

Mark Scheme (Results)

June 2012

GCSE Statistics
Paper: 5ST1H/01

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June 2012

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NOTES ON MARKING PRINCIPLES

1 Mark Schemes

- These should be applied positively. Candidates should all receive the same treatment. They should be rewarded for what they have shown they can do rather than penalised for omissions.

2 Types of mark

- M marks: method marks
- A marks: accuracy marks Note: you cannot give an A mark if you have given M0
- B marks: unconditional accuracy marks (independent of M marks)

3 Abbreviations

- cao – correct answer only
- isw – ignore subsequent working
- oe – or equivalent (and appropriate)
- indep – independent
- QWC – quality of written communication
- ft – follow through
- SC: special case
- dep – dependent
- awrt – anything which rounds to
- () – brackets round words mean these are not essential

4 No working

- If no working is shown then correct answers normally score full marks
- If no working is shown then incorrect (even though nearly correct) answers score no marks.

5 With working

- If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.
- If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.
- If it is clear from the working that the “correct” answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.
- If there is no answer on the answer line then check the working for an obvious answer.
- Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader. If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

6 Follow through marks

- Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.
- Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

7 Ignoring subsequent work

- It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect cancelling of a fraction that would otherwise be correct
- It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.
- Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

8 Probability

- Probability answers must be given as fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths), unless it states otherwise on the mark scheme.
- Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.
- If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.
- If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

9 Linear equations

- Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

10 Parts of questions

- Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

11 Range of answers

- Unless otherwise stated, when an answer is given in a range (e.g. 3.5 – 4.2) then this is inclusive of the end points, and includes all the numbers in between.

12 Quality of Written Communication

- This is denoted by an asterisk near the question number/part (*). Mark schemes will indicate within the table how marks are to be allocated. In this subject we need to see that correct statistical terms are used.

Guidance on the use of codes within this mark scheme

M1 – method mark

A1 – accuracy mark

B1 – Working mark

C1 – communication mark

QWC – quality of written communication

oe – or equivalent

awrt – anything which rounds to

cao – correct answer only

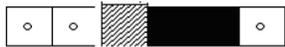
ft – follow through

sc – special case

dep – dependent (on a previous mark or conclusion)

indep – independent

isw – ignore subsequent working

5ST1H_01					
Question		Working	Answer	Mark	Notes
1	(a)(i)		Illness (not medical or dental appt.)	2	B1 Accept 'illness'.
	(ii)		Other unauthorised circumstances		B1 Accept 'other'.
	(b)		Excluded, no alternative provision	1	B1 Accept 'excluded'. May be seen in a sentence.
2	(a)			2	B2 if all 6 correct (B1 for 5 correct)
	(b)		<p>Top right of grid</p> <p>Squares are shaded darkest in this area. oe</p>	2	<p>B1 Accept equivalent descriptions, including reference to individual squares in this area. (...but not just a single square) e.g. "Square F1" is B0. "Around square F1" is B1 "along E" is B0. "Top of E" is B1 Accept North East.</p> <p>B1 Accept sensible equivalent wording. (Reference to <u>individual</u> numbers is B0) e.g. ... most black/solid squares is B1 ... most 16-24 squares is B1 BUT ... likely to be where a building stood is B0</p>

5ST1H_01				
Question	Working	Answer	Mark	Notes
3	(a)	ANY TWO FROM THREE: 1. Cheaper 2. Less time/quicker 3. Less data/easier (to handle)	2	B2 for two correct (B1 B0 for one correct) Accept equivalent statements. Accept two statements in one answer. Accept converses if clearly refer to 'census'. (One comment only from each type.) (Do not allow contradictory comments.)
	(b)	Electoral roll or electoral register OR A list of council tax payers/residents (register or database are equivalent to list)	1	B1 A suitable list of the population is required. (incomplete lists: e.g. telephone directory is B0; all council tax payers is B0)
	(c)	ANY TWO OF: <ul style="list-style-type: none"> • This is not a good sample. • This is biased. • Not all residents have an equal chance of being selected. • <u>Only</u> asks North Street residents. • Residents elsewhere cannot give opinions. • Residents in one street may have similar interests/views. • North Street may not be representative. • (Sample) too small 	2	B2 Two correct statements (B1 for one correct statement). Allow sensible equivalent wording suggesting bias, restricted opinions, or too small sample. Ignore excess reasons if not contradictory.
	(d)(i)	EITHER This is biased/leading. OR This is trying to persuade you to agree oe	2	B1
	(ii)	EITHER The boxes overlap/You do not know which box for £2 (or £1, or £0) OR It doesn't say how often (weekly/monthly etc) OR No option for not wanting one.		B1 Accept e.g. it should say £1 to £1.99 e.g. it should say how much per week/month etc

5ST1H_01					
Question		Working	Answer	Mark	Notes
4	(a)		26, 53, 80, 97, 100	1	B1
	(b)	Correct plotting of points and joining with curve or straight lines	Correct Horizontal Plots Correct Vertical Plots	3	B1 B1 ft (½ square tolerance for these two marks) SC If B0 B0 then five correct points is B1
			Join with straight lines or curve.		B1ft (Must be increasing) (Ignore any line to left of 20 - i.e. (16, 0) not needed)
	(c)	line from 50 on 'vertical' scale	29.5	2	M1 (implied by A1ft within tolerance) (Allow use of their $\Sigma f \div 2$) A1 ft (Accept value in range 29 up to but <u>less than</u> 30, OR ft value from a line/curve with positive gradient, ± 1 small square)
(d)		The age (at which women have their first child) has gone up/increased. OR Women (having their first child) in 2008 are older.	1	B1 ft from (c) (If no answer to (c), then B0) Accept equivalent clear comparison of 2008 and 1990. e.g. "is/was lower" is B0 but "is/was lower in 1990" is B1 (Ignore any figures. e.g. gone up by x years) Must be comparison, not just stating values.	

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Question	Working	Answer	Mark	Notes
5	(a)	8 9 1 4 8 3 4 5 7 7 9 0 1 3 5 5	2	B2 All correct (B1 One error or omission) (Note misplaced leaf is one error not two) NB: Ignore '6' in median position (the child added in part (d)) SC: Unordered (with all leaves) is B1
	(b)	16.6	1	B1
	(c)	$\frac{262.9}{16}$	2	M1 for Σx divided by 16 A1 awrt 16.4 (allow $16\frac{69}{160}$)
	(d)(i)	It will stay the same.	2	B1 Allow clear equivalent wording SC: "It will become 16.6" is B1 (BUT 16.6 alone is B0)
	(ii)	It will go up/increase (slightly) OR It will change to 16.44(1176...) OR It will stay the same <u>to 1 dp</u>		B1ft Correct interpretation from their (c) e.g. "still 16.4" is B0 but "still 16.4 to 1dp" is B1
	(e)	$\frac{5}{17}$	2	M1 for seeing 5 or $\frac{5}{n}$ A1 cao (allow 0.29 or 29% awrt) SC: $0.3125 (= \frac{5}{16})$ is B1

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Question	Working	Answer	Mark	Notes
6	(a)	‘Males are unemployed for longer/more months than females.’ (or converse) OR ‘males and females are unemployed for similar time’	1	B1 Any hypothesis which relates to length of unemployment of both males and females. (Reference to <u>numbers</u> rather than % may be acceptable <u>in this part only.</u>) (Do NOT accept questions.)
	(b)	Lines at 44 then 64 then 81 then 91 then 95, and correct shading. (Tolerance of ½ line vertically)	3	M1 for attempt at drawing a composite (i.e. stacked) chart, blocks in correct order. A2 for getting all correct OR A1 for getting lower 2 blocks correct (44,64) or all correct lines but with incorrect/no shading. SC: If M0, all correct lines within tolerance is B2 (ignore shading).
	(c)	CONCLUSION: My hypothesis is/is not correct. (May be a re-statement of hypothesis in (a) OR answering their ‘question’ from (a)) REASON: e.g. Higher % of females unemployed for shorter periods. e.g. 52% males and 64% females under 6 months unemployed. e.g. 14% males but only 5% females over 36 months unemployed. etc	2	B1ft Must fit correctly from part (a). Note: If hypothesis/question in (a) relates to <u>numbers</u> unemployed, then first B1 in (c) can only be awarded for “cannot say if correct, as we only have percentages”. B1ft Allow follow through from (b). A correct comment comparing a number of months of unemployment Candidates must NOT refer to <u>numbers of</u> males/females. This question is about %

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Question	Working		Answer	Mark	Notes																																												
7	(a)(i)		Qualitative	1	B1																																												
	(ii)		Quantitative	1	B1																																												
	(iii)		Quantitative	1	B1																																												
	(b)		Speed (of serve)	1	B1																																												
	(c)	<table border="1"> <thead> <tr> <th>rank</th> <th>d²</th> <th>rank'</th> <th>d²</th> </tr> </thead> <tbody> <tr><td>1</td><td>0</td><td>10</td><td>81</td></tr> <tr><td>7</td><td>25</td><td>4</td><td>4</td></tr> <tr><td>4</td><td>1</td><td>7</td><td>16</td></tr> <tr><td>5</td><td>1</td><td>6</td><td>4</td></tr> <tr><td>10</td><td>25</td><td>1</td><td>16</td></tr> <tr><td>9</td><td>9</td><td>2</td><td>16</td></tr> <tr><td>2</td><td>25</td><td>9</td><td>4</td></tr> <tr><td>3</td><td>25</td><td>8</td><td>0</td></tr> <tr><td>8</td><td>1</td><td>3</td><td>36</td></tr> <tr><td>6</td><td>16</td><td>5</td><td>25</td></tr> </tbody> </table> <p> $\Sigma d^2 = 128$ (Reverse: $\Sigma d^2 = 202$) $r_s = 1 - \frac{6 \times 128'}{10 \times 99}$ (Reverse: $1 - \frac{6 \times 202'}{10 \times 99}$) </p>	rank	d ²	rank'	d ²	1	0	10	81	7	25	4	4	4	1	7	16	5	1	6	4	10	25	1	16	9	9	2	16	2	25	9	4	3	25	8	0	8	1	3	36	6	16	5	25	<p>= ±0.22(4...)</p>	4	<p>B1 for ranks correct</p> <p>M1 for Σd^2 attempted for their ranks (must use <u>ranks</u>)</p> <p>M1(dep on 1st M1) for correct substitution into formula (including 1-...) with their Σd^2</p>
rank	d ²	rank'	d ²																																														
1	0	10	81																																														
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	(d)	<table border="1"> <tr> <td>Description:</td> <td>This is (weak) positive correlation (or negative if (c) is <0)</td> <td rowspan="2">OR</td> <td>This is no/little/weak correlation</td> </tr> <tr> <td>Interpretation:</td> <td>(There is slight evidence to say) the faster the serve the higher the position in world tennis (rank)</td> <td>There is no (clear evidence of a) relationship between serve and position in world tennis (rank).</td> </tr> </table>	Description:	This is (weak) positive correlation (or negative if (c) is <0)	OR	This is no/little/weak correlation	Interpretation:	(There is slight evidence to say) the faster the serve the higher the position in world tennis (rank)	There is no (clear evidence of a) relationship between serve and position in world tennis (rank).		2	<p>B1</p> <p>Description consistent with (c) (Only follow through if $r_s < 1$)</p> <p>B1 cao (Interpretation)</p> <p>Answer in context. Must not be inconsistent with description. Must not be inconsistent with their ranking. ($r_s < 1$) (If B0 for description it must be consistent with answer to (c))</p>																																					
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Question	Working	Answer	Mark	Notes																				
8	(a)	ANY TWO OF: 1. Time Consuming. 2. More expensive. 3. Lots of data to handle OR harder/more work than a sample. 4. Difficult to be sure the whole population is used.	2	B2 for two correct (B1 B0 for one correct) May give two reasons in one answer space. Do not allow same reason type twice. Do not accept contradictory statements.																				
	* (b)	<table border="1"> <thead> <tr> <th>Aspect</th> <th>Answer</th> <th>SC1</th> <th>SC2</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Name</td> <td>Use Stratified sampling</td> <td>Systematic sampling</td> </tr> <tr> <td>2</td> <td>Numbering</td> <td>Number students</td> <td>Number students</td> </tr> <tr> <td>3</td> <td>Randomness</td> <td>Select by random sampling</td> <td>With a random starting point (between 0-7 (or 1- 8) select every 8th student.)</td> </tr> <tr> <td>4</td> <td>Proportion</td> <td>Numbers in proportion with the year group size OR Same percentage from each year group OR 18 students from Y7 (or 18 of Y8, 19 of Y9, 12 of Y10 or Y11, 10 of Y12, or 11of Y13) (i.e. calculation for at least one year group)</td> <td></td> </tr> </tbody> </table>	Aspect	Answer	SC1	SC2	1	Name	Use Stratified sampling	Systematic sampling	2	Numbering	Number students	Number students	3	Randomness	Select by random sampling	With a random starting point (between 0-7 (or 1- 8) select every 8th student.)	4	Proportion	Numbers in proportion with the year group size OR Same percentage from each year group OR 18 students from Y7 (or 18 of Y8, 19 of Y9, 12 of Y10 or Y11, 10 of Y12, or 11of Y13) (i.e. calculation for at least one year group)		5	<p>B1 (aspect 1) Name</p> <p>B1 (aspect 2) Numbering</p> <p>B1 (aspect 3) Idea of randomness ('Words' in brackets not needed for this B1)</p> <p>B1 (aspect 4)</p> <p>Apply Special Cases SC1 & SC2 if not describing proportion/strata approach.</p> <p>B1 Work which uses the correct statistical 'wording' shown in bold (including that in brackets) <u>in any 3 aspects</u> for <u>their method</u>.</p>
Aspect	Answer	SC1	SC2																					
1	Name	Use Stratified sampling	Systematic sampling																					
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		Note: Significance of <u>wording in bold</u> is shown in 5 th B1 mark																						

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Question	Working	Answer	Mark	Notes
9	(a)	<p>Class Widths: (4), 5, 10, 10, 10, 20</p> <p>FD: (3), 3, 2, 1.8, 1.7, 1.1, 0.35</p>	3	<p>B1 correct widths</p> <p>B2 all fd correct (B1 if at least three fd values correct OR B1ft if ALL fd follow through from their widths)</p>
	(b)	Correct histogram	2	B2ft All correct from their frequency density (½ small square tolerance) (B1ft if only one incorrect block)
	(c)	<p>This can be seen by the Positive Skew of the diagram. OR Some sensible statement about the shape of the histogram or frequency densities.</p> <p>The probability of a young driver having an accident is greater. (OR converse with older driver) OR Premiums are related to risk.</p>	2	<p>B1 (Reason)</p> <p>Allow “higher bars (or higher fd) for younger drivers” OR “bars are decreasing”</p> <p>B1 (Contextual interpretation)</p> <p>Allow “younger drivers (or “they”) have more accidents”</p>

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Question	Working	Answer	Mark	Notes	
10	(a)(i)	$\frac{9.4 + 7.0 + 6.2 + 8.0}{4}$ $\frac{7.0 + 6.2 + 8.0 + 8.8}{4}$ $\frac{6.2 + 8.0 + 8.8 + 7.0}{4}$	7.65, 7.5, 7.5 (millions)	4	M1 for attempt to add 4 numbers from table and divide by 4 (Implied by one correct if no working) A2 for 3 correct (any order) (A1 for 2 correct seen)
	(ii)		Plot 3 points - Mid way 2008 Q4/Q1, 2009 Q1/Q2, 2009 Q2/Q3		B1ft for plotting all three correctly (ie ½ square tolerance)
	(b)		Trend line	1	B1 Appropriate trend line
	(c)		Downward / decreasing / falling OR e.g. there are fewer visitors as time goes on	1	B1 Condone 'negative (trend)' but 'negative correlation' alone is B0 Direct comparison of dates is B0
	(d)	$\pm \frac{1.1 + 1.5 + 1.5}{3} = \frac{4.1}{3}$	= 1.3...	2	M1 for adding 3 attempts at seasonal variation (consistent quarter) and dividing by 3 A1ft (positive only) (Accept 1.2 to 1.4, or ft from their line)
(e)	Finding value ('6.8') in range 6.5 to 7.0 OR finding value from their extended trend line at 2010/Q3 '6.8' + '1.3...'	= 8.1...	3	M1ft '6.8' (in range 6.5 to 7.0) OR for their trend line value M1d ft (Dep on 1 st M1) for their '6.8' + their (d) (Only if 1 < their (d) < 2) A1 Must see some working. (Accept answer in range 7.7 to 8.4)	

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Question	Working	Answer	Mark	Notes
11	(a)	4.2 hrs, $4\frac{1}{5}$ hrs, $4\frac{2}{10}$ hrs OR 4 hours 12 minutes	1	B1 (Allow 4h 12min, BUT 4.12 or 4.12min are B0)
	(b)	5 hours (5 hrs 0 min))	1	B1
	(c)(i)	X is an outlier (OR anomaly OR extreme/rogue value)	4	B1 Condone poor spelling but not 'outliner'
	(ii)	(IQR =) 6 - 5 1.5 × 1 = 1.5 hours 6 + 1.5 = 7.5 hrs Outlier if > 7.5 (or hours and minutes)	The IQR is 1 (hour). Upper Outliers start at 6 + 1.5 (hours) Values above 7.5 are outliers OR 8.9 (or X) > 7.5 hours OR X is more than 1.5 IQR (or 1.5 hrs) above upper quartile (or 6h)	M1 for IQR=1, OR 6-5(=1) M1 7 h 30 min or 7.5 (or 6 + 1.5) (Their Q3 + 1.5x their IQR) A1 dep on both M1 There must be reference to their '7.5' being an outlier boundary OR a clear comparison of X or 8.9 with 7.5
	(d)	Four <u>comparisons</u> from: <ul style="list-style-type: none"> • Males have greater Interquartile range (or IQR) • Males have a greater range • Males have a lower median • Males distribution is symmetrical (or no skew or no outlier) but Females distribution is positive skew (OR both are roughly symmetrical) • Contextual interpretation of one of the above 	4	B1 B1 B1 B1 Max one mark from each of the five options. Ignore excess statements if not contradictory. Allow equivalent converse statements about females. Comparison of individual values other than median is B0 The words in bold must be used in those comparisons. (Condone poor spelling but 'medium' is B0)

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Question	Working	Answer	Mark	Notes
12	(a)(i)	$\frac{280}{20}$ or $280 \div 20$ OR $14 \times 20 = 280$	3	B1
	(ii)	$\sqrt{\frac{4220}{20} - 14^2}$ $= \sqrt{15} = 3.87... = 3.9$		M1 for using correct formula for sd, including square root. NB: $\sqrt{\frac{4220}{280}} = 3.88 (= 3.9)$ Scores M0A0 A1 evaluated to 3.87 or better OR $\sqrt{15}$ leading to 3.9
	(b)	$\frac{12 - 14}{3.9}$ (= 0.516...) = - 0.5 awrt	3	M1 for sight or use of $\pm \left(\frac{x - \text{mean}}{\text{sd}} \right)$ M1 for $+\left(\frac{12 - 14}{3.9} \right)$ (with 3.9 or better for sd) A1 for awrt -0.5 only SC: No working with awrt +0.51 or +0.52 is B1
	(c)	Melvin did better in the figure skating. His standardised score is higher in figure skating. (OR converse)	2	Both these marks are dependent upon having an answer to (b). B1ft for correct conclusion for their value in (b) B1ft for correct comparison of values. Must follow for their (b) in range -4 to +4 (Less negative is B1 BUT Closer to zero/mean is B0)

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Question		Working	Answer	Mark	Notes
13	(a)		<p>COMPARISON: There are more (people living in the Lake District)</p> <p>REASON: The pie chart of the people living in the Lake District has the largest area. (accept 'is bigger')</p>	2	<p>For both marks: only allow converse if they mention 'Snowdonia'. B1 Any comment implying more people: e.g. 2.25x (or 2x) as many people</p> <p>B1 Any comment implying the chart is bigger: e.g. 2.25x as big (or 2x as big) e.g. bigger radius/diameter</p>
	(b)		40 - 59 (years)	1	B1
	(c)		<p>COMPARISON: There are more (40 -59 year olds living in the Lake District.)</p> <p>REASON: The area of the sector is greater (in the pie chart for the Lake District.)</p>	2	<p>For both marks: only allow converse if they mention 'Snowdonia'. B1</p> <p>B1 Need to see the word 'area', BUT Accept: It is the same proportion/angle of a larger population/pie chart IF 'area' is mentioned in (a)</p>

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Question		Working	Answer	Mark	Notes
14	(a)		30, 12 and 7 in correct place 10 and 6 in correct place 3 in correct place	3	B1 (30, 12, 7) B1 (10, 6) B1ft (3) Award final B1ft if their '10'+ '6'+ '3' is 19
	(b)	$\frac{32+30}{100}$	$\frac{62}{100} = \frac{31}{50}$ oe	1	B1ft (follow through their 30, but answer must be a probability)
	(c)	$\frac{12+32}{84}$	$\frac{44}{84} = \frac{11}{21}$ oe (0.52 or better)	2	M1 for $\frac{n}{84}$ (must have $0 < n < 84$) (This can be implied by correct answer, or by correct follow through answer) A1 ft (follow through their 12, even with no working)

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