

EDEXCEL 6683 STATISTICS S1 JANUARY 2004 MARK SCHEME

Question	Mark Scheme	Marks
<p>1. (a)</p>	<p>$\sum m = 150 ; \sum m^2 = 5500$</p> <p>$\sum t = 71.6 ; \sum t^2 = 930 ; \sum mt = 2147$</p> <p>$S_{mt} = 2147 - \frac{150 \times 71.6}{6} = \underline{357}$</p> <p>$S_{mm} = 5500 - \frac{150^2}{6} = \underline{1750}$</p> <p>No working shown SR: B1 B1 only</p>	<p>5500 & 2147 seen</p> <p>B1</p> <p>Accept $\frac{357}{60} = 59.5$</p> <p>M1 A1</p> <p>Accept $291.\dot{6}$</p> <p>A1 (4)</p>
<p>(b)</p>	<p>$b = \frac{357}{1750} = \underline{0.204}$</p> <p>$a = \frac{71.6}{6} - 0.204 \times \frac{150}{6} = \underline{6.8\dot{3}}$</p> <p>$\therefore t = \underline{6.83 + 0.204m}$</p> <p>No working seen SR: $t = 6.83 + 0.204m$ B1 only</p>	<p>M1</p> <p>M1</p> <p>(Accept $6.8\dot{3}$, 6.83, $6\frac{5}{6}\%$)</p> <p>A1 (3)</p>
<p>(c)</p>	<p>$7.35 \Rightarrow m = 35$</p> <p>$\therefore t = 6.8\dot{3} + 0.204 \times 35 = \underline{13.97\dot{3}}$</p>	<p>14.0 AWRT</p> <p>M1 A1 (2)</p>
<p>(d) (i)</p>	<p>$9.00 \Rightarrow m = 120$</p> <p>No; outside range of data (after 7.50 am)</p>	<p>B1; B1</p>
<p>(ii)</p>	<p>No; No evidence model will apply one month later</p>	<p>B1; B1 (4)</p>

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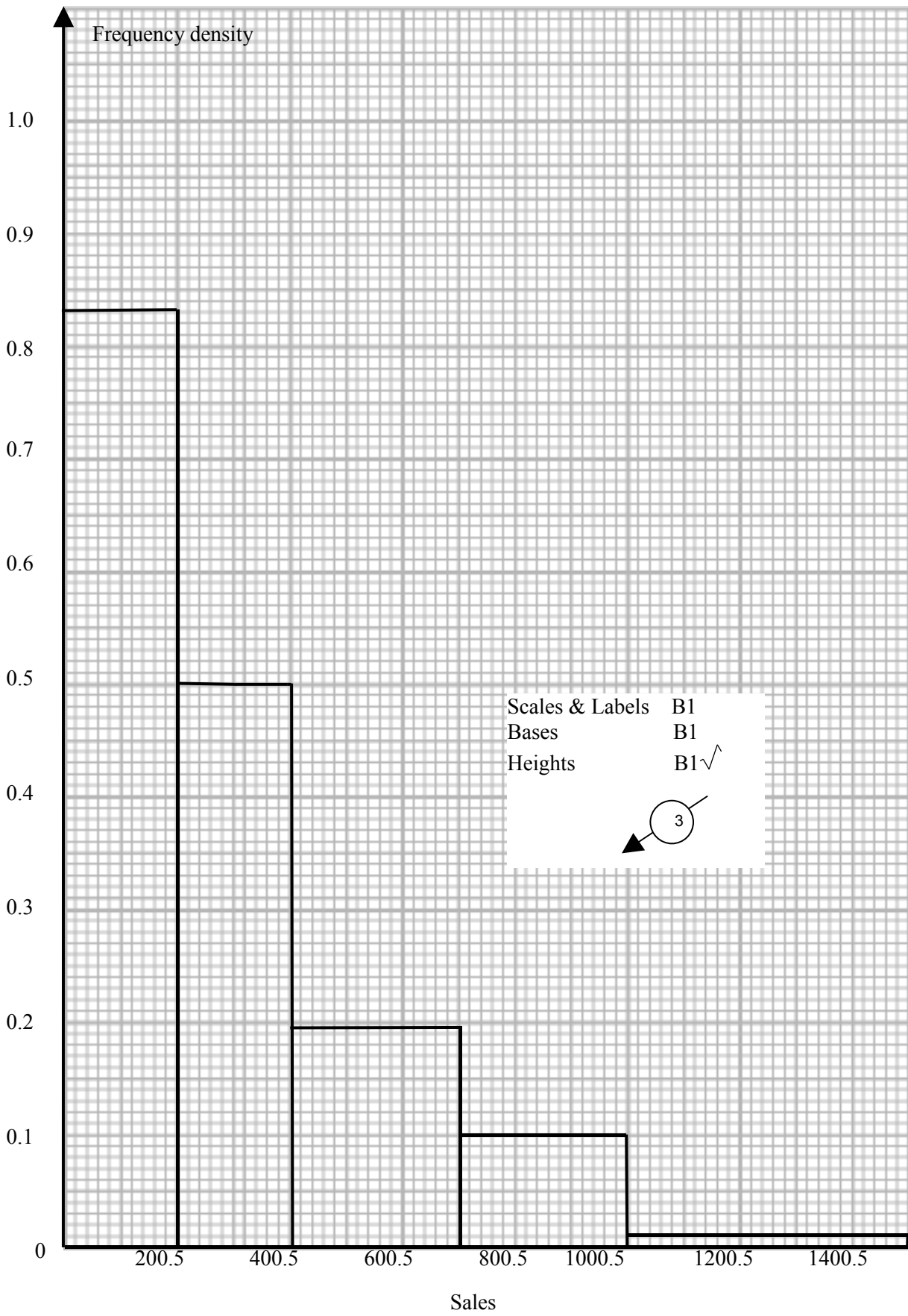
Question	Mark Scheme	Mark
3. (a)	$P(1 < X \leq 3) = P(X = 2) + P(X = 3)$ $= \frac{1}{12} + \frac{1}{12} = \frac{2}{12} = \frac{1}{6}$	M1 A1 (2)
(b)	$F(2.6) = P(X \leq 2) = 1 - P(X = 3) = 1 - \frac{1}{12} = \frac{11}{12}$ <p>(or: $P(X \leq 2) = \frac{1}{3} + \frac{1}{2} + \frac{1}{12} = \frac{11}{12}$)</p>	$\frac{11}{12}; 0.91\dot{7}; 0.91\dot{6}$ B1 (1)
(c)	$E(X) = \left(0 \times \frac{1}{3}\right) + \dots + \left(3 \times \frac{1}{12}\right) = \frac{11}{12}$	Use of $\sum xP(X = x)$ $\frac{11}{12};$ AWRT 0.917 M1 A1 (2)
(d)	$E(2X - 3) = 2E(X) - 3$ $= 2 \times \frac{11}{12} - 3 = -\frac{14}{12} = -\frac{7}{6}$	Use of $E(ax + b)$ $-\frac{7}{6}; -1\frac{1}{6};$ AWRT -1.17 M1 A1 (2)
(e)	$\text{Var}(X) = 1^2 \times \frac{1}{2} + \dots + 3^2 \times \frac{1}{12} - \left(\frac{11}{12}\right)^2$ $= \frac{107}{144}$	Use of $E(X^2) - \{E(X)\}^2$ Correct substitution $\frac{107}{144};$ AWRT 0.743 M1 A1 A1 (3)

EDEXCEL 6683 STATISTICS S1 JANUARY 2004 MARK SCHEME

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4. (a) (i)	$P(A \cap B') = P(A/B') P(B') = \frac{4}{5} \times \frac{1}{2} = \frac{4}{10} = \frac{2}{5}$ Use of $P(A/B')P(B')$	M1 A1
(ii)	$P(A \cap B) = P(A) - P(A \cap B')$ $= \frac{2}{5} - \frac{2}{5}$ $= \underline{0}$	M1 A1
(iii)	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $= \frac{2}{5} + \frac{1}{2} - 0$ $= \underline{\frac{9}{10}}$	M1 A1
(iv)	$P(A/B) = \frac{P(A \cap B)}{P(B)} = 0$	B1 (7)
(b) (i)	since $P(A \cap B) = 0$ seen A and B are mutually exclusive	B1 B1 (2)
(ii)	Since $P(A/B) \neq P(A)$ or equivalent A and B are NOT independent	B1 B1 (2)

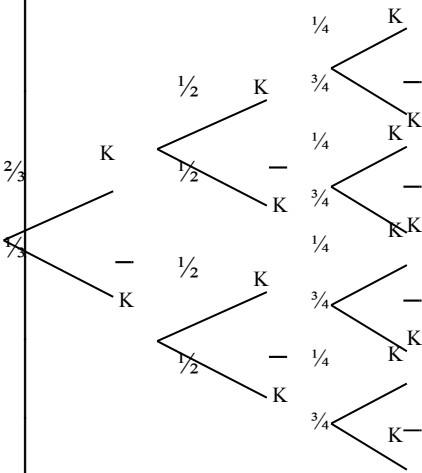
EDEXCEL 6683 STATISTICS S1 JANUARY 2004 MARK SCHEME

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<p>5. (a)</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Sales</th> <th style="width: 25%;">No. of days</th> <th style="width: 25%;">Class width</th> <th style="width: 25%;">Frequency density</th> </tr> </thead> <tbody> <tr> <td>1-200</td> <td>166</td> <td>200</td> <td>0.830</td> </tr> <tr> <td>201-400</td> <td>100</td> <td>200</td> <td>0.500</td> </tr> <tr> <td>401-700</td> <td>59</td> <td>300</td> <td>0.197</td> </tr> <tr> <td>701-1000</td> <td>30</td> <td>300</td> <td>0.100</td> </tr> <tr> <td>1001-1500</td> <td>5</td> <td>500</td> <td>0.010</td> </tr> </tbody> </table>	Sales	No. of days	Class width	Frequency density	1-200	166	200	0.830	201-400	100	200	0.500	401-700	59	300	0.197	701-1000	30	300	0.100	1001-1500	5	500	0.010	<p>Frequency densities M1 A1</p> <p>Graph (5)</p>
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<p>NB Frequency densities can be scored on graph</p> <p>(b)</p> $Q_2 = 200.5 + \frac{(180 - 166)}{100} \times 200 = \underline{228.5}$ <p style="text-align: right;">228/229/230</p> $Q_1 = 0.5 + \frac{90}{166} \times 200 = \underline{108.933\dots}$ <p style="text-align: right;">109 AWRT</p> $Q_3 = 400.5 + \frac{(270 - 266)}{59} \times 300 = \underline{420.838}$ <p style="text-align: right;">AWRT 421/425</p> <p>(n = 270.75 ⇒ Q₃ = 424.6525)</p> $\text{IQR} = 420.830\dots - 108.933\dots = \underline{311.905\dots}$ <p style="text-align: right;">B1 (5)</p> <p>(c)</p> $\sum fx = 110980 \quad ; \quad \sum fx^2 = 58105890$ <p style="text-align: right;">Attempt at $\sum fx$ or $\sum fy$ M1</p> $\sum fy = 748; \sum fy^2 = 3943.5 \text{ where } y = \frac{x - 100.5}{100}$ <p style="text-align: right;">Attempt at $\sum fx^2$ or $\sum fy^2$ M1</p> $\mu = 308.277\dot{7}$ <p style="text-align: right;">308 AWRT M1 A1</p> $\sigma = 257.6238$ <p style="text-align: right;">258 AWRT M1 A1 (6)</p> <p>No working shown: SR B1 B1 only for μ, σ.</p>																										



EDEXCEL 6683 STATISTICS S1 JANUARY 2004 MARK SCHEME

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(d)	Median & IQR Sensible reason e.g. Assuming other years are skewed.	B1 B1 dep (2)

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<p>6. (a)</p>	 <p>Tree with correct number of branches</p> <p>$\frac{2}{3}, \frac{1}{3}$</p> <p>$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}$</p> <p>$\frac{1}{4}, \frac{3}{4}, \frac{3}{4}, \frac{1}{4}$</p>	<p>M1</p> <p>A1</p> <p>A1</p> <p>A1 (4)</p>
<p>(b)</p>	<p>$P(\text{All 3 Keys}) = \frac{2}{3} \times \frac{1}{2} \times \frac{1}{4} = \frac{2}{24} = \frac{1}{12}$</p>	<p>$\frac{1}{12}; 0.08\dot{3}; 0.0833$</p> <p>M1 A1 (2)</p>
<p>(c)</p>	<p>$P(\text{exactly 1 key}) = \left(\frac{2}{3} \times \frac{1}{2} \times \frac{3}{4}\right) + \left(\frac{1}{3} \times \frac{1}{2} \times \frac{3}{4}\right) + \left(\frac{1}{3} \times \frac{1}{2} \times \frac{1}{4}\right)$ 3 triples added</p> <p>$= \frac{10}{24} = \frac{5}{12}$</p>	<p>M1</p> <p>Each correct</p> <p>$\frac{10}{24}; \frac{5}{12}; 0.4\dot{1}\dot{6}; 0.417$</p> <p>A1 A1 A1 A1 (5)</p>
<p>(d)</p>	<p>P (Keys not collected on at least 2 successive stages)</p> <p>$= \left(\frac{2}{3} \times \frac{1}{2} \times \frac{3}{4}\right) + \left(\frac{1}{3} \times \frac{1}{2} \times \frac{1}{4}\right) + \left(\frac{1}{3} \times \frac{1}{2} \times \frac{3}{4}\right)$</p> <p>$= \frac{10}{24} = \frac{5}{12}$</p>	<p>3 triples added</p> <p>Each correct</p> <p>$\frac{10}{24}; \frac{5}{12}; 0.41\dot{6}; 0.417$</p> <p>M1</p> <p>A1 A1 A1</p> <p>A1 (5)</p>

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<p>6. (d)</p>	<p>Alternative:</p> <p>1 – P (Keys collected on at least 2 successive stages)</p> $= 1 - \left\{ \left(\frac{2}{3} \times \frac{1}{2} \times \frac{1}{4} \right) + \left(\frac{2}{3} \times \frac{1}{2} \times \frac{3}{4} \right) + \left(\frac{1}{3} \times \frac{1}{2} \times \frac{1}{4} \right) \right\}$ $= \frac{5}{8}$	<p>M1</p> <p>A1 A1 A1</p> <p>A1</p> <p>(5)</p>