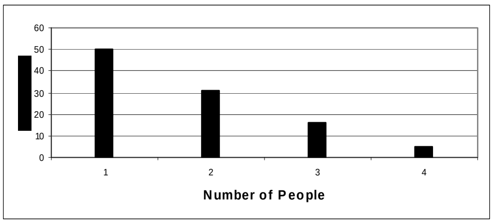
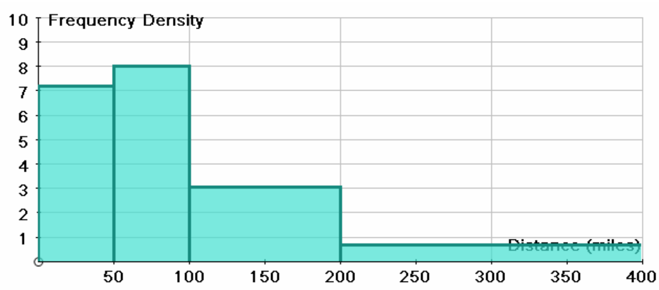
4766 Statistics 1

Q1 (i)	Median = 2 Mode = 1	B1 CAO B1 CAO	**2**
(ii)		S1 labelled linear scales on both axes H1 heights	**2**
(iii)	Positive	B1	**1**
		TOTAL	**5**
Q2 (i)	$\binom{25}{5}$ different teams = 53130	M1 for $\binom{25}{5}$ A1 CAO	**2**
(ii)	$\binom{14}{3}\times\binom{11}{2} = 364\times 55 = 20020$	M1 for either combination M1 for product of both A1 CAO	**3**
		TOTAL	**5**
Q3 (i)	Mean = $\frac{126}{12}$ = 10.5 Sxx = $1582 - \frac{126^2}{12}$ = 259 s = $\sqrt{\frac{259}{11}}$ = 4.85	B1 for mean M1 for attempt at *Sxx* A1 CAO	**3**
(ii)	New mean = 500 + 100 $\times$10.5 = 1550 New s = 100 $\times$4.85 = 485	B1 ANSWER GIVEN M1A1FT	**3**
(iii)	On average Marlene sells more cars than Dwayne. Marlene has less variation in monthly sales than Dwayne.	E1 E1FT	**2**
		TOTAL	**8**

Q4 **(i)**	E(X) = 25 because the distribution is symmetrical. Allow correct calculation of Σrp	E1 <u>ANSWER GIVEN</u>	**1**
(ii)	E(X^2) = $10^2 \times 0.2 + 20^2 \times 0.3 + 30^2 \times 0.3 + 40^2 \times 0.2$ = 730 Var(X) = 730 – 25^2 = 105	M1 for $\Sigma r^2 p$ (at least 3 terms correct) M1dep for – 25^2 A1 CAO	**3**
		TOTAL	**4**
Q5 **(i)**	Distance / freq / width / f dens 0- / 360 / 50 / 7.200 50- / 400 / 50 / 8.000 100- / 307 / 100 / 3.070 200-400 / 133 / 200 / 0.665 	M1 for fds A1 CAO Accept any suitable unit for fd such as eg freq per 50 miles. L1 linear scales on both axes and label W1 width of bars H1 height of bars	**5**
(ii)	Median = 600th distance Estimate = 50 + $^{240}/_{400} \times 50$ = 50 + 30 = 80	B1 for 600^{th} M1 for attempt to interpolate A1 CAO	**3**
		TOTAL	**8**
Q6 **(i)**	(*A*) P(at most one) $= \frac{83}{100} = 0.83$ (*B*) P(exactly two) $= \frac{10+2+1}{100} = \frac{13}{100} = 0.13$	B1 aef M1 for (10+2+1)/100 A1 aef	**1** **2**
(ii)	P(all at least one) $= \frac{53}{100} \times \frac{52}{99} \times \frac{51}{98} = \frac{140556}{970200} = 0.145$	M1 for $\frac{53}{100} \times$ M1*dep* for product of next 2 correct fractions A1 CAO	**3**
		TOTAL	**6**

Q7 (i)	$a = 0.8$, $b = 0.85$, $c = 0.9$.	B1 for any one B1 for the other two	**2**
(ii)	P(Not delayed) = $0.8 \times 0.85 \times 0.9 = 0.612$ P(Delayed) = $1 - 0.8 \times 0.85 \times 0.9 = 1 - 0.612 = 0.388$	M1 for product A1 CAO M1 for 1 – P(delayed) A1FT	**4**
(iii)	P(just one problem) $= 0.2\times0.85\times0.9 + 0.8\times0.15\times0.9 + 0.8\times0.85\times0.1$ $= 0.153 + 0.108 + 0.068 = 0.329$	B1 one product correct M1 three products M1 sum of 3 products A1 CAO	**4**
(iv)	P(Just one problem | delay) $= \frac{\text{P(Just one problem and delay)}}{\text{P(Delay)}} = \frac{0.329}{0.388} = 0.848$	M1 for numerator M1 for denominator A1FT	**3**
(v)	P(Delayed | No technical problems) *Either* $= 0.15 + 0.85 \times 0.1 = 0.235$ *Or* $= 1 - 0.9 \times 0.85 = 1 - 0.765 = 0.235$ *Or* $= 0.15 \times 0.1 + 0.15 \times 0.9 + 0.85 \times 0.1 = 0.235$ *Or (using conditional probability formula)* $\frac{\text{P(Delayed and no technical problems)}}{\text{P(No technical problems)}}$ $= \frac{0.8\times0.15\times0.1 + 0.8\times0.15\times0.9 + 0.8\times0.85\times0.1}{0.8}$ $= \frac{0.188}{0.8} = 0.235$	M1 for 0.15 + M1 for second term A1CAO M1 for product M1 for 1 – product A1CAO M1 for all 3 products M1 for sum of all 3 products A1CAO M1 for numerator M1 for denominator A1CAO	**3**
(vi)	Expected number = $110 \times 0.388 = 42.7$	M1 for product A1FT	**2**
		TOTAL	**18**

Q8 (i)	X ~ B(15, 0.2) (*A*) $P(X = 3) = \binom{15}{3} \times 0.2^3 \times 0.8^{12} = 0.2501$ OR from tables $0.6482 - 0.3980 = 0.2502$ (*B*) $P(X \geq 3) = 1 - 0.3980 = 0.6020$ (*C*) $E(X) = np = 15 \times 0.2 = 3.0$	M1 $0.2^3 \times 0.8^{12}$ M1 $\binom{15}{3} \times p^3 q^{12}$ A1 CAO OR: M2 for 0.6482 – 0.3980 A1 CAO M1 $P(X \leq 2)$ M1 $1 - P(X \leq 2)$ A1 CAO M1 for product A1 CAO	**3** **3** **2**
(ii)	(*A*) Let p = probability of a randomly selected child eating at least 5 a day H_0: $p = 0.2$ H_1: $p > 0.2$ (*B*) H_1 has this form as the proportion who eat at least 5 a day is expected to increase.	B1 for definition of p in context B1 for H_0 B1 for H_1 E1	**4**
(iii)	Let X ~ B(15, 0.2) $P(X \geq 5) = 1 - P(X \leq 4) = 1 - 0.8358 = 0.1642 > 10\%$ $P(X \geq 6) = 1 - P(X \leq 5) = 1 - 0.9389 = 0.0611 < 10\%$ So critical region is {6,7,8,9,10,11,12,13,14,15} 7 lies in the critical region, so we reject null hypothesis and we conclude that there is evidence to suggest that the proportion who eat at least five a day has increased.	B1 for 0.1642 B1 for 0.0611 M1 for at least one comparison with 10% A1 CAO for critical region *dep* on M1 and at least one B1 M1 *dep* for comparison A1 *dep* for decision and conclusion **in context**	**6**
		TOTAL	**18**