

Question	Answer	Marks																																				
6(a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3">A</th> <th colspan="3">B</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>2</td> <td>6</td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>2</td> <td>0</td> <td>3</td> <td>0</td> <td>1 5 8</td> </tr> <tr> <td>9</td> <td>7</td> <td>2 1 1</td> <td>4</td> <td>1 2 2</td> <td>7 9</td> </tr> <tr> <td></td> <td>3</td> <td>2</td> <td>5</td> <td>2</td> <td></td> </tr> <tr> <td></td> <td>4</td> <td>6</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>KEY 1 4 2 means \$41 000 for A and \$42 000 for B</p> <p>Correct stem</p> <p>Correct A on LHS</p> <p>Correct B on same diagram</p> <p>Correct key for <i>their</i> diagram, both companies identified and correct units</p>	A			B					2	6			5	2	0	3	0	1 5 8	9	7	2 1 1	4	1 2 2	7 9		3	2	5	2			4	6				<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>4</p>
A			B																																			
		2	6																																			
5	2	0	3	0	1 5 8																																	
9	7	2 1 1	4	1 2 2	7 9																																	
	3	2	5	2																																		
	4	6																																				
6(b)	Median = [\\$]42 000	B1																																				
	LQ = [\\$]35 000 UQ = [\\$]52 000	B1																																				
	IQR = [\\$]17 000 (FT if $49000 \leq UQ \leq 53000 - 32000 \leq LQ \leq 41000$)	B1 FT																																				
		3																																				

Question	Answer	Marks
6(c)	Sum of given 11 numbers is 433 000	M1
	Sum of 12 numbers, including new = $38\,500 \times 12 = 462\,000$	M1
	Difference = new salary = [\\$]29 000	A1
		3

Question	Answer	Marks	Guidance
1(a)	Cumulative frequency (cf) graph	M1	At least 3 points plotted accurately at class upper end points (25, 16) (50, 44) (75, 86) (100, 104) (150, 132) (200, 150). Linear cf scale $0 \leq cf \leq 150$ and linear time scale $0 \leq \text{time (mins)} \leq 200$ with at least 3 values identified on each axis.
		A1	All points plotted correctly, curve drawn (within tolerance) and joined to (0,0). Axes labelled cumulative frequency (cf), time (t) and minutes (min), or a suitable title.
		2	
1(b)	Line from cumulative frequency = 30 to meet graph at t is between 37.5 and 42	B1 FT	Not from wrong working. Must be an increasing cumulative frequency graph.
		1	

Question	Answer	Marks	Guidance
5(a)	$P(A) = \frac{10}{36}$ $P(B) = \frac{24}{36}$	B1	Accept $P(A) = \frac{10}{36}, \frac{5}{18}, 0.278$ and $P(B) = \frac{24}{36}, \frac{2}{3}, 0.667$.
	$P(A \cap B) = \frac{8}{36}$	B1	
	$\frac{10}{36} \times \frac{24}{36}$	M1	Their $P(A) \times$ their $P(B)$ seen numerically, $0 \leq$ their $P(A), P(B) \leq 1$.
	$= \frac{5}{27}, 0.185 \left[\neq \frac{8}{36} \right]$ Events are not independent	A1 FT	Multiplication evaluated correctly and compared with intersection that is not a product of multiplication, conclusion stated, notation $P(A), P(B)$ and $P(A \cap B)$ used.
		4	

Question	Answer	Marks	Guidance
5(b)	$\left[P(B A') = \frac{P(B \cap A')}{P(A')} = \right]$ $\frac{16}{36} / \left(1 - \frac{10}{36} \right)$	M1	$\left[P(B \cap A') = \right] \frac{16}{36}, 0.4444$ or their $P(B) -$ their $P(A \cap B)$ seen as numerator or denominator of conditional probability fraction.
		M1	$\left[P(A') = \right] \left(1 - \frac{10}{36} \right), \frac{26}{36}, 0.7222$ or $1 -$ their $P(A)$ seen as denominator of conditional probability fraction.
	$= \frac{8}{13}$	A1	Final answer $\frac{16}{26}, \frac{8}{13}, 0.6153846$ to at least 3SF.
Alternative Method for Question 5(b): Direct from outcome tables			
5(b)	$\left[P(B A') = \frac{\text{Number of outcomes } (B \cap A')}{\text{Number of outcomes } (A')} = \right]$ $\frac{16}{26}$	M1	$\left[\text{Number of outcomes } (B \cap A') = \right] 16$ seen as numerator or denominator of conditional probability fraction.
		M1	$\left[\text{Number of outcomes } (A') = \right] 26$ seen as denominator of conditional probability fraction.
		A1	Final answer $\frac{16}{26}, \frac{8}{13}, 0.6153846$ to at least 3SF.
		3	

Question	Answer	Marks	Guidance
5(a)	<p>Probabilities for Bag A selection R,B,G $\left(\frac{6}{12}, \frac{5}{12}, \frac{1}{12} \right)$</p> <p>Probabilities for Bag B selection: $\frac{6}{9}, \frac{3}{9}, [0]$ $\frac{5}{9}, \frac{4}{9}, [0]$ $\frac{5}{9}, \frac{3}{9}, \frac{1}{9}$</p>	B1	Correct structure and probabilities for Bag A branches which must be the first set of branches, including labels R, B, G.
		B1	Correct structure and probabilities for one Bag B branch, including labels R, B, [G]. Condone inclusion of branches with 0 probability.
		B1	Correct structure and probabilities for remaining Bag B branches, including labels R, B, [G]. Condone inclusion of branches with 0 probability. Additional branches without a probability of zero lose this mark.
		3	
5(b)	$[P(RR) + P(BB) + P(GG) =] \frac{6}{12} \times \frac{6}{9} + \frac{5}{12} \times \frac{4}{9} + \frac{1}{12} \times \frac{1}{9}$	M1	Correct or FT tree diagram probabilities with all 3 (R, B and G) branches. Note: working may be by tree diagram.
	$= \frac{57}{108}, \frac{19}{36}$	A1	Accept 0.5278, 0.528.
		2	

Question	Answer	Marks	Guidance
5(c)	$P(A \text{ blue} B \text{ blue}) = \frac{\frac{5}{12} \times \frac{4}{9}}{\frac{6}{12} \times \frac{3}{9} + \frac{5}{12} \times \frac{4}{9} + \frac{1}{12} \times \frac{3}{9}}$	M1	$\frac{5}{12} \times \frac{4}{9}$ or $\frac{20}{108}$ or $\frac{5}{27}$ or <i>their</i> P(BB) from Q5(b) seen as a numerator of a single fraction. FT tree diagram with values from only 2 bags.
		B1 FT	$\frac{6}{12} \times \frac{3}{9} + \frac{5}{12} \times \frac{4}{9} + \frac{1}{12} \times \frac{3}{9}$ seen as the denominator of a single fraction. $\frac{5}{27}$ or <i>their</i> P(BB) may be seen from Q5b in place of $\frac{5}{12} \times \frac{4}{9}$ FT tree diagram with values from only 2 bags.
	A1	Accept 0.488, 0.4878. SCB1 if either M or B mark not scored $\frac{20}{41}$ or 0.4878.	
	3		

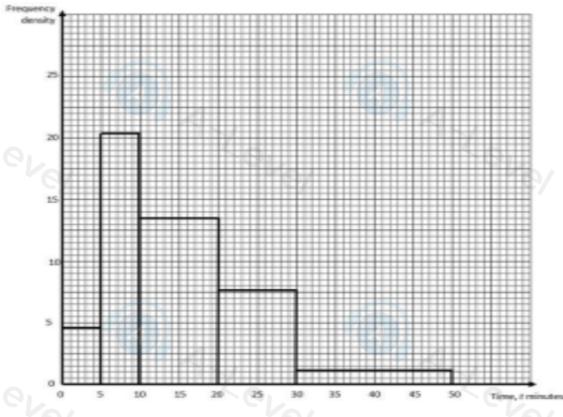
Question	Answer	Marks
7(a)	$\frac{9!}{212!} = 90\,720$	B1
		1
7(b)	$\frac{6!}{2!}$ 360	M1
		A1
		2

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Question	Answer	Marks	
7(c)	2 Es together = $\frac{8!}{2!}$ (= 20160)	M1	
	Es not together = $90720 - 20160 = 70560$	M1	
	Probability = $\frac{70560}{90720}$	M1	
	$\frac{7}{9}$ or 0.778	A1	
	Alternative method for question 7(c)		
	_ ^ _ ^ _ ^ _ ^ _ ^ _		
	$\frac{7!}{2!} \times \frac{8 \times 7}{2} = 70560$		
	$7! \times k$ in numerator, k integer ≥ 1 , denominator ≥ 1	M1	
	Multiplying by 8C_2 OE	M1	
	Probability = $\frac{70560}{90720}$	M1	
$\frac{7}{9}$ or 0.778	A1		
	4		

Question	Answer	Marks
7(d)	Scenarios are: E L ___ 3C_3 10 E E L ___ 3C_2 10 E ___ ___ 3C_4 5 E E ___ ___ 3C_3 10	M1
	Summing the number of ways for 3 or 4 correct scenarios	M1
	Total = 35	A1
		3

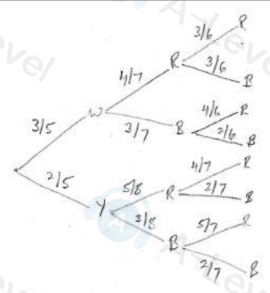
QUESTIONS

Question	Answer	Marks	Guidance
3(a)	Cw: 5 5 10 10 20	M1	At least 4 frequency densities calculated (f/cw), accept unsimplified and class widths ± 1 of true values. May be implied by graph.
	Fd: 4.6 20.4 13.5 7.6 1.2	A1	All heights correct on graph NOT FT
		B1	Bar ends at 0, 5, 10, 20, 30, 50 clear intention not to draw at 4.5 or 5.5 etc.
		B1	Axes labelled: Frequency density (fd), time (t) and mins (or appropriate title). Linear scales between 0 and 20.4 or above on vertical axis, and 0 and 50 or above on the horizontal axis. (Axes may be reversed.)
		4	
3(b)	$\frac{2.5 \times 23 + 7.5 \times 102 + 15 \times 135 + 25 \times 76 + 40 \times 24}{360}$	M1	Uses at least 4 midpoint attempts (e.g. 2.5 ± 0.5) in correct formula, accept unsimplified expression, denominator either correct or <i>their</i> Σ frequencies.
	$\left[\frac{5707.5}{360} = \right] 15.9, 15 \frac{41}{48}$	A1	Evaluated.
		2	

QUESTIONS

Question	Answer	Marks	Guidance
5(a)	Total number of ways = $\frac{8!}{3!2!}$ (= 3360)	B1	Correct unsimplified expression for total number of ways
	Number of ways with V and E in correct positions = $\frac{6!}{2 \times 2!}$ (= 180)	B1	$\frac{6!}{2 \times 2!}$ alone or as numerator in an attempt to find the number of ways with V and E in correct positions. No \times, \pm
	Probability = $\frac{180}{3360} \left(= \frac{3}{56} \right)$ or 0.0536	B1 FT	Final answer from <i>their</i> $\frac{6!}{2 \times 2!}$ divided by <i>their</i> total number of ways
	Alternative method for question 5(a)		
	$\frac{1}{8} \times \frac{3}{7}$	M1	$\frac{a}{8} \times \frac{b}{7}$ seen, no other terms (correct denominators)
		M1	$\frac{1}{c} \times \frac{3}{d}$ seen, no other terms (correct numerators)
	$\frac{3}{56}$ or 0.0536	A1	
		3	

Question	Answer	Marks	Guidance
5(b)	Rs together and Es together: $5!$ (120)	B1	Alone or as numerator of probability to represent the number of ways with Rs and Es together, no \times , +, -
	Es together: $\frac{6!}{2!}$ (= 360)	B1	Alone or as denominator of probability to represent the number of ways with Es together, no \times , + or -
	Probability = $\frac{5!}{\frac{6!}{2!}}$	M1	<i>their</i> $\frac{5!}{6!}$ seen <i>their</i> $\frac{6!}{2!}$
	$\frac{1}{3}$	A1	OE
Alternative method for question 5(b)			
	P(Rs together and Es together): $\frac{5!}{\text{their total number of ways}} \left(= \frac{1}{28} \right)$	B1	
	P(Es together): $\frac{6!}{\text{their total number of ways}} \left(= \frac{3}{28} \right)$	B1	Alone or as numerator of probability to represent the P(Rs and Es together), no \times , +, -
	Probability = $\frac{1}{\frac{28}{3}}$	M1	Alone or as denominator of probability to represent the P(Es together), no \times , + or -
	$\frac{1}{3}$	A1	OE, <i>their</i> $\frac{1}{28}$ seen <i>their</i> $\frac{3}{28}$
		4	

Question	Answer	Marks	Guidance
5(a)		B1	Correct tree diagram structure. (3 tiers).
		B1	Counter and first marble probabilities correct with outcomes labelled.
		B1	Second marble probabilities correct with outcomes labelled.
		3	

Question	Answer	Marks	Guidance																				
5(b)	<table border="1"> <tr> <td>P(WRB)</td> <td>$\frac{3}{5} \times \frac{4}{7} \times \frac{3}{6}$</td> <td>$\left[\frac{6}{35} \right]$</td> <td>0.171(4)</td> </tr> <tr> <td>P(WBR)</td> <td>$\frac{3}{5} \times \frac{3}{7} \times \frac{4}{6}$</td> <td>$\left[\frac{6}{35} \right]$</td> <td>0.171(4)</td> </tr> <tr> <td>P(YRB)</td> <td>$\frac{2}{5} \times \frac{5}{8} \times \frac{3}{7}$</td> <td>$\left[\frac{3}{28} \right]$</td> <td>0.107(1)</td> </tr> <tr> <td>P(YBR)</td> <td>$\frac{2}{5} \times \frac{3}{8} \times \frac{5}{7}$</td> <td>$\left[\frac{3}{28} \right]$</td> <td>0.107(1)</td> </tr> <tr> <td>[Total]</td> <td></td> <td>$\frac{39}{70}$</td> <td>0.557</td> </tr> </table>	P(WRB)	$\frac{3}{5} \times \frac{4}{7} \times \frac{3}{6}$	$\left[\frac{6}{35} \right]$	0.171(4)	P(WBR)	$\frac{3}{5} \times \frac{3}{7} \times \frac{4}{6}$	$\left[\frac{6}{35} \right]$	0.171(4)	P(YRB)	$\frac{2}{5} \times \frac{5}{8} \times \frac{3}{7}$	$\left[\frac{3}{28} \right]$	0.107(1)	P(YBR)	$\frac{2}{5} \times \frac{3}{8} \times \frac{5}{7}$	$\left[\frac{3}{28} \right]$	0.107(1)	[Total]		$\frac{39}{70}$	0.557	M1	At least 2 correct 3-term products linked to correct scenarios. May be clearly identified on tree diagram. FT from a 3-tier tree.
	P(WRB)	$\frac{3}{5} \times \frac{4}{7} \times \frac{3}{6}$	$\left[\frac{6}{35} \right]$	0.171(4)																			
	P(WBR)	$\frac{3}{5} \times \frac{3}{7} \times \frac{4}{6}$	$\left[\frac{6}{35} \right]$	0.171(4)																			
	P(YRB)	$\frac{2}{5} \times \frac{5}{8} \times \frac{3}{7}$	$\left[\frac{3}{28} \right]$	0.107(1)																			
	P(YBR)	$\frac{2}{5} \times \frac{3}{8} \times \frac{5}{7}$	$\left[\frac{3}{28} \right]$	0.107(1)																			
[Total]		$\frac{39}{70}$	0.557																				
		M1	4 correct identified scenarios added. May be clearly identified on the tree diagram, condone identification by correct (or FT) un-simplified products.																				
	$= \frac{39}{70}, 0.557$	A1	SCBI for $\frac{39}{70}$ if one or both M marks not scored WWW.																				
		3																					

Question	Answer	Marks	Guidance
5(c)	$P(\text{White} b) = \frac{\frac{3}{5} \times \frac{4}{7} \times \frac{3}{6} + \frac{3}{5} \times \frac{3}{7} \times \frac{4}{6}}{\text{their } \frac{39}{70}} = \left[\frac{36}{210} + \frac{36}{210} \right] = \frac{72}{210} = \frac{12}{35}$	M1	Correct formula for conditional probability using <i>their</i> probabilities from 3-tier tree with <i>their</i> (b) < 1 or correct in denominator. Condone $\frac{12}{35}$ or <i>their</i> $P(WRB) + P(WBR)$ from part b $\frac{39}{70}$ or <i>unsimplified expression</i>
	$= \frac{8}{13}, 0.615$	A1	
		2	