

Mark Scheme

Qn	Answer	Mk	Comment																								
1	<table border="1"> <thead> <tr> <th>Time</th> <th>freq</th> <th>width</th> <th>freq density</th> </tr> </thead> <tbody> <tr> <td>40-</td> <td>26</td> <td>5</td> <td>5.2</td> </tr> <tr> <td>45-</td> <td>18</td> <td>5</td> <td>3.6</td> </tr> <tr> <td>50-</td> <td>31</td> <td>10</td> <td>3.1</td> </tr> <tr> <td>60-</td> <td>16</td> <td>10</td> <td>1.6</td> </tr> <tr> <td>70-</td> <td>9</td> <td>20</td> <td>0.45</td> </tr> </tbody> </table> 	Time	freq	width	freq density	40-	26	5	5.2	45-	18	5	3.6	50-	31	10	3.1	60-	16	10	1.6	70-	9	20	0.45	<p>M1 A1</p> <p>G1 G1 G1</p>	<p>Calculation of fd's (accept values in proportion)</p> <p>Linear scales Widths of bars Heights of bars</p>
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(ii)	<p>e.g. The distribution is positively skewed The mode is at the extreme left of the distribution. Accept range = 50 or median = 52</p>	<p>E1 E1</p>																									
2	<p>(i) Mean = $83.95/8 = 10.49$</p> $\text{Variance} = \frac{881.2119 - \frac{83.95^2}{8}}{7}$ $= 0.03737$ <p>Standard deviation = 0.193</p> <p>(ii) 2 standard deviations below mean</p> $= 10.49 - 2(0.193)$ $= 10.104$ <p>but $10.04 < 10.104$</p> <p>so 10.04 is an outlier.</p> <p>(iii) This time is much faster than the others. This may be the result of wind assistance, faulty timing, false start and should be discarded. Opposite conclusion such as this could be a genuinely fast time, can also receive full credit.</p>	<p>B1</p> <p>M1 A1</p> <p>M1 A1</p>	<p>Follow through if divisor n has been used above.</p> <p>Appreciating need for investigation Comment in context</p>																								

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3	Let $P(B) = x$ Using $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $0.9 = 2x + x - 0.3$ $x = 0.4$ $P(B) = 0.4$	M1 M1 A1	Correct set of equations Correct solution												
4	<table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 0 10px;">r</td> <td style="padding: 0 10px;">0</td> <td style="padding: 0 10px;">1</td> <td style="padding: 0 10px;">2</td> <td style="padding: 0 10px;">3</td> <td style="padding: 0 10px;">4</td> </tr> <tr> <td style="padding: 0 10px;">$P(X = r)$</td> <td style="padding: 0 10px;">$6k$</td> <td style="padding: 0 10px;">$10k$</td> <td style="padding: 0 10px;">$12k$</td> <td style="padding: 0 10px;">$12k$</td> <td style="padding: 0 10px;">$10k$</td> </tr> </table> $50k = 1 \rightarrow k = 1/50$	r	0	1	2	3	4	$P(X = r)$	$6k$	$10k$	$12k$	$12k$	$10k$	B1 B1 M1	1 value correct all 3 correct sum of 1
r	0	1	2	3	4										
$P(X = r)$	$6k$	$10k$	$12k$	$12k$	$10k$										
(ii)	$E(X) = 110k = 2.2$	M1 A1	sum of rp cao												
(iii)	$P(X > 2.2) = 22k = 0.44$	B1													
5	(i) $\binom{12}{8}$ ways of choosing forwards = 495 (ii) $\binom{12}{8} \times \binom{11}{7}$ ways of choosing team $= 495 \times 330 = 163350$	M1 A1 M1 M1 A1	Product with (i) backs cao												
6	(i) $P(\text{Correct forecast}) = \frac{55 + 128 + 81}{365} = \frac{264}{365}$ (ii) $P(\text{Correct forecast given sunny forecast})$ $= \frac{55}{75} = 0.733$ (iii) $P(\text{Correct forecast given wet weather})$ $= \frac{81}{117} = 0.692$ (iv) $P(\text{Cloudy weather given correct forecast})$ $= \frac{128}{264} = 0.485$	M1 A1 M1 A1 M1 A1 M1 A1	Numerator Denominator Denominator Denominator												
Qn	Answer	Mk	Comment												

7																											
(i)	Median distance = 88 th value = 480	M1	Within 5																								
A		A1	cao																								
B	Lower Quartile = 44 th value = 320	B1																									
	Upper Quartile = 132 nd value = 680	B1																									
	Interquartile range = 680 – 320 = 360	M1	ft																								
(ii)		G1	Basic idea																								
		G1	Linear 0 - 1200																								
		G1	Box including median (accurate)																								
(iii)	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Distance</th> <th style="text-align: right;">Frequency</th> </tr> </thead> <tbody> <tr> <td>$0 < d \leq 200$</td> <td style="text-align: right;">20</td> </tr> <tr> <td>$200 < d \leq 400$</td> <td style="text-align: right;">44</td> </tr> <tr> <td>$400 < d \leq 600$</td> <td style="text-align: right;">54</td> </tr> <tr> <td>$600 < d \leq 800$</td> <td style="text-align: right;">32</td> </tr> <tr> <td>$800 < d \leq 1000$</td> <td style="text-align: right;">19</td> </tr> <tr> <td>$1000 < d \leq 1200$</td> <td style="text-align: right;">7</td> </tr> </tbody> </table>	Distance	Frequency	$0 < d \leq 200$	20	$200 < d \leq 400$	44	$400 < d \leq 600$	54	$600 < d \leq 800$	32	$800 < d \leq 1000$	19	$1000 < d \leq 1200$	7	M1	Correct classes										
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(iv)	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Mid (x)</th> <th style="text-align: left;">f</th> <th style="text-align: left;">fx</th> </tr> </thead> <tbody> <tr> <td>100</td> <td>20</td> <td>2000</td> </tr> <tr> <td>300</td> <td>44</td> <td>13200</td> </tr> <tr> <td>500</td> <td>54</td> <td>27000</td> </tr> <tr> <td>700</td> <td>32</td> <td>22400</td> </tr> <tr> <td>900</td> <td>19</td> <td>17100</td> </tr> <tr> <td>1100</td> <td>7</td> <td>7700</td> </tr> <tr> <td></td> <td style="border-top: 1px solid black;">176</td> <td style="border-top: 1px solid black;">89400</td> </tr> </tbody> </table>	Mid (x)	f	fx	100	20	2000	300	44	13200	500	54	27000	700	32	22400	900	19	17100	1100	7	7700		176	89400	M1	mid points
Mid (x)	f	fx																									
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	176	89400																									
		M1	fx																								
	Estimate of mean = 507.95	A1																									
(v)	Mid point of first class now 150	M1	150																								
	Total increase of 1000																										
	New estimate of mean = 513.6	A1																									
(vi)	The point (0,0) would move to (100,0)	E1	point (0,0)																								
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8	Number not turning up $X \sim B(16, 0.2)$		
(i)	$P(X = 0) = 0.8^{16} = 0.0281$	M1 A1	0.8^{16} or tables
(ii)	$P(X > 3) = 1 - P(X \leq 3)$ or $P(X \leq 12)$ $= 1 - 0.5981 = 0.4019$	M1 M1 A1	Manipulation Use of tables
(iii)	$X \sim B(17, 0.2) \rightarrow P(X \geq 1) = 0.9775$ Greater than 0.9 so acceptable	M1 A1 E1	B(17, 0.2) 0.9775
(iv)	$X \sim B(18, 0.2) \rightarrow P(X \geq 2) = 0.9009$ Can make 18 appointments $X \sim B(19, 0.2) \rightarrow P(X \geq 3) = 0.7631$	M1 A1 A1 M1	18 and ≥ 2 0.9009 18 ok 19 and ≥ 3
(v)	Now $X \sim B(20, p)$ Let p be probability of not turning up. $H_0: p = 0.2$ $H_1: p \neq 0.2$ $P(X \leq 1) = 0.0692 > 2.5\%$ cannot reject H_0 conclude that the proportion of patients not turning up is unchanged.	B1 B1 B1 M1 M1 A1 E1	 0.0692 correct comparison cannot reject H_0