

GCE

Edexcel GCE

Statistics S1 (6683)

Summer 2005

advancing learning, changing lives

Mark Scheme (Results)

June 2005  
6683 Statistics S1  
Mark Scheme

Question Number	Scheme	Marks
1.	Diagram A : $y$ & $x$ : $r = -0.79$ ; As $x$ increases, $y$ decreases or most points lie in the 2 <sup>nd</sup> and 4 <sup>th</sup> quadrant.  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.  Diagram C : $t$ & $s$ : $r = 0.68$ ; As $s$ increases, $t$ increases or most points lie in the 1 <sup>st</sup> and 3 <sup>rd</sup> quadrants	B1;B1dep  B1;B1dep  B1;B1dep (6)
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)	$Q_2 = 50.5 + \frac{(67-23)}{53} \times 10 = 58.8$  $Q_1 = 52.48$ ; $Q_3 = 67.12$	awrt 58.8/58.9 M1 A1  awrt 52.5/52.6 67.1/67.3 A1 A1 (4)
	Special case : no working B1 B1 B1 ( $\equiv$ A's on the open)	
(d)	$\bar{x} = \frac{8379.5}{134} = 62.5335\dots$  $s = \sqrt{\frac{557489.75}{134} - \left(\frac{8379.5}{134}\right)^2}$  $s = 15.8089\dots$ ( $S_{n-1} = 15.86825\dots$ )	awrt 62.5 B1  M1 A1√  awrt 15.8 (15.9) A1 (4)
	Special case : answer only B1 B1 ( $\equiv$ A's on the open)	
(e)	$\frac{Q_3 - 2Q_2 + Q_1}{Q_3 - Q_1} = \frac{67.12 - 2 \times 58.8 + 52.48}{67.12 - 52.48}$  $= 0.1366 \Rightarrow ; +ve$ skew	subst their $Q_1, Q_2$ & $Q_3$ need to show working for A1√ and have reasonable values for quartiles awrt 0.14 M1 A1√ A1; B1 (4)
(f)	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	B1 (1)

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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 <math>S_{xy}</math> 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 <math>b</math> 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) (<math>\equiv</math> to B0 M0 A1 M0 A1 B1 on the open)</p>	<p>B1</p> <p>M1 A1</p> <p>M1 A1</p> <p>B1 <math>\checkmark</math></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 &amp; m - 250</p> <p>M1 A1 <math>\checkmark</math></p> <p style="text-align: right;">3 s.f.</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>

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

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

<p>6(a)</p> <p>(b)</p> <p>(c)</p>	<p><math>M \sim N(155, 3.5^2)</math></p> <p><math>P(M &gt; 160) = P\left(z &gt; \frac{160-155}{3.5}\right)</math>  <math>= P(z &gt; 1.43)</math>  <math>= 0.0764</math></p> <p><math>P(150 \leq M \leq 157) = P(-1.43 \leq z \leq 0.57)</math>  <math>= 0.7157 - (1 - 0.9236)</math>  <math>= 0.6393</math></p> <p>special case : answer only B0 B0 M1 A1</p> <p><math>P(M \leq m) = 0.3 \Rightarrow \frac{m-155}{3.5} = -0.5244</math>  <math>m = 153.2</math></p>	<p>standardising  <math>\pm(160 - 155), \sigma, \sigma^2, \sqrt{\sigma}</math></p> <p>M1 A1 A1 (3)</p> <p>awrt -1.43, 0.57  <math>p &gt; 0.5</math>  <math>0.6393 - 0.6400</math> 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;"><b>12</b></td> <td style="text-align: center;">30</td> <td></td> </tr> <tr> <td>Arts</td> <td style="text-align: center;"><b>27</b></td> <td style="text-align: center;"><b>23</b></td> <td style="text-align: center;"><b>50</b></td> <td style="text-align: center;">50 may be seen in (a)</td> </tr> <tr> <td>Humanities</td> <td style="text-align: center;">44</td> <td style="text-align: center;"><b>24</b></td> <td style="text-align: center;">68</td> <td style="text-align: center;">23 may be seen in (b)</td> </tr> <tr> <td>Totals</td> <td style="text-align: center;">89</td> <td style="text-align: center;"><b>59</b></td> <td style="text-align: center;">148</td> <td></td> </tr> </tbody> </table> <p><math>P(\text{Arts}) = \frac{50}{148} = \frac{25}{74} = 0.338</math></p> <p><math>P(\text{No glasses} / \text{Arts}) = \frac{23/148}{50/148} = \frac{23}{50} = 0.46</math></p> <p><math>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)</math>  <math>= \frac{55}{74} = 0.743</math></p> <p><math>P(\text{Science} / \text{Right handed}) = \frac{\frac{30}{148} \times 0.8}{\frac{55}{74}} = \frac{12}{55} = 0.218</math></p>		Glasses	No Glasses	Totals		Science	18	<b>12</b>	30		Arts	<b>27</b>	<b>23</b>	<b>50</b>	50 may be seen in (a)	Humanities	44	<b>24</b>	68	23 may be seen in (b)	Totals	89	<b>59</b>	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 ✓ on their (a)</p> <p>awrt 0.743</p> <p>M1 A1 ✓ A1 (3)</p> <p>✓ on their (c)</p> <p>M1 A1 ✓ A1 (3)</p>
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