

Mark Scheme (Results)

Summer 2007

GCE

GCE Mathematics

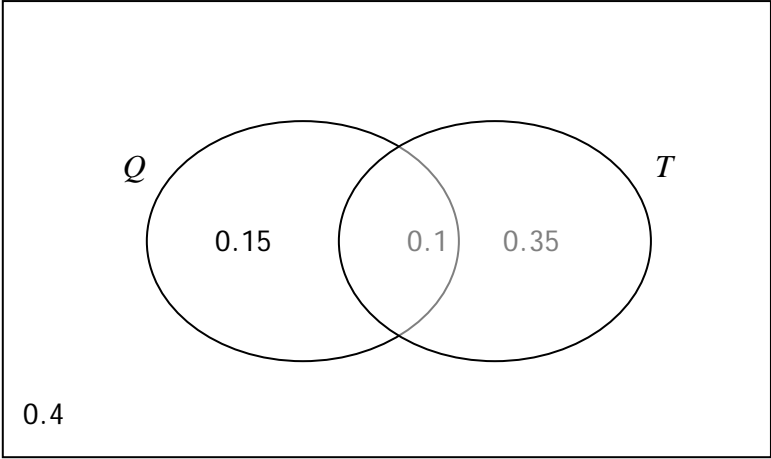
Statistics S1 (6681)

June 2007
6683 Statistics S1
Mark Scheme

Question Number	Scheme	Marks
1. (a)	$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{-808.917}{\sqrt{113573 \times 8.657}}$ $= -0.81579\dots$	<p style="text-align: right;">M1</p> <p style="text-align: right;">A1</p> <p style="text-align: right;">(2)</p>
(b)	Houses are <u>cheaper</u> further away from the station or equivalent statement	B1
(c)	-0.816	(1)
(c)		B1
		(1)
		Total 4 marks
Notes:		
1(a)	<p>M1 for knowing formula and clear attempt to sub in correct values from question. Root required for method. Anything that rounds to -0.82 for A1. Correct answer with no working award 2/2</p>	
(b)	<p>Context based on negative correlation only required. Accept <u>Houses</u> are <u>more expensive</u> closer to the <u>station</u> or equivalent statement. Require 'house prices' or 'station' and a clear correct comparison.</p>	
(c)	<p>Accept anything that rounds to -0.82 or 'the same' or 'unchanged' or equivalent. Award B1 if value quoted same as answer to (a).</p>	

Question Number	Scheme	Marks
<p>2(a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p> <p>(e)</p>	<p>$\frac{1}{2}$</p> <p>54</p> <p>+ is an 'outlier' or 'extreme value' Any heavy musical instrument or a statement that the instrument is heavy</p> <p>$Q_3 - Q_2 = Q_2 - Q_1$ so symmetrical or no skew</p> <p>$P(W < 54) = 0.75$ (or $P(W > 54) = 0.25$) or correctly labelled and shaded diagram</p> <p>$\frac{54 - 45}{\sigma} = 0.67$ $\sigma = 13.43.....$</p>	<p>B1</p> <p>(1)</p> <p>B1</p> <p>(1)</p> <p>B1</p> <p>(2)</p> <p>B1</p> <p>Dependent – only award if B1 above</p> <p>B1</p> <p>(2)</p> <p>M1</p> <p>M1B1</p> <p>A1</p> <p>(4)</p> <p>Total 10 marks</p>
<p>Notes</p> <p>2(a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p> <p>(e)</p>	<p>Accept 50% or half or 0.5. Units not required.</p> <p>Correct answer only. Units not required.</p> <p>'Anomaly' only award B0 Accept '85kg was heaviest instrument on the trip' or equivalent for second B1. Examples of common acceptable instruments; double bass, cello, harp, piano, drums, tuba Examples of common unacceptable instruments: violin, viola, trombone, trumpet, french horn, guitar</p> <p>'Quartiles equidistant from median' or equivalent award B1 then symmetrical or no skew for B1 Alternative: 'Positive tail is longer than negative tail' or 'median closer to lowest value' or equivalent so slight positive skew. B0 for 'evenly' etc. instead of 'symmetrical' B0 for 'normal' only</p> <p>Please note that B mark appears first on ePEN First line might be missing so first M1 can be implied by second. Second M1 for standardising with sigma and equating to z value NB Using 0.7734 should not be awarded second M1 Anything which rounds to 0.67 for B1. Accept 0.675 if to 3sf obtained by interpolation Anything that rounds to 13.3 – 13.4 for A1.</p>	

<p>3(a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p> <p>(e)</p>	<p>Use overlay</p> $S_{xy} = 28750 - \frac{315 \times 620}{8} = 4337.5$ <p>**answer given** so award for method</p> $S_{xx} = 15225 - \frac{315^2}{8} = 2821.875$ $b = \frac{4377.5}{S_{xx}} = 1.537... = 1.5$ $a = \bar{y} - b\bar{x} = \frac{620}{8} - b\frac{315}{8} = 16.97... = 17.0$ <p>Use overlay</p> <p>Brand D, since a long way above / from the line Using line: $y = 17 + 35 \times 1.5 = 69.5$</p> <p style="text-align: right;">dependent upon 'Brand D' above</p>	<p>B2 (2)</p> <p>M1</p> <p>M1A1 (3)</p> <p>M1,A1</p> <p>M1,A1</p> <p>B1 B1 (2) B1</p> <p>B1 M1A1 (4)</p> <p>Total 15 marks</p>
<p>Notes:</p> <p>3(a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p> <p>(e)</p>	<p>Points B2, within 1 small square of correct point, subtract 1 mark each error minimum 0.</p> <p>Anything that rounds to 2820 for A1</p> <p>Anything that rounds to 1.5 and 17.0 (accept 17)</p> <p>Follow through for the intercept for first B1. Correct slope of straight line for second B1.</p> <p>Anything that rounds to 69p-71p for final A1. Reading from graph is acceptable for M1A1. If value read from graph at $x = 35$ is answer given but out of range, then award M1A0.</p>	

<p>4(a)</p> <p>(b)</p> <p>(c)</p>	$P(Q \cup T) = 0.6$ $P(Q) + P(T) - P(Q \cap T) = 0.6$ $P(Q \cap T) = 0.1$  $P(Q \cap T Q \cup T) = \frac{0.15}{0.60} = \frac{1}{4} \text{ or } 0.25 \text{ or } 25\%$	<p>B1 M1 A1 (3)</p> <p>M1 A1 B1 (3)</p> <p>M1A1 A1 (3)</p> <p>Total 9 marks</p>
<p>Notes:</p> <p>4(a)</p> <p>(b)</p> <p>(c)</p>	<p>B1 for 0.6 M1 for use of $P(Q) + P(T) - P(Q \cap T) = P(Q \cup T)$ 0.1 Correct answer only for A1 Alternative: (25+45+40=)110% B1 110-100=10% M1A1 0.1 stated clearly as the final answer with no working gets 3/3</p> <p>Two intersecting closed curves for M1, no box required. At least one label (<i>Q</i> or <i>T</i>) required for first A1. Follow through (0.25- 'their 0.1') and (0.45- 'their 0.1') for A1. 0.4 and box required, correct answer only for B1 Using %, whole numbers in Venn diagram without % sign, whole numbers in correct ratio all OK</p> <p>Require fraction with denominator 0.6 or their equivalent from Venn diagram for M1 Follow through their values in fraction for A1 Final A1 is correct answer only. <u>No working no marks.</u></p>	

<p>5(a)</p> <p>18-25 group, area=7x5=35 25-40 group, area=15x1=15</p> <p>(b)</p> <p>(25-20)x5+(40-25)x1=40</p> <p>(c)</p> <p>Mid points are 7.5, 12, 16, 21.5, 32.5</p> $\sum f = 100$ $\frac{\sum ft}{\sum f} = \frac{1891}{100} = 18.91$ <p>(d)</p> $\sigma_t = \sqrt{\frac{41033}{100} - \bar{t}^2}$ $\sigma_t = \sqrt{52.74\dots} = 7.26$ <p>(e)</p> <p>$Q_2 = 18$ or 18.1 if (n+1) used</p> <p>$Q_1 = 10 + \frac{15}{16} \times 4 = 13.75$ or 15.25 numerator gives 13.8125</p> <p>$Q_3 = 18 + \frac{25}{35} \times 7 = 23$ or 25.75 numerator gives 23.15</p> <p>(f)</p> <p>0.376...</p> <p>Positive skew</p>	<p>B1 B1 (2)</p> <p>M1A1 (2)</p> <p>M1 B1 M1A1 (4)</p> <p>M1 M1 A1 (3)</p> <p>B1 M1A1 A1 (4)</p> <p>B1 B1 (2)</p> <p>Total 17 marks</p>	
<p>Notes:</p> <p>5(b)</p> <p>(c)</p> <p>(d)</p> <p>(e)</p> <p>(f)</p>	<p>5x5 is enough evidence of method for M1. Condone 19.5, 20.5 instead of 20 etc. Award 2 if 40 seen.</p> <p>Look for working for this question in part (d) too. Use of some mid-points, at least 3 correct for M1. These may be tabulated in (d). Their $\frac{\sum ft}{\sum f}$ for M1 and anything that rounds to 18.9 for A1.</p> <p>Clear attempt at $\frac{41033}{100} - \bar{t}^2$ or $\frac{n}{n-1} \left(\frac{41033}{100} - \bar{t}^2 \right)$ alternative for first M1. They may use their \bar{t} and gain the method mark. Square root of above for second M1 Anything that rounds to 7.3 for A1.</p> <p>Clear attempt at either quartile for M1 These will take the form 'their lower limit' + correct fraction x 'their class width'. Anything that rounds to 13.8 for lower quartile. 23 or anything that rounds to 23.2 dependent upon method used.</p> <p>Anything that rounds to 0.38 for B1 or 0.33 for B1 if (n+1) used. Correct answer or correct statement that follows from their value for B1.</p>	

6(a)	$P(X > 25) = P\left(Z > \frac{25 - 20}{4}\right)$ $= P(Z > 1.25)$ $= 1 - 0.8944$ $= 0.1056$	<p>M1</p> <p>M1</p> <p>A1</p> <p>(3)</p>
(b)	$P(X < 20) = 0.5 \text{ so } P(X < d) = 0.5 + 0.4641 = 0.9641$ $P(Z < z) = 0.9641, z = 1.80$ $\frac{d - 20}{4} = 1.80$ $d = 27.2$	<p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>(4)</p> <p>Total 7 marks</p>
Notes:		
(a)	<p>Standardise with 20 and 4 for M1, allow numerator 20-25</p> <p>1- probability for second M1</p> <p>Anything that rounds to 0.106 for A1.</p> <p>Correct answer with no working award 3/3</p>	
(b)	<p>0.9641 seen or implied by 1.80 for B1</p> <p>1.80 seen for B1</p> <p>Standardise with 20 and 4 and equate to z value for M1</p> <p>Z=0.8315 is M0</p> <p>Anything that rounds to 27.2 for final A1.</p> <p>Correct answer with no working 4/4</p>	

<p>7(a)</p>	$p + q = 0.45$ $\sum xP(X = x) = 4.5$ $3p + 7q = 1.95$	<p>B1 M1 A1 (3)</p>
<p>(b)</p>	<p>Attempt to solve equations in (a)</p> $q = 0.15$ $p = 0.30$	<p>M1 A1 A1 (3)</p>
<p>(c)</p>	$P(4 < X < 7) = P(5) + P(7)$ $= 0.2 + q = 0.35$	<p>M1 A1 (2)</p>
<p>(d)</p>	$\text{Var}(X) = E(X^2) - [E(X)]^2 = 27.4 - 4.5^2$ $= 7.15$	<p>M1 A1 (2)</p>
<p>(e)</p>	$E(19 - 4X) = 19 - 4 \times 4.5 = 1$	<p>B1 (1)</p>
<p>(f)</p>	$\text{Var}(19 - 4X) = 16\text{Var}(X)$ $= 16 \times 7.15 = 114.4$	<p>M1 A1 (2)</p>
<p>Total 13 marks</p>		
<p>Notes:</p>	<p>7(a) $0.55 + p + q = 1$ award B1. Not seen award B0. $0.2 + 3p + 1 + 7q + 1.35 = 4.5$ or equivalent award M1A1 $3p + 7q + k = 4.5$ award M1.</p> <p>(b) Attempt to solve must involve 2 linear equations in 2 unknowns Correct answers only for accuracy. Correct answers with no working award 3/3</p> <p>(c) Follow through accuracy mark for their q, $0 < q < 0.8$</p> <p>(d) Attempt to substitute <u>given</u> values <u>only</u> into correct formula for M1. 7.15 only for A1 7.15 seen award 2/2</p> <p>(f) Accept 'invisible brackets' i.e. $-4^2 \text{Var}(X)$ provided answer positive. Anything that rounds to 114 for A1.</p>	