

Mark Scheme (Results) Summer 2010

GCE

Statistics S1 (6683)

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Summer 2010

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General Marking Guidance

1. The total number of marks for the paper is 75.
2. The Edexcel Mathematics mark schemes use the following types of marks:
 - M marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
 - A marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
 - B marks are unconditional accuracy marks (independent of M marks)
3. Abbreviations

These are some of the marking abbreviations that will appear in the mark scheme

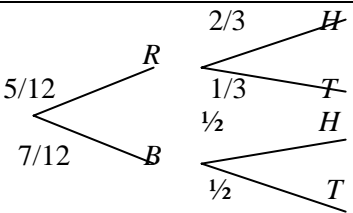
- ft - follow through
- awrt - answers which round to
- oe - or equivalent (and appropriate)
- isw - ignore subsequent working
- cao - correct answer only
- cso - correct solution only. There must be no errors in this part of the question to obtain this mark
- SC: special case

June 2010

Statistics S1 6683

Mark Scheme

Question Number	Scheme	Marks
Q1 (a)	$r = \frac{8825}{\sqrt{1022500 \times 130.9}}, \quad = \text{awrt } \underline{\mathbf{0.763}}$	M1 A1 (2)
(b)	Teams with high attendance scored more goals (oe, statement in context)	B1 (1)
(c)	0.76(3)	B1ft (1)
Total 4		
(a)	M1 for a correct expression, square root required Correct answer award 2/2	
(b)	Context required (attendance and goals). Condone causality. B0 for 'strong positive correlation between attendance and goals' on its own oe	
(c)	Value required. Must be a correlation coefficient between -1 and +1 inclusive. B1ft for 0.76 or better or same answer as their value from part (a) to at least 2 d.p.	

Question Number	Scheme	Marks
Q2 (a)	 <p style="text-align: center;">P(R) and P(B) 2nd set of probabilities</p>	<p>B1 B1 (2) M1 A1 (2) M1 A1ft A1 (3) M1 A1ft A1 (3) Total 10</p>
	<p>(b) $P(H) = \frac{5}{12} \times \frac{2}{3} + \frac{7}{12} \times \frac{1}{2}, = \frac{41}{72}$ or awrt 0.569</p> <p>(c) $P(R H) = \frac{\frac{5}{12} \times \frac{2}{3}}{\frac{41}{72}}, = \frac{20}{41}$ or awrt 0.488</p> <p>(d) $\left(\frac{5}{12}\right)^2 + \left(\frac{7}{12}\right)^2$ $= \frac{25}{144} + \frac{49}{144} = \frac{74}{144}$ or $\frac{37}{72}$ or awrt 0.514</p>	<p>(a) 1st B1 for the probabilities on the first 2 branches. Accept 0.416 and 0.583 2nd B1 for probabilities on the second set of branches. Accept 0.6, 0.3, 0.5 and $\frac{1.5}{3}$ Allow exact decimal equivalents using clear recurring notation if required.</p> <p>(b) M1 for an expression for P(H) that follows through their sum of two products of probabilities from their tree diagram</p> <p>(c) M1 for $\frac{P(R \cap H)}{P(H)}$ with denominator their (b) substituted e.g. $\frac{P(R \cap H)}{P(H)} = \frac{5}{12}$ (their (b)) award M1.</p> <p>Formula seen</p> <p>Formula not seen M1 for $\frac{\text{probability} \times \text{probability}}{\text{their } b}$ but M0 if fraction repeated e.g. $\frac{5}{12} \times \frac{2}{3}$. $\frac{2}{3}$</p> <p>1st A1ft for a fully correct expression or correct follow through 2nd A1 for $\frac{20}{41}$ o.e.</p> <p>(d) M1 for $\left(\frac{5}{12}\right)^2$ or $\left(\frac{7}{12}\right)^2$ can follow through their equivalent values from tree diagram 1st A1 for both values correct or follow through from their original tree and + 2nd A1 for a correct answer Special Case $\frac{5}{12} \times \frac{4}{11}$ or $\frac{7}{12} \times \frac{6}{11}$ seen award M1A0A0</p>

Question Number	Scheme	Marks
Q3 (a)	$2a + \frac{2}{5} + \frac{1}{10} = 1$ <p style="text-align: right;">(or equivalent)</p> $\underline{\underline{a = \frac{1}{4} \text{ or } 0.25}}$	M1 A1 (2)
(b)	$E(X) = \underline{1}$	B1 (1)
(c)	$E(X^2) = 1 \times \frac{1}{5} + 1 \times \frac{1}{10} + 4 \times \frac{1}{4} + 9 \times \frac{1}{5}$ <p style="text-align: right;">(= 3.1)</p>	M1
(d)	$\text{Var}(X) = 3.1 - 1^2,$ <p style="text-align: right;">$= \underline{\underline{2.1 \text{ or } \frac{21}{10} \text{ oe}}}$</p>	M1 A1 (3)
(e)	$\text{Var}(Y) = (-2)^2 \text{Var}(X),$ <p style="text-align: right;">$= \underline{\underline{8.4 \text{ or } \frac{42}{5} \text{ oe}}}$</p>	M1 A1 (2)
(e)	$X \geq Y$ when $X = 3$ or $2,$ so probability = " $\frac{1}{4}$ " + " $\frac{1}{5}$ " <p style="text-align: right;">$= \underline{\underline{\frac{9}{20} \text{ oe}}}$</p>	M1 A1ft A1 (3)
Total 11		
(a)	M1 for a clear attempt to use $\sum P(X = x) = 1$ Correct answer only 2/2. NB Division by 5 in parts (b), (c) and (d) seen scores 0. Do not apply ISW.	
(b)	B1 for 1	
(c)	1 st M1 for attempting $\sum x^2 P(X = x)$ at least two terms correct. Can follow through. 2 nd M1 for attempting $E(X^2) - [E(X)]^2$ or allow subtracting 1 from their attempt at $E(X^2)$ provided no incorrect formula seen. Correct answer only 3/3.	
(d)	M1 for $(-2)^2 \text{Var}(X)$ or $4\text{Var}(X)$ Condone missing brackets provided final answer correct for their $\text{Var}(X)$. Correct answer only 2/2.	
(e)	Allow M1 for distribution of $Y = 6 - 2X$ and correct attempt at $E(Y^2) - [E(Y)]^2$ M1 for identifying $X = 2, 3$ 1 st A1ft for attempting to find their $P(X=2) + P(X = 3)$ 2 nd A1 for $\frac{9}{20}$ or 0.45	

Question Number	Scheme	Marks
Q4	<p>(a) $\frac{2+3}{\text{their total}} = \frac{5}{\text{their total}} = \frac{1}{6}$ (** given answer**)</p> <p>(b) $\frac{4+2+5+3}{\text{total}}, = \frac{14}{30}$ or $\frac{7}{15}$ or 0.46</p> <p>(c) $P(A \cap C) = 0$</p> <p>(d) $P(C \text{reads at least one magazine}) = \frac{6+3}{20} = \frac{9}{20}$</p> <p>(e) $P(B) = \frac{10}{30} = \frac{1}{3}$, $P(C) = \frac{9}{30} = \frac{3}{10}$, $P(B \cap C) = \frac{3}{30} = \frac{1}{10}$ or $P(B C) = \frac{3}{9}$</p> <p>$P(B) \times P(C) = \frac{1}{3} \times \frac{3}{10} = \frac{1}{10} = P(B \cap C)$ or $P(B C) = \frac{3}{9} = \frac{1}{3} = P(B)$</p> <p>So yes they are statistically independent</p>	<p>M1 A1cso (2)</p> <p>M1 A1 (2)</p> <p>B1 (1)</p> <p>M1 A1 (2)</p> <p>M1</p> <p>M1</p> <p>A1cso (3)</p> <p>Total 10</p>
	<p>(a) M1 for $\frac{2+3}{\text{their total}}$ or $\frac{5}{30}$</p> <p>(b) M1 for adding at least 3 of “4, 2, 5, 3” and dividing by their total to give a probability Can be written as separate fractions substituted into the completely correct Addition Rule</p> <p>(c) B1 for 0 or 0/30</p> <p>(d) M1 for a denominator of 20 or $\frac{20}{30}$ leading to an answer with denominator of 20 $\frac{9}{20}$ only, 2/2</p> <p>(e) 1st M1 for attempting all the required probabilities for a suitable test 2nd M1 for use of a correct test - must have attempted all the correct probabilities. Equality can be implied in line 2. A1 for fully correct test carried out with a comment</p>	

Question Number	Scheme	Marks
Q5	<p>(a) 23, 35.5 (may be in the table)</p> <p>(b) Width of 10 units is 4 cm so width of 5 units is <u>2 cm</u> Height = $2.6 \times 4 = \mathbf{10.4 \text{ cm}}$</p> <p>(c) $\sum fx = 1316.5 \Rightarrow \bar{x} = \frac{1316.5}{56} =$ awrt <u>23.5</u> $\sum fx^2 = 37378.25$ can be implied So $\sigma = \sqrt{\frac{37378.25}{56} - \bar{x}^2} =$ awrt <u>10.7</u> allow $s = 10.8$</p> <p>(d) $Q_2 = (20.5) + \frac{(28 - 21)}{11} \times 5 = 23.68\dots$ awrt <u>23.7 or 23.9</u></p> <p>(e) $Q_3 - Q_2 = 5.6, Q_2 - Q_1 = 7.9$ (or $\bar{x} < Q_2$) [7.9 > 5.6 so] <u>negative skew</u></p>	<p>B1 B1 (2)</p> <p>B1</p> <p>M1 A1 (3)</p> <p>M1 A1</p> <p>B1</p> <p>M1 A1 (5)</p> <p>M1 A1 (2)</p> <p>M1</p> <p>A1 (2)</p> <p>Total 14</p>
	<p>(b) M1 for their width x their height=20.8. Without labels assume width first, height second and award marks accordingly.</p> <p>(c) 1st M1 for reasonable attempt at $\sum x$ and /56 2nd M1 for a method for σ or $s, \sqrt{\quad}$ is required Typical errors $\sum (fx)^2 = 354806.3$ M0, $\sum f^2 x = 13922.5$ M0 and $(\sum fx)^2 = 1733172$ M0 Correct answers only, award full marks.</p> <p>(d) Use of $\sum f(x - \bar{x})^2 =$ awrt 6428.75 for B1 lcb can be 20, 20.5 or 21, width can be 4 or 5 and the fraction part of the formula correct for M1 - Allow 28.5 in fraction that gives awrt 23.9 for M1A1</p> <p>(e) M1 for attempting a test for skewness using quartiles or mean and median. Provided median greater than 22.55 and less than 29.3 award for M1 for $Q_3 - Q_2 < Q_2 - Q_1$ without values as a valid reason. SC Accept mean close to median and no skew oe for M1A1</p>	

Question Number	Scheme	Marks
Q6	<p>(a) See overlay</p> <p>(b) The points lie reasonably close to a straight line (o.e.)</p> <p>(c) $\sum d = 27.7, \quad \sum f = 146$ (both, may be implied)</p> $S_{dd} = 152.09 - \frac{(27.7)^2}{6} = 24.208.....$ <p style="text-align: right;">awrt <u>24.2</u></p> $S_{fd} = 723.1 - \frac{27.7 \times 146}{6} = 49.06....$ <p style="text-align: right;">awrt <u>49.1</u></p> <p>(d) $b = \frac{S_{fd}}{S_{dd}} = 2.026....$ awrt <u>2.03</u></p> $a = \frac{146}{6} - b \times \frac{27.7}{6} = 14.97..... \quad \text{so } \underline{f = 15.0 + 2.03d}$ <p>(e) A flight costs £2.03 (or about £2) for every extra 100km or about 2p per km.</p> <p>(f) $15.0 + 2.03d < 5d$ so $d > \frac{15.0}{(5 - 2.03)} = 5.00 \sim 5.05$</p> <p>So $t > 500 \sim 505$</p>	<p>B1 B1 (2)</p> <p>B1 (1)</p> <p>B1</p> <p>M1 A1</p> <p>A1 (4)</p> <p>M1 A1</p> <p>M1 A1 (4)</p> <p>B1ft (1)</p> <p>M1</p> <p>A1 (2)</p> <p style="text-align: right;">Total 14</p>
	<p>(a) 1st B1 for at least 4 points correct (allow \pm one 2mm square) 2nd B1 for all points correct (allow \pm one 2 mm square)</p> <p>(b) Ignore extra points and lines Require reference to points and line for B1.</p> <p>(c) M1 for a correct method seen for either - a correct expression 1st A1 for S_{dd} awrt 24.2 2nd A1 for S_{fd} awrt 49.1</p> <p>(d) 1st M1 for a correct expression for b - can follow through their answers from (c) 2nd M1 for a correct method to find a - follow through their b and their means 2nd A1 for $f = \dots$ in terms of d and all values awrt given expressions. Accept 15 as rounding from correct answer only.</p> <p>(e) Context of cost and distance required. Follow through their value of b</p> <p>(f) M1 for an attempt to find the intersection of the 2 lines. Value of t in range 500 to 505 seen award M1. Value of d in range 5 to 5.05 award M1. Accept t greater than 500 to 505 inclusive to include graphical solution for M 1A1</p>	

Question Number	Scheme	Marks
Q7 (a)	$P(D > 20) = P\left(Z > \frac{20-30}{8}\right)$ $= P(Z > -1.25)$ $= \underline{\underline{0.8944}} \qquad \qquad \qquad \underline{\underline{\text{awrt } 0.894}}$ <p>(b) $P(D < Q_3) = 0.75$ so $\frac{Q_3 - 30}{8} = 0.67$</p> $Q_3 = \text{awrt } \underline{\underline{35.4}}$ <p>(c) $35.4 - 30 = 5.4$ so $Q_1 = 30 - 5.4 = \text{awrt } \underline{\underline{24.6}}$</p> <p>(d) $Q_3 - Q_1 = 10.8$ so $1.5(Q_3 - Q_1) = 16.2$ so $Q_1 - 16.2 = h$ or $Q_3 + 16.2 = k$ $h = \underline{\underline{8.4 \text{ to } 8.6}}$ and $k = \underline{\underline{51.4 \text{ to } 51.6}}$ both</p> <p>(e) $2P(D > 51.6) = 2P(Z > 2.7)$</p> $= 2[1 - 0.9965] = \text{awrt } \underline{\underline{0.007}}$	<p>M1 A1 A1 (3)</p> <p>M1 B1 A1 (3)</p> <p>B1ft (1)</p> <p>M1 A1 (2)</p> <p>M1 M1 A1 (3)</p> <p>Total 12</p>
	<p>(a) M1 for an attempt to standardise 20 or 40 using 30 and 8. 1st A1 for $z = \pm 1.25$ 2nd A1 for awrt 0.894</p> <p>(b) M1 for $\frac{Q_3 - 30}{8} =$ to a z value M0 for 0.7734 on RHS. B1 for (z value) between 0.67~0.675 seen. M1B0A1 for use of $z = 0.68$ in correct expression with awrt 35.4</p> <p>(c) Follow through using their of quartile values.</p> <p>(d) M1 for an attempt to calculate $1.5(\text{IQR})$ and attempt to add or subtract using one of the formulae given in the question - follow through their quartiles</p> <p>(e) 1st M1 for attempting $2P(D > \text{their } k)$ or $(P(D > \text{their } k) + P(D < \text{their } h))$ 2nd M1 for standardising their h or k (may have missed the 2) so allow for standardising $P(D > 51.6)$ or $P(D < 8.4)$ Require boths Ms to award A mark.</p>	

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