

Question Number	Scheme	Marks
6. i.(a)	n is large and p is small	B1 (1)
(b)	$[X \sim B(3000, 0.0025) \rightarrow] Y \sim \text{Po}(7.5)$ $P(Y > 7) = 1 - P(Y \leq 7) = 1 - 0.5246 = 0.47536 \dots$ awrt <u>0.475</u>	B1 M1 A1 (3)
ii.(a)	A list/database/register of all employees	B1 (1)
(b)	The probability distribution of the number of employees that cycle to work [from all possible samples of 150]	B1 (1)
(c)	$D \sim N(60, 36)$ $P(C \leq \alpha) = P(Z \leq z) = 0.0668$ $\frac{\alpha - "60"}{"6"} = -1.5$ or $\frac{"60" - \alpha}{"}6"} = 1.5$ <u>$\alpha = 51$</u>	B1 M1 B1 A1cao (4)
(d)	$P(C \leq 51) = P(D \leq 51.5)$ $P\left(Z \leq \frac{"51" - "60" + 0.5}{"}6"}\right)$ $= P(Z \leq -1.42) = 1 - 0.9222$ $= 0.0778/0.0782 \dots$ awrt <u>0.078</u>	M1 A1 (2) [12 marks]

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4 (i)(a)	$\frac{b-27}{b-a} = \frac{3}{4}$ or $\frac{27-a}{b-a} = \frac{1}{4}$ and $\frac{(b-a)^2}{12} = 300$ $a = 12$ and $b = 72$	M1M1 A1 (3)															
(b)	$[4P(X < k - 10) = P(X > k + 20) \Rightarrow] 4\left(\frac{k-10-'12'}{'72-12'}\right) = \frac{'72'-(k+20)}{'72-12'}$ $4(k-22) = 52-k \Rightarrow k = 28$	M1 A1 (2)															
(ii)	<table> <tr> <td>$L \square U(21, 42)$</td> <td>$L \square U(0, 42)$</td> <td>$S \square U(5.25, 10.5)$</td> </tr> <tr> <td>$\frac{L}{4} - \left(\frac{42-L}{4}\right) > 2$</td> <td>$\frac{L}{4} - \left(\frac{42-L}{4}\right) > 2$ or $\left(\frac{42-L}{4}\right) - \frac{L}{4} > 2$</td> <td>$S - (10.5 - S) > 2$</td> </tr> <tr> <td>$L > 25$</td> <td>$L < 17$ or $L > 25$</td> <td>$S > 6.25$</td> </tr> <tr> <td>$= (42 - '25') \times \frac{1}{21}$</td> <td>$= ('17' - 0) \times \frac{1}{42} + (42 - '25') \times \frac{1}{42}$</td> <td>$(10.5 - '6.25') \times \frac{1}{5.25}$</td> </tr> <tr> <td></td> <td>$= \frac{17}{21}$ oe</td> <td></td> </tr> </table>	$L \square U(21, 42)$	$L \square U(0, 42)$	$S \square U(5.25, 10.5)$	$\frac{L}{4} - \left(\frac{42-L}{4}\right) > 2$	$\frac{L}{4} - \left(\frac{42-L}{4}\right) > 2$ or $\left(\frac{42-L}{4}\right) - \frac{L}{4} > 2$	$S - (10.5 - S) > 2$	$L > 25$	$L < 17$ or $L > 25$	$S > 6.25$	$= (42 - '25') \times \frac{1}{21}$	$= ('17' - 0) \times \frac{1}{42} + (42 - '25') \times \frac{1}{42}$	$(10.5 - '6.25') \times \frac{1}{5.25}$		$= \frac{17}{21}$ oe		M1 A1 M1 A1 (4)
$L \square U(21, 42)$	$L \square U(0, 42)$	$S \square U(5.25, 10.5)$															
$\frac{L}{4} - \left(\frac{42-L}{4}\right) > 2$	$\frac{L}{4} - \left(\frac{42-L}{4}\right) > 2$ or $\left(\frac{42-L}{4}\right) - \frac{L}{4} > 2$	$S - (10.5 - S) > 2$															
$L > 25$	$L < 17$ or $L > 25$	$S > 6.25$															
$= (42 - '25') \times \frac{1}{21}$	$= ('17' - 0) \times \frac{1}{42} + (42 - '25') \times \frac{1}{42}$	$(10.5 - '6.25') \times \frac{1}{5.25}$															
	$= \frac{17}{21}$ oe																
Notes		Total 9															

Question Number	Scheme	Marks
5. (a)(i)	$H_0 : p = 0.35 \quad H_1 : p \neq 0.35$	B1
(ii)	$B(15, 0.35)$	M1
	CR $X \leq 10 \cup X \geq 10$ (Allow any letter)	A1A1
		(4)
(b)	8 is not in CR	M1
	There is evidence that the Company's <u>claim</u> is true	A1ft
		(2)
(c)	$0.0142 + 0.0124 = 0.0266$	B1
		(1)
		[7]

Question Number	Scheme	Marks
5(a)	$d = 7$	B1
	$\frac{c}{3} - \frac{7}{6} = 1 - \frac{1}{6}("7" - c)^2$	M1
	$\frac{c}{3} - \frac{7}{6} = 1 - \frac{1}{6}("49" - 2 \times "7" c + c^2)$ oe or $c^2 - 12c + 36 = 0$ oe	dM1
	$(c - 6)^2 = 0 \therefore c = 6 *$	A1*
		(4)
(b)	$P(X > 3.5) = 1 - \frac{1}{6}(3.5 - 3)^2$	M1
	$= \frac{23}{24}$ oe awrt 0.958	A1
		(2)
(c)	$P(3.5 < X < 5.5) = \left(\frac{5.5}{3} - \frac{7}{6}\right) - \left(\frac{1}{6}(3.5 - 3)^2\right) \left[= \frac{5}{8} \right]$ oe	M1
	$P(X > 4.5 \mid 3.5 < X < 5.5) = \frac{\left(\frac{5.5}{3} - \frac{7}{6}\right) - \left(\frac{4.5}{3} - \frac{7}{6}\right)}{"5/8"}$	M1
	$= \frac{8}{15}$ oe awrt 0.533	A1
		(3)
Notes		Total 9

Question Number	Scheme	Marks
7(i)	$\frac{a+b}{2} = 9$ and $\frac{13-5}{b-a} = \frac{1}{5}$ or $a = -11$ and $b = 29$	M1
	$P\left(X > \frac{29-11}{3}\right) [= P(X > 6)]$ or $P\left(X > \frac{9 \times 2}{3}\right) [= P(X > 6)] = \frac{23}{40}$	M1A1
	(3)	
(ii)	$\frac{1}{12}(c-1)^2 = 0.48 \Rightarrow c = 3.4$	M1
	$E(Y) = \frac{1+3.4}{2}$	M1
	$E(Y^2) = 0.48 + \left(\frac{1+3.4}{2}\right)^2 = 5.32$	M1A1
	(4)	
(iii)	$W \sim U[0,20] \quad X \sim U[10,20] \quad Y \sim U[0,10]$	
	$W < 6$ or $W > 14$ or $X < 12$ or $Y > 8$ any letter, ignore distribution	M1
	$2 \times P(W < 6) = 2 \times \frac{(6-0)}{20}$ or $2 \times P(W > 14) = 2 \times \frac{(20-14)}{20}$ or	
	$P(W < 6) = \frac{6-0}{20}$ and $P(W > 14) = \frac{20-14}{20}$ or $P(X > 14) = \frac{20-14}{10}$ or $P(Y < 6) = \frac{6-0}{10}$	M1
	$P(8 < W < 12) = \frac{12-8}{20}$ or $P(X < 12) = \frac{12-10}{10}$ or $P(Y > 8) = \frac{10-8}{10}$	M1
	$P(\text{shortest side} < 6) = \frac{3}{10} + \frac{3}{10} + \frac{1}{5}$ or $\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$	dM1A1
	(5)	
	Alternative 1	
	$6 < W < 8$ or $12 < W < 14$ any letter, ignore distribution	M1
	$P(6 < W < 8) = \frac{8-6}{20}$ or $P(12 < W < 14) = \frac{14-12}{20}$	M2 for
	$P(6 < W < 8) = \frac{1}{10}$ and $P(12 < W < 14) = \frac{1}{10}$ or	$P(12 < X < 14) = \frac{14-12}{10}$ or
	$2 \times P(6 < W < 8) = 2 \times \frac{1}{10}$ or $2 \times P(12 < W < 14) = 2 \times \frac{1}{10}$	$P(6 < Y < 8) = \frac{8-6}{10}$
	$P(\text{shortest side} < 6) = 1 - \frac{1}{10} - \frac{1}{10}$ or $1 - \frac{2}{10} = \frac{4}{5}$	dM1A1
	Alternative 2	(5)
	$W > 10$ or $12 < W < 14$ or $6 < W < 8$ or $W < 10$ any letter, ignore distribution	M1
	$P(12 < W < 14) = \frac{14-12}{20}$ and $P(W > 10) = \frac{20-10}{20}$ or	M1
	$P(6 < W < 8) = \frac{8-6}{20}$ and $P(W < 10) = \frac{10-0}{20}$	
	$P(12 < W < 14 W > 10) = \frac{\frac{1}{10}}{\frac{1}{2}} = \frac{1}{5}$ or $P(6 < W < 8 W < 10) = \frac{\frac{1}{10}}{\frac{1}{2}} = \frac{1}{5}$	M1
	$P(\text{shortest side} < 6) = 1 - \frac{1}{5} = \frac{4}{5}$	dM1A1
	(5)	
	NB Any answer of $\frac{4}{5}$ scores 5/5 provided it has not come from incorrect working	
	Total 12	

Question	Scheme	Marks															
4.(a)	$P(D = -1) [=P(1 \text{ blue and } 2 \text{ red marbles selected })] = 3 \times 0.2 \times 0.8^2 = 0.384^*$	M1A1cso (2)															
(b)	<table><tr><td>d</td><td>-3</td><td>$[-1]$</td><td>1</td><td>3</td></tr><tr><td></td><td>0.8^3</td><td>$[3 \times 0.2 \times 0.8^2]$</td><td>$3 \times 0.2^2 \times 0.8$</td><td>$0.2^3$</td></tr><tr><td>$P(D = d)$</td><td>$0.512 = \frac{64}{125}$</td><td>$[0.384 = \frac{48}{125}]$</td><td>$0.096 = \frac{12}{125}$</td><td>$0.008 = \frac{1}{125}$</td></tr></table>	d	-3	$[-1]$	1	3		0.8^3	$[3 \times 0.2 \times 0.8^2]$	$3 \times 0.2^2 \times 0.8$	0.2^3	$P(D = d)$	$0.512 = \frac{64}{125}$	$[0.384 = \frac{48}{125}]$	$0.096 = \frac{12}{125}$	$0.008 = \frac{1}{125}$	B1 M1 A1 (3)
d	-3	$[-1]$	1	3													
	0.8^3	$[3 \times 0.2 \times 0.8^2]$	$3 \times 0.2^2 \times 0.8$	0.2^3													
$P(D = d)$	$0.512 = \frac{64}{125}$	$[0.384 = \frac{48}{125}]$	$0.096 = \frac{12}{125}$	$0.008 = \frac{1}{125}$													
(c)	-3	B1 (1)															
(d)	$X \sim B(12, 0.2)$ $P(X \leq 4) = 0.9274$ $P(X \geq 5) = 0.0726 < 0.10$ $P(X \leq 3) = 0.7946$ $P(X \geq 4) = 0.2054 > 0.10$ CR: $X \geq 5$	M1 A1 (2)															
(e)	0.0726	B1ft (1)															
		Total 9															

Question Number	Scheme	Marks
3 (a)(i)	$3 + [0] + 29 = 32^*$	B1*
(ii)	$3 + 15 + 29 = 47^*$	B1*
		(2)
(b)	$f(t) = \begin{cases} \frac{1}{15} & 32 \leq t \leq 47 \\ 0 & \text{otherwise} \end{cases}$	M1 A1 (2)
(c) (i)	$[E(T) =] 39.5 \text{ oe}$	B1
(ii)	$[Var(T) =] \frac{(47 - 32)^2}{12}$	M1
	$\frac{75}{4} = 18.75$	A1
		(3)
(d)	$(40 - 32) \times \frac{1}{15}$	M1
	$= \frac{8}{15}$	A1
		(2)
Notes		Total 9