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Mark Scheme (Results)
Summer 2007

GCE

GCE Mathematics

Statistics S1 (6681)

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June 2007
6683 Statistics S1
Mark Scheme

Question Number	Scheme	Marks
1. (a)	$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{-808.917}{\sqrt{113573 \times 8.657}}$ $= -0.81579...$	**M1** **A1** **(2)**
(b)	Houses are <u>cheaper</u> further away from the station or equivalent statement **B1**	**(1)**
(c)	-0.816	**B1** **(1)**
		Total 4 marks

Notes:

1(a) 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

(b) 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.

(c) Accept anything that rounds to -0.82 or 'the same' or 'unchanged' or equivalent.
Award B1 if value quoted same as answer to (a).

Question Number	Scheme	Marks
2(a)	$\frac{1}{2}$	**B1** **(1)**
(b)	54	**B1** **(1)**
(c)	+ is an 'outlier' or 'extreme value' Any heavy musical instrument or a statement that the instrument is heavy **B1**	**B1** **(2)**
(d)	$Q_3 - Q_2 = Q_2 - Q_1$ so symmetrical or no skew Dependent – only award if B1 above	**B1** **B1** **(2)**
(e)	$P(W < 54) = 0.75$ (or $P(W > 54) = 0.25$)or correctly labelled and shaded diagram **M1** $\frac{54-45}{\sigma} = 0.67$ $\sigma = 13.43.....$	**M1B1** **A1** **(4)**
		Total 10 marks

Notes

2(a) Accept 50% or half or 0.5.
Units not required.

(b) Correct answer only.
Units not required.

(c) '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

(d) '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

(e) **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.

3(a)	Use overlay	**B2** **(2)**
(b)	$S_{xy} = 28750 - \frac{315 \times 620}{8} = 4337.5$ **answer given** so award for method	**M1**
	$S_{xx} = 15225 - \frac{315^2}{8} = 2821.875$	**M1A1** **(3)**
(c)	$b = \frac{4377.5}{S_{xx}}, = 1.537... = 1.5$	**M1,A1**
	$a = \overline{y} - b\overline{x} = \frac{620}{8} - b\frac{315}{8} = 16.97... = 17.0$	**M1,A1** **(4)**
(d)	Use overlay	**B1**∫ **B1** **(2)**
(e)	Brand D, since a long way above / from the line dependent upon 'Brand D' above Using line: $y = 17 + 35 \times 1.5 = 69.5$	**B1** **B1** **M1A1** **(4)** **Total 15 marks**

Notes:

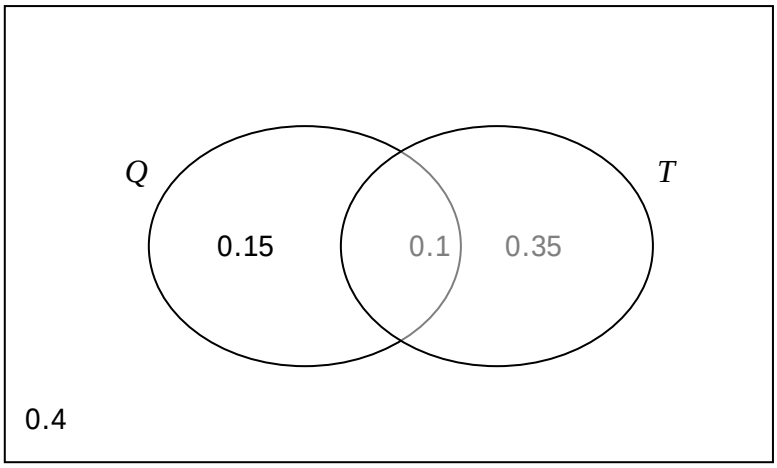
3(a) Points B2,within 1 small square of correct point, subtract 1 mark each error minimum 0.

(b) Anything that rounds to 2820 for A1

(c) Anything that rounds to 1.5 and 17.0 (accept 17)

(d) Follow through for the intercept for first B1..
Correct slope of straight line for second B1.

(e) 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.

4(a)	$P(Q \cup T) = 0.6$ $P(Q) + P(T) - P(Q \cap T) = 0.6$ $P(Q \cap T) = 0.1$	**B1** **M1** **A1** **(3)**
(b)	 Venn 0.15, 0.35 0.4 and box	**M1** **A1∫** **B1** **(3)**
(c)	$P(Q \cap T' \mid Q \cup T) = \frac{0.15}{0.60} = \frac{1}{4}$ or 0.25 or 25%	**M1A1∫A1** **(3)** **Total 9 marks**

Notes:

4(a)
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

(b)
Two intersecting closed curves for M1, no box required.
At least one label (*Q* or *T*) 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

(c)
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.
No working no marks.

5(a)	18-25 group, area=7x5=35 25-40 group, area=15x1=15	**B1** **B1** **(2)**
(b)	(25-20)x5+(40-25)x1=40	**M1A1** **(2)**
(c)	Mid points are 7.5, 12, 16, 21.5, 32.5 $\sum f = 100$ $\frac{\sum ft}{\sum f} = \frac{1891}{100} = 18.91$	**M1** **B1** **M1A1** **(4)**
(d)	$\sigma_t = \sqrt{\frac{41033}{100} - \bar{t}^2}$ $\sqrt{\frac{n}{n-1}\left(\frac{41033}{100} - \bar{t}^2\right)}$ alternative OK $\sigma_t = \sqrt{52.74...} = 7.26$	**M1** **M1** **A1** **(3)**
(e)	$Q_2 = 18$ or 18.1 if (n+1) used $Q_1 = 10 + \frac{15}{16} \times 4 = 13.75$ or 15.25 numerator gives 13.8125 $Q_3 = 18 + \frac{25}{35} \times 7 = 23$ or 25.75 numerator gives 23.15	**B1** **M1A1** **A1** **(4)**
(f)	0.376… Positive skew	**B1** **B1**$\surd$ **(2)**
		Total 17 marks

Notes:

5(b) 5x5 is enough evidence of method for M1.
Condone 19.5, 20.5 instead of 20 etc.
Award 2 if 40 seen.

(c) 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.

(d) 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.

(e) 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.

(f) 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.

6(a)	$P(X > 25) = P\left(Z > \frac{25-20}{4}\right)$	**M1**
	$= P(Z > 1.25)$	**M1**
	$= 1 - 0.8944$	
	$= 0.1056$	**A1**
		(3)
(b)	$P(X < 20) = 0.5$ so $P(X < d) = 0.5 + 0.4641 = 0.9641$	**B1**
	$P(Z < z) = 0.9641$, $z = 1.80$	**B1**
	$\frac{d-20}{4} = 1.80$	**M1**
	$d = 27.2$	**A1**
		(4)
		Total 7 marks

Notes:

(a)

Standardise with 20 and 4 for M1, allow numerator 20-25
1- probability for second M1
Anything that rounds to 0.106 for A1.
Correct answer with no working award 3/3

(b)

0.9641 seen or implied by 1.80 for B1
1.80 seen for B1
Standardise with 20 and 4 and equate to z value for M1
Z=0.8315 is M0
Anything that rounds to 27.2 for final A1.
Correct answer with no working 4/4

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7(a)	$p+q=0.45$.	**B1**
	$\sum xP(X=x)=4.5$	**M1**
	$3p+7q=1.95$	**A1**
		(3)
(b)	Attempt to solve equations in (a)	**M1**
	$q=0.15$	**A1**
	$p=0.30$	**A1**
		(3)
(c)	$P(4<X<7)=P(5)+P(7)$	**M1**
	$=0.2+q=0.35$	**A1**$\surd$
		(2)
(d)	$Var(X)=E(X^2)-[E(X)]^2=27.4-4.5^2$	**M1**
	$=7.15$	**A1**
		(2)
(e)	$E(19-4X)=19-4\times4.5=1$	**B1**
		(1)
(f)	$Var(19-4X)=16Var(X)$	**M1**
	$=16\times7.15=114.4$	**A1**
		(2)
		Total 13 marks

Notes:

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.

(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

(c)
Follow through accuracy mark for their q, $0<q<0.8$

(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

(f)
Accept 'invisible brackets' i.e. -4^2 Var (X) provided answer positive.
Anything that rounds to 114 for A1.