

June 2005
6683 Statistics S1
Mark Scheme

Question Number	Scheme	Marks
1.	<p>Diagram A : y & x : $r = -0.79$; As x increases, y decreases or most points lie in the 2nd and 4th quadrant.</p> <p>Diagram B : v & u : $r = 0.08$; No real pattern. Several values of v for one value of u or points lie in all four quadrants, randomly scattered.</p> <p>Diagram C : t & s : $r = 0.68$; As s increases, t increases or most points lie in the 1st and 3rd quadrants</p>	<p>B1;B1dep</p> <p>B1;B1dep</p> <p>B1;B1dep (6)</p>
2. (a)	Distance is a continuous.	continuous B1 (1)
(b)	F.D = freq/class width \Rightarrow 0.8, 3.8, 5.3, 3.7, 0.75, 0.1	or the same multiple of M1 A1 (2)
(c)	$Q_2 = 50.5 + \frac{(67-23)}{53} \times 10 = 58.8$ <p>$Q_1 = 52.48$; $Q_3 = 67.12$</p> <p>Special case : no working B1 B1 B1 (= A's on the open)</p>	<p>awrt 58.8/58.9 M1 A1</p> <p>awrt 52.5/52.6 67.1/67.3 A1 A1 (4)</p>
(d)	$\bar{x} = \frac{8379.5}{134} = 62.5335\dots$ $s = \sqrt{\frac{557489.75}{134} - \left(\frac{8379.5}{134}\right)^2}$ <p>$s = 15.8089\dots$ ($S_{n-1} = 15.86825\dots$)</p> <p>Special case : answer only B1 B1 (= A's on the open)</p>	<p>awrt 62.5 B1</p> <p>M1 A1√</p> <p>awrt 15.8 (15.9) A1 (4)</p>
(e)	$\frac{Q_3 - 2Q_2 + Q_1}{Q_3 - Q_1} = \frac{67.12 - 2 \times 58.8 + 52.48}{67.12 - 52.48}$ <p style="text-align: center;">$= 0.1366 \Rightarrow ; +ve$ skew</p>	<p>subst their Q_1, Q_2 & Q_3 need to show working for A1√ and have reasonable values for quartiles</p> <p>awrt 0.14 M1 A1√ A1; B1 (4)</p>
(f)	<p>For +ve skew Mean > Median & $62.53 > 58.80$ or $Q_3 - Q_2 (8.32) > Q_2 - Q_1 (6.32)$ Therefore +ve skew</p>	<p>B1 (1)</p>

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3. (a)	$S_{xy} = 8880 - \frac{130 \times 48}{8} = (8100)$ <p style="text-align: right;">may be implied</p> $S_{xx} = 20487.5$ $b = \frac{s_{xy}}{s_{xx}} = \frac{8100}{20487.5} = 0.395363\dots$ <p style="text-align: right;">allow use of their S_{xy} for M awrt 0.395</p> $a = \frac{48}{8} - (0.395363\dots) \frac{130}{8} = -0.424649\dots$ <p style="text-align: right;">allow use of their b for M awrt -0.425</p> $y = -0.425 + 0.395x$ <p style="text-align: right;">3s.f.</p> <p>Special case answer only B0 M0 B1 M0 B1 B1 (fully correct 3sf) (\equiv to B0 M0 A1 M0 A1 B1 on the open)</p>	<p>B1</p> <p>M1 A1</p> <p>M1 A1</p> <p>B1 \checkmark</p> <p>(6)</p>
(b)	$f - 100 = -0.424649\dots + 0.395\dots(m - 250)$ $f = 0.735 + 0.395m$	<p style="text-align: right;">subst $f - 100$ & $m - 250$</p> <p style="text-align: right;">3 s.f.</p> <p>M1 A1 \checkmark</p> <p>A1</p> <p>(3)</p>
(c)	$m = 235 \Rightarrow f = 93.64489\dots$	<p style="text-align: right;">awrt 93.6/93.7</p> <p>B1</p> <p>(1)</p>

4(a)	$1.5 (Q_3 - Q_1) = 1.5 (28 - 12) = 24$ $Q_3 + 24 = 52 \Rightarrow 63$ is an outlier $Q_1 - 24 < 0 \Rightarrow$ no outliers	may be implied at $Q_3 + \dots$ or $Q_1 - \dots$, 52 and -12 or < 0 or evidence of no lower outliers 63 is an outlier	B1 M1, A1 A1 M1 A1 A1	(7)
(b)	Distribution is +ve skew; $Q_2 - Q_1 (5) < Q_3 - Q_2 (11)$;		B1; B1	(2)
(c)	Many delays are small so passengers should find these acceptable or sensible comment in the context of the question.		B1	(1)

5.(a)	$k + 2k + 3k + 5k + 6k = 1$ $17k = 1$ $k = \frac{1}{17} = 0.0588$	use of $\sum P(X = x) = 1$	M1	(2)
			A1	
(b)	$E(X) = 1 \times \frac{1}{17} + 2 \times \frac{2}{17} + \dots + 5 \times \frac{6}{17} = \frac{64}{17}$ $= 3 \frac{13}{17}$	use of $\sum xP(X = x)$ and at least 2 prob correct	M1	
		Do not ignore subsequent working	A1	
(c)	$E(X^2) = 1^2 \times \frac{1}{17} + 2^2 \times \frac{2}{17} + \dots + 5^2 \times \frac{6}{17} = \left(\frac{266}{17} = 15.6 \right)$ $\text{Var}(X) = \frac{266}{17} - \left(\frac{64}{17} \right)^2$ $= 1.4740\dots$	use of $\sum x^2 P(X = x)$ and at least 2 prob correct	M1 A1	
		use of $\sum x^2 P(X = x)$ -	M1	
		awrt 1.47	A1	(4)
(d)	$\text{Var}(4 - 3X) = 9 \text{Var}(X) = 9 \times 1.47 = 13.23 \Rightarrow 13.2$ $\text{or } 9 \times 1.4740\dots = 13.266 \Rightarrow 13.3$	cao 9 Var X	M1 A1	(2)

<p>6(a)</p> <p>6(b)</p> <p>6(c)</p>	<p>$M \sim N(155, 3.5^2)$</p> <p>$P(M > 160) = P\left(z > \frac{160-155}{3.5}\right)$ $= P(z > 1.43)$ $= 0.0764$</p> <p>$P(150 \leq M \leq 157) = P(-1.43 \leq z \leq 0.57)$ $= 0.7157 - (1 - 0.9236)$ $= 0.6393$</p> <p>special case : answer only B0 B0 M1 A1</p> <p>$P(M \leq m) = 0.3 \Rightarrow \frac{m-155}{3.5} = -0.5244$ $m = 153.2$</p>	<p>standardising $\pm(160-155), \sigma, \sigma^2, \sqrt{\sigma}$</p> <p>M1 A1 A1 (3)</p> <p>awrt -1.43, 0.57 $p > 0.5$ 0.6393 - 0.6400 4dp</p> <p>B1 B1 M1 A1 (4)</p> <p>-0.5244 att stand = z value for A1 may use awrt to -0.52.</p> <p>B1 M1 A1 A1 (4)</p>																								
<p>7.</p> <p>(a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Glasses</th> <th style="text-align: center;">No Glasses</th> <th style="text-align: center;">Totals</th> <th></th> </tr> </thead> <tbody> <tr> <td>Science</td> <td style="text-align: center;">18</td> <td style="text-align: center;">12</td> <td style="text-align: center;">30</td> <td></td> </tr> <tr> <td>Arts</td> <td style="text-align: center;">27</td> <td style="text-align: center;">23</td> <td style="text-align: center;">50</td> <td rowspan="2" style="vertical-align: middle;">50 may be seen in (a) 23 may be seen in (b)</td> </tr> <tr> <td>Humanities</td> <td style="text-align: center;">44</td> <td style="text-align: center;">24</td> <td style="text-align: center;">68</td> </tr> <tr> <td>Totals</td> <td style="text-align: center;">89</td> <td style="text-align: center;">59</td> <td style="text-align: center;">148</td> <td></td> </tr> </tbody> </table> <p>$P(\text{Arts}) = \frac{50}{148} = \frac{25}{74} = 0.338$</p> <p>$P(\text{No glasses} / \text{Arts}) = \frac{23/148}{50/148} = \frac{23}{50} = 0.46$</p> <p>$P(\text{Right Handed}) = \left(\frac{30}{148} \times 0.8\right) + \left(\frac{50}{148} \times 0.7\right) + \left(\frac{68}{148} \times 0.75\right)$ $= \frac{55}{74} = 0.743$</p> <p>$P(\text{Science} / \text{Right handed}) = \frac{\frac{30}{148} \times 0.8}{(c)} = \frac{12}{55} = 0.218$</p>		Glasses	No Glasses	Totals		Science	18	12	30		Arts	27	23	50	50 may be seen in (a) 23 may be seen in (b)	Humanities	44	24	68	Totals	89	59	148		<p>B1 B1</p> <p>a number/148</p> <p>M1 A1 (4)</p> <p>prob their(a)prob or number their 50</p> <p>M1 A1 (2)</p> <p>attempt add three prob A1 \checkmark on their (a)</p> <p>awrt 0.743</p> <p>M1 A1 \checkmark A1 (3)</p> <p>\checkmark on their (c)</p> <p>M1 A1 \checkmark A1 (3)</p>
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