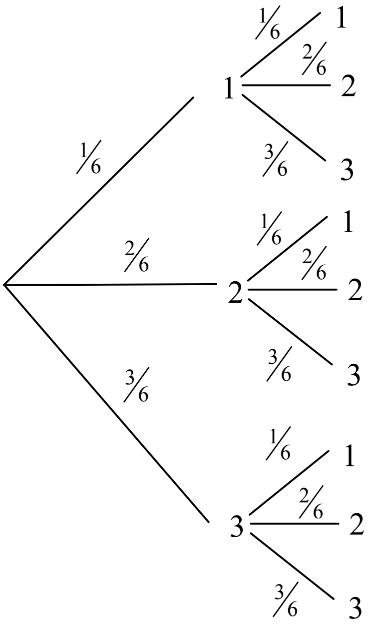
<table>
<tr><th>Question Number</th><th colspan="2">Scheme</th><th>Marks</th></tr>
<tr><td rowspan="6">1.</td><td rowspan="3"><table><tr><th></th><th>1</th><th>2</th><th>2</th><th>3</th><th>3</th><th>3</th></tr><tr><td>1</td><td>2</td><td>3</td><td>3</td><td>4</td><td>4</td><td>4</td></tr><tr><td>2</td><td>3</td><td>4</td><td>4</td><td>5</td><td>5</td><td>5</td></tr><tr><td>2</td><td>3</td><td>4</td><td>4</td><td>5</td><td>5</td><td>5</td></tr><tr><td>3</td><td>4</td><td>5</td><td>5</td><td>6</td><td>6</td><td>6</td></tr><tr><td>3</td><td>4</td><td>5</td><td>5</td><td>6</td><td>6</td><td>6</td></tr><tr><td>3</td><td>4</td><td>5</td><td>5</td><td>6</td><td>6</td><td>6</td></tr></table></td><td>2 × (1, 2, ….., 3)</td><td>M1</td></tr>
<tr><td>Adding</td><td>M1</td></tr>
<tr><td>All ≥ 5 correctly indicated</td><td>A1</td></tr>
<tr><td rowspan="2">∴ P (sum at least 5) = $\frac{21}{36} = \frac{7}{12}$</td><td>Attempt to count ≥ 5</td><td>M1</td></tr>
<tr><td>$\frac{21}{36}; \frac{7}{12}$; $0.58\dot{3}$; 0.583</td><td>A1</td></tr>
<tr><td colspan="2"></td><td>(5 marks)</td></tr>
<tr><td rowspan="5">Alt 1</td><td rowspan="5"> </td><td>Tree with relevant branches</td><td>M1</td></tr>
<tr><td>All correct - $\frac{2}{6}$, $\frac{3}{6}$ on those branches</td><td>A1</td></tr>
<tr><td>P(sum at least 5) = $\left(\frac{2}{6}\times\frac{3}{6}\right)+\left(\frac{3}{6}\times\frac{2}{6}\right)$</td><td>M1</td></tr>
<tr><td>+ $\left(\frac{3}{6}\times\frac{3}{6}\right)$ (At least 2 pairs & adding)</td><td>A1</td></tr>
<tr><td>= $\frac{21}{36}; \frac{7}{12}$; $0.58\dot{3}$; 0.583</td><td>A1 (5)</td></tr>
</table>

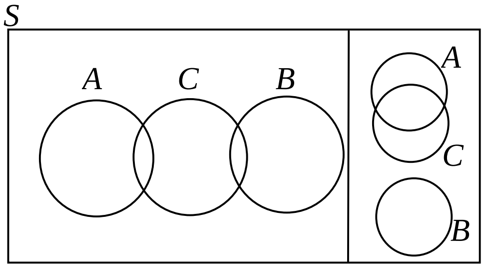
Question Number	Scheme	Marks
Alt 2	Outcomes (2, 3), (3, 3), (3, 2) Recognising 2 pairs Can be implied	M1
	All correct	A1
	$\left(\frac{2}{6}\times\frac{3}{6}\right)+\left(\frac{3}{6}\times\frac{3}{6}\right)+\left(\frac{3}{6}\times\frac{2}{6}\right)$ Multiplying 2 pairs of 2 probs. & adding	M1
	All correct	A1
	$\frac{21}{36}$	A1 (5)
Alt 3	P (sum ≥ 5) = 12 $\left(\frac{1}{6}\times\frac{1}{6}\right)$ + 9 $\left(\frac{1}{6}\times\frac{1}{6}\right)$ a($p_1 \times p_2$) or b($p_1 \times p_2$)	M1
	$p_1 = p_2 = \frac{1}{6}$	A1
	a( ) + b( )	M1
	21 or 12 + 9	A1
	$\frac{21}{36}$ $\frac{21}{36}$	A1 (5)
Alt 4	$\begin{array}{c\|ccccc} x & 2 & 3 & 4 & 5 & 6 \\ \hline P(X=x) & \frac{1}{36} & \frac{4}{36} & \frac{10}{36} & \frac{12}{36} & \frac{9}{36} \end{array}$ 2, 3, 4, 5, 6	M1
	Adding probability	M1
	All correct	A1
	$P(X \geq 5) = \frac{12}{36} + \frac{9}{36}$ Adding P(5) & P(6)	M1
	$\frac{21}{36}$ $\frac{21}{36}$	A1 (5)

Question Number		Scheme		Marks	
2.	(a)	Scatter diagram	Labels (not x, y)	B1	
			Sensible scales allow axis interchange	B1	
			Points	B2	
			(−1 ee)		(4)
	(b)	$S_{hc} = 884484 - \frac{1562 \times 5088}{9} = 1433\tfrac{1}{3}$	correct use of S	M1	
			$1433\tfrac{1}{3}$; $1433.\dot{3}$	A1	
		$S_{hh} = 1000\tfrac{2}{9}$; $S_{cc} = 2550$	$1000\tfrac{2}{9}$, $1000.\dot{2}$; 2550	A1; A1	(4)
		(NB: accept :- 9; i.e.:- $159\tfrac{7}{27}$; $111\tfrac{11}{81}$; $283\tfrac{1}{3}$)			
	(c)	$r = \frac{1433\tfrac{1}{3}}{\sqrt{1000\tfrac{2}{9} \times 2550}}$	substitution in correct formula	M1 A1 ft	
		$= 0.897488\ldots.$	AWRT 0.897(accept 0.8975)	A1	(3)
	(d)	Taller people tend to be more confident	context	B1	(1)
	(e)	$b = \frac{1433.\dot{3}}{1000.\dot{2}} = 1.433014\ldots..$		M1	
		$a = \frac{5088}{9} - \frac{1433.\dot{3}}{1000.\dot{2}} \times \frac{1562}{9} = 316.6256...$	allow use of their b	M1	
		$\therefore c = 317 + 1.43h$	3sf	A1	(3)
	(f)	$h = 180 \Rightarrow$ c = 574.4 or 574.5683….	subt. of 180	M1	
			574 - 575	A1	(2)
	(g)	$161 \leq h \leq 193$		B1	(1)
					(18 marks)
		NB (a) No graph paper $\Rightarrow$ 0/4			

Question Number	Scheme		Marks	
3. (a)	$0.5 + b + a = 1$	use of $\Sigma P(X = x) = 1$	M1 A1	
	$0.3 + 2b + 3a = 1.7$	use of $E(x) = \Sigma x P(X = x)$	M1 A1	
	$\therefore\ a = 0.4$			
	$b = 0.1$	$a = 0.4,\ b = 0.1$	B1	(5)
(b)	$P(0 < X < 1.5) = P(X = 1) = 0.3$		B1	(1)
(c)	$E\ (2X - 3) = 2E(X) - 3$	Use of $E(aX + b)$	M1	
	$= 2 \times 1.7 - 3 = 0.4$		A1	(2)
(d)	$\text{Var}(X) = (1^2 \times 0.3) + (2^2 \times 0.1) + (3^2 \times 0.4) - 1.7^2$	Use of $E(x^2) - \{E(x)\}^2$	M1	
	$= 1.41$ (*)		A1 ft	
		cso	A1	(3)
(e)	$\text{Var}(2X - 3) = 2^2\ \text{Var}(X)$	Use of Var	M1	
	$= 4 \times 1.41 = 5.64$		A1	(2)
				(13 marks)

Question Number	Scheme		Marks
4. (a)(i)	$\bar{x} = \frac{270}{16} = 16.875$	16.875, $16\frac{7}{8}$; 16.9; 16.88	B1
	sd = $\sqrt{\frac{4578}{16} - 16.875^2}$	$\frac{\sum x^2}{16} - \bar{x}^2$ & √	M1
		All correct	A1 ft
	= 1.16592….	AWRT 1.17	A1
(ii)	Mean % attendance = $\frac{16.875}{18} \times 100$ (= 93.75)	cao	B1 ft (5)
(b)	First 4|1 means 14 Second 1|8 means 18		
	(1) 4 | 1 | 4 4 4 (3)	Both Labels and 1 key	B1
	(1) 5 | 1 | 5 5 5 5 (4)	Back-to-back	
	(3) 6 6 6 | 1 | 6 6 6 (3)	S and L	M1
	(5) 7 7 7 7 7 | 1 | 7 (1)	(ignore totals)	dep.
	(6) 8 8 8 8 8 8 | 1 | 8 8 8 (3)	Sensible splits of 1	M1
	(0) | 1 | 9 (1)	First-correct	A1
	(0) | 2 | 0 (1)	Second - correct	A1 (5)
(c)	Mode Median IQR		
	First 18 17 2		B1 B1 B1
	Second 15 16 3		B1 B1 B1 (6)
(d)	Median$_S$ < Median$_F$; Mode$_F$ > Mode$_S$;		
	Second had larger spread/IQR	ANY THREE sensible comments	B1 B1 B1 (3)
	Only 1 student attends all classes in second		
	Mean%$_F$ > Mean%$_S$		
			(19 marks)

Question Number	Scheme	Marks
5.	Let L represent length of visit $\therefore L \sim N(90, \sigma^2)$	
(*a*)	$P(L < 125) = 0.80$ or $P(L > 125) = 0.20$	
	$\therefore P\left(Z < \frac{125-90}{\sigma}\right) = 0.8$ $\therefore P\left(L > \frac{125-90}{\sigma}\right) = 0.20$ Standardising, ±(125 – 90), $\sigma/\sigma^2/\sqrt{\sigma}$	M1
	$\therefore \frac{125-90}{\sigma} = 0.8416$ 0.8416	B1
	$\frac{\pm(125-90)}{\sigma} = \text{z value}$	M1
	$\therefore \sigma = \frac{35}{0.8416} = 41.587\ldots..$ AWRT 41.6	A1 (4)
(b)	$P(L < 25) = P\left(Z < \frac{125-90}{41.587....}\right)$ Standardising 25, 90, their +ve 41.587	M1
	$= P(Z < -1.56)$	
	$= 1 - P(Z < 1.56)$ For use of symmetry or $\Phi(-z) = 1 - \Phi(z)$; $p < 0.5$	M1
	$= 0.0594$	A1 (3)
(c)	$90 + 3\sigma = 215 \Rightarrow$ 6.25 pm for latest arrival	B1
	$90 + 2\sigma = 173.\dot{3} \Rightarrow$ 7.07 pm for latest arrival Based on $2\sigma/3\sigma$ rule	
	$\therefore$ This normal distribution is <u>not</u> suitable.	B1 (2)
		(9 marks)

Question Number	**Scheme**	**Marks**
6. (*a*)		
	A, B, C inside S	B1
	A, B no overlap	B1
	A, C overlap	B1 (3)
(b)	$P(A\vert C) = \dfrac{P(A\cap C)}{P(C)} = \dfrac{P(A)P(C)}{P(C)} = P(A)$ Use of independence	M1
	$= 0.2$	A1 (2)
(c)	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ use of $P(A \cup B)$ & $P(A \cap B) = 0$ can be implied	M1
	$= 0.2 + 0.4 - 0$	
	$= 0.6$	A1 (2)
(d)	$P(A \cup C) = P(A) + P(C) - P(A \cap C)$ Use of $P(A \cup C)$ & independence	M1
	$\therefore 0.7 = 0.2 + P(C) - 0.2\,P(C)$	A1
	$\therefore 0.5 = P(C)\ \{1 - 0.2\}$ Solving for $P(C)$ from an equation with $2P(C)$ terms	M
	$\therefore P(C) = {}^{5}\!/_{8}$	A1 (4)
		(11 marks)
	NB $P(B \cup C) = P(B) + P(C) - P(B \cap C)$ $= 0.4 + 0.625 - P(B \cap C) \Rightarrow P(B \cap C) > 0$	