

EDEXCEL 6683 STATISTICS S1 JANUARY 2004 MARK SCHEME

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

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2. (a)	Symmetrical (about the mean μ) Mode = mean = median Horizontal axis asymptotic to curve Distribution is ‘bell shaped’ – accept sketch 95% of data lies within 2 sd’s of the mean	B1;B1;B1 (3) Any 3 sensible properties
(b)	$X \sim N(27, 10^2)$ $\therefore P(26 < x < 28) = P\left(\frac{26-27}{10} < Z < \frac{28-27}{10}\right)$ Standardising with $\mu = 27,$ $\sigma = 10$ or $\sqrt{10}$ One correct (seen) $= P(-0.1 < Z < 0.1)$ -0.1 or 0.1 $= \Phi(0.1) - \{1 - \Phi(0.1)\}$ or $2 \times \{\Phi(0.1) - 0.5\}$ $= \underline{0.0796}$ <u>0.0796 or 0.0797</u>	M1 A1 A1 A1 (4)

Data is continuous	B0
Area under curve = 1	B0
Limits are $-\infty$ & ∞	B0
IQR contains 50% of data	B0
68% between $\mu \pm \sigma$	B1
Most of data within 3 s.d of mean	B1
No +ve or –ve skew	B1
Never touches axes at either side (ie asymptotic)	B1

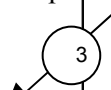
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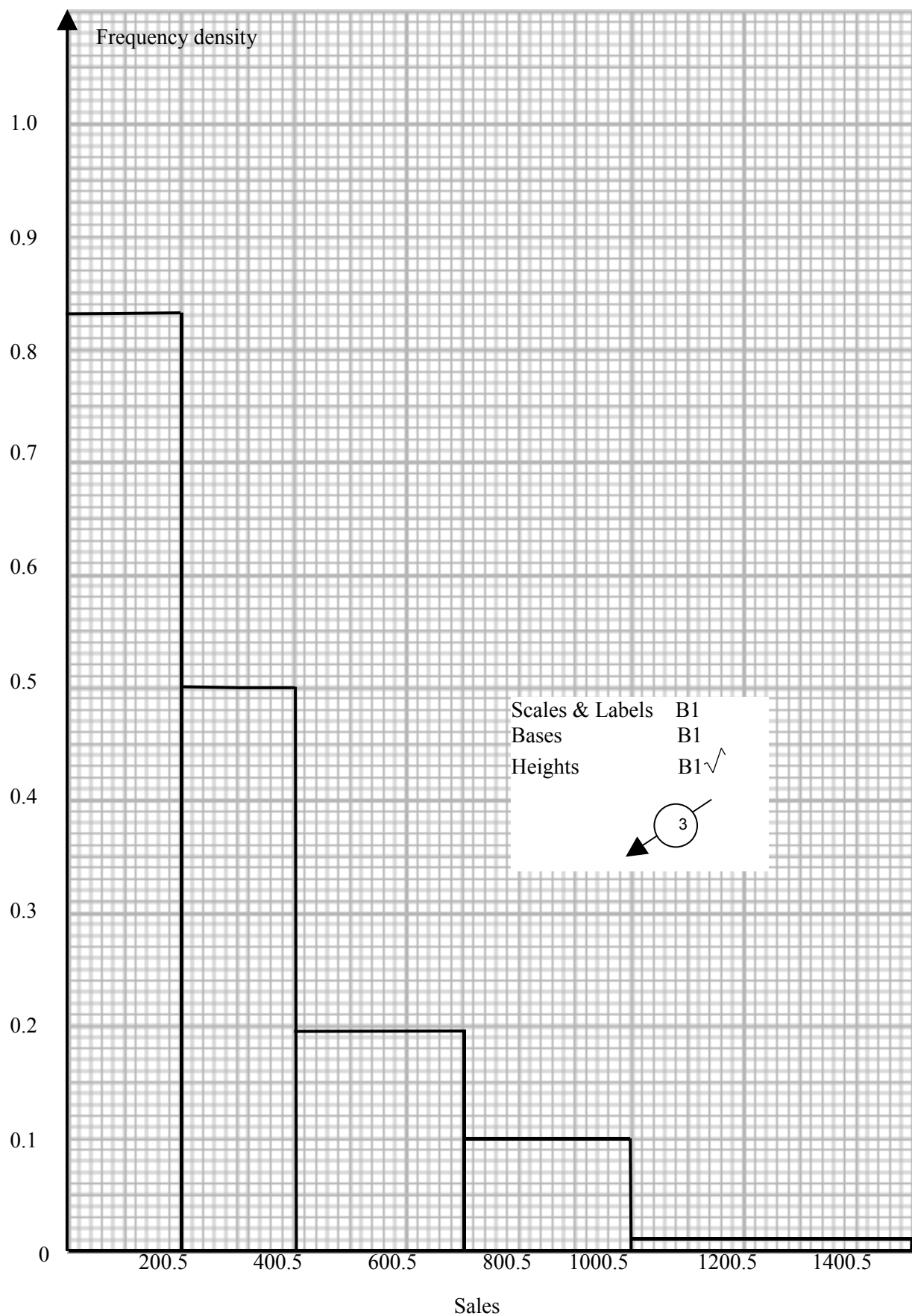
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3. (a)	$P(1 < X \leq 3) = P(X = 2) + P(X = 3)$ $= \frac{1}{12} + \frac{1}{12} = \frac{2}{12} = \frac{1}{6}$	M1 A1 (2)
(b)	$F(2.6) = P(X \leq 2) = 1 - P(X = 3) = 1 - \frac{1}{12} = \frac{11}{12}$ (or : $P(X \leq 2) = \frac{1}{3} + \frac{1}{2} + \frac{1}{12} = \frac{11}{12}$)	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 $\sum xP(X = x)$ M1 A1 (2)
(d)	$E(2X-3) = 2E(X)-3$ $= 2 \times \frac{11}{12} - 3 = -\frac{14}{12} = -\frac{7}{6}$	Use of $E(ax + b)$ 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 M1 A1 A1 (3)

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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)	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $= \frac{2}{5} + \frac{1}{2} - 0$ $= \frac{9}{10}$	M1 A1 ✓
(iv)	$P(A/B) = P \frac{(A \cap B)}{P(B)} = 0$	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)

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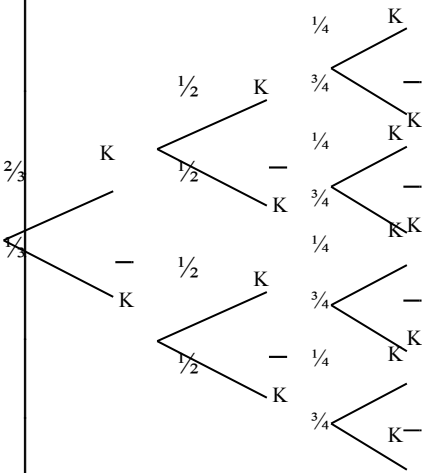
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5. (a)	<table border="1"><thead><tr><th>Sales</th><th>No. of days</th><th>Class width</th><th>Frequency density</th></tr></thead><tbody><tr><td>1-200</td><td>166</td><td>200</td><td>0.830</td></tr><tr><td>201-400</td><td>100</td><td>200</td><td>0.500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



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

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

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