

Mark Scheme 4766
June 2005

Statistics 1 (4766)

Qn	Answer	Mk	Comment
<p>1</p> <p>(i)</p> <p>(ii)</p>	<p>Mean = $657/20 = 32.85$</p> <p>Variance = $\frac{1}{19}(22839 - \frac{657^2}{20}) = 66.13$</p> <p>Standard deviation = 8.13</p> <p>$32.85 + 2(8.13) = 49.11$</p> <p>none of the 3 values exceed this so no outliers</p>	<p>B1 cao</p> <p>M1 A1 cao</p> <p>M1 ft</p> <p>A1 ft</p>	<p>Calculation of 49.11</p>
<p>2</p> <p>(i)</p> <p>(ii)</p> <p>(iii)</p>	<div data-bbox="332 787 898 1113" data-label="Figure"> <p>The graph shows a curve representing the relationship between the length of a journey (x-axis) and an unspecified variable (y-axis). The x-axis is labeled 'Length of journey' and has major ticks at 0, 2, 4, 6, 8, and 10. The y-axis has major ticks at 0, 20, 40, 60, 80, 100, and 120. The curve starts at the origin (0,0) and increases at a decreasing rate, passing through points approximately at (1, 38), (2, 68), (3, 89), (4, 103), (6, 112), and (10, 120). The curve is concave down, indicating positive skewness.</p> </div> <p>Median = 1.7 miles</p> <p>Lower quartile = 0.8 miles</p> <p>Upper quartile = 3 miles</p> <p>Interquartile range = 2.2 miles</p> <p>The graph exhibits positive skewness</p>	<p>G1</p> <p>G1 G1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>A1 ft</p> <p>E1</p>	<p>For calculating 38,68,89,103,112,120 Plotting end points Heights inc (0,0)</p>

<p>3</p> <p>(i)</p> <p>(ii)</p> <p>(iii)</p>	$P(X = 4) = \frac{1}{40} (4)(5) = \frac{1}{2} \text{ (Answer given)}$ $E(X) = (2+12+36+80) \frac{1}{40}$ <p>So $E(X) = 3.25$</p> $\text{Var}(X) = (2+24+108+320) \frac{1}{40} - 3.25^2$ $= 11.35 - 10.5625$ $= 0.7875$ <p>Expected number of weeks = $\frac{6}{40} \times 45$</p> <p style="text-align: center;">= 6.75 weeks</p>	<p>B1</p> <p>M1 A1 cao</p> <p>M1 M1 dep</p> <p>A1 cao</p> <p>M1 A1</p>	<p>Calculation must be seen</p> <p>Sum of rp</p> <p>Sum of r²p -3.25²</p> <p>Use of np</p>
<p>4</p> <p>(i)</p> <p>(ii)</p> <p>(iii)</p>	<p>Number of choices = $\binom{6}{3} = 20$</p> <p>Number of ways = $\binom{6}{3} \times \binom{7}{4} \times \binom{8}{5}$</p> $= 20 \times 35 \times 56$ $= 39200$ <p>Number of ways of choosing 12 questions</p> $= \binom{21}{12} = 293930$ <p>Probability of choosing correct number from each section = $39200/293930$</p> <p style="text-align: center;">= 0.133</p>	<p>M1 A1</p> <p>M1 M1</p> <p>A1 cao</p> <p>M1</p> <p>M1 ft A1 cao</p>	<p>For $\binom{6}{3}$</p> <p>Correct 3 terms Multiplied</p> <p>For $\binom{21}{12}$</p>

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(i)	<table border="1"> <thead> <tr> <th></th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> </thead> <tbody> <tr> <th>1</th> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <th>2</th> <td>2</td> <td>2</td> <td>6</td> <td>4</td> <td>10</td> <td>6</td> </tr> <tr> <th>3</th> <td>3</td> <td>6</td> <td>3</td> <td>12</td> <td>15</td> <td>6</td> </tr> <tr> <th>4</th> <td>4</td> <td>4</td> <td>12</td> <td>4</td> <td>20</td> <td>12</td> </tr> <tr> <th>5</th> <td>5</td> <td>10</td> <td>15</td> <td>20</td> <td>5</td> <td>30</td> </tr> <tr> <th>6</th> <td>6</td> <td>6</td> <td>6</td> <td>12</td> <td>30</td> <td>6</td> </tr> </tbody> </table>		1	2	3	4	5	6	1	1	2	3	4	5	6	2	2	2	6	4	10	6	3	3	6	3	12	15	6	4	4	4	12	4	20	12	5	5	10	15	20	5	30	6	6	6	6	12	30	6	B1	All correct
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(ii)	<p>(A) $P(\text{LCM} > 6) = 1/3$</p> <p>(B) $P(\text{LCM} = 5n) = 11/36$</p> <p>(C) $P(\text{LCM} > 6 \cap \text{LCM} = 5n) = 2/9$</p>	B1 B1 M1 A1 cao	Use of diagram																																																	
(iii)	$\frac{1}{3} \times \frac{11}{36} \neq \frac{2}{9}$ <p>Hence events are not independent</p>	M1 E1	Use of definition																																																	

6			
(i)		G1 G1	Probabilities Outcomes
(ii)		M1	

(A)	$P(\text{First team}) = 0.9^3 = 0.729$	A1	
(B)	$P(\text{Second team}) =$ $0.9 \times 0.9 \times 0.1 + 0.9 \times 0.1 \times 0.5 + 0.1 \times 0.9 \times 0.5$ $= 0.081 + 0.045 + 0.045 = 0.171$	M1 M1 A1	1 correct triple 3 correct triples added
(iii)	$P(\text{asked to leave}) = 1 - 0.729 - 0.171$ $= 0.1$	B1	
(iv)	$P(\text{Leave after two games given leaves})$ $= \frac{0.1 \times 0.5}{0.1} = \frac{1}{2}$	M1 ft A1 cao	Denominator
(v)	$P(\text{at least one is asked to leave})$ $= 1 - 0.9^3 = 0.271$	M1 ft M1 A1 cao	Calc'n of 0.9 $1 - ()^3$
(vi)	$P(\text{Pass a total of 7 games})$ $= P(\text{First, Second, Second}) + P(\text{First, First, Leave after three games})$ $= 3 \times 0.729 \times 0.171^2 + 3 \times 0.729^2 \times 0.05$ $= 0.064 + 0.080$ $= 0.144$	M1 M1 ft M1 ft M1 A1 cao	Attempts both $0.729(0.171)^2$ $0.05(0.729)^2$ multiply by 3

7 (i)	$X \sim B\left(15, \frac{1}{6}\right)$ $P(X = 0) = \left(\frac{5}{6}\right)^{15} = 0.065$	M1 A1 cao	$\left(\frac{5}{6}\right)^{15}$
(ii)	$P(X = 4) = \binom{15}{4} \times \left(\frac{1}{6}\right)^4 \times \left(\frac{5}{6}\right)^{11}$ $= 0.142 \text{ (or } 0.9102 - 0.7685)$	M1 M1 A1 cao	$\left(\frac{1}{6}\right)^4 \left(\frac{5}{6}\right)^{11}$ multiply by $\binom{15}{4}$

(iii)	$P(X > 3) = 1 - P(X \leq 3)$ $= 1 - 0.7685 = 0.232$	M1 A1	
(iv)	Let p = probability of a six on any throw	B1	Definition of p
(A)	$H_0 : p = \frac{1}{6} \quad H_1 : p < \frac{1}{6}$ $X \sim B\left(15, \frac{1}{6}\right)$ $P(X = 0) = 0.065$ $0.065 < 0.1 \text{ and so reject } H_0$ <p>Conclude that there is sufficient evidence at the 10% level that the dice are biased against sixes.</p>	B1 M1 M1 dep E1 dep	Both hypotheses 0.065 Comparison
(B)	$H_0 : p = \frac{1}{6} \quad H_1 : p > \frac{1}{6}$ $X \sim B\left(15, \frac{1}{6}\right)$ $P(X \geq 5) = 1 - P(X \leq 4) = 1 - 0.910 = 0.09$ $0.09 < 0.1 \text{ and so reject } H_0$ <p>Conclude that there is sufficient evidence at the 10% level that the dice are biased in favour of sixes.</p>	B1 M1 M1 dep E1 dep	Both hypotheses 0.09 Comparison
(v)	<p>Conclusions contradictory. Even if null hypothesis is true, it will be rejected 10% of the time purely by chance. Or other sensible comments.</p>	E1 E1	Contradictory By chance