KING EDWARD VI SCHOOL

SHAKESPEARE'S SCHOOL

Year 9 School Examination

Subject: Statistics

Mark Scheme

General marking guidance

These notes offer general guidance, but the specific notes for examiners appertaining to individual questions take precedence.

1 All candidates must receive the same treatment. Examiners must mark the last candidate in exactly the same way as they mark the first.

Where some judgement is required, mark schemes will provide the principles by which marks will be awarded; exemplification/indicative content will not be exhaustive. When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the response should be sent to review.

2 All the marks on the mark scheme are designed to be awarded; mark schemes should be applied positively. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme. If there is a wrong answer (or no 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.

Questions where working is not required: In general, the correct answer should be given full marks.
Questions that specifically require working: In general, candidates who do not show working on this type of question will get no marks – full details will be given in the mark scheme for each individual question.

3 Crossed out work
This should be marked **unless** the candidate has replaced it with an alternative response.

4 Choice of method
If there is a choice of methods shown, mark the method that leads to the answer given on the answer line.

If no answer appears on the answer line then mark both methods **as far as they are identical** and award these marks.

5 Incorrect method
If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.

6 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working as you can check the answer, 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 or its context. (eg an incorrectly cancelled fraction when the unsimplified fraction would gain full marks).

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect (eg incorrect algebraic simplification).

8 Probability

Probability answers must be given as a fraction, percentage or decimal. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

9 Range of answers

Unless otherwise stated, when an answer is given as a range (eg 3.5 – 4.2) then this is inclusive of the end points (eg 3.5, 4.2) and all numbers within the range.

Guidance on the use of abbreviations within this mark scheme	
M	method mark awarded for a correct method or partial method
A	accuracy mark (awarded after a correct method; if no method or process is seen then full marks for the question are implied but see individual mark schemes for more details)
B	unconditional accuracy mark (no method needed)
oe	or equivalent
cao	correct answer only
ft	follow through (when appropriate as per mark scheme)
sc	special case
dep	dependent (on a previous mark)
indep	independent
awrt	answer which rounds to
isw	ignore subsequent working

Question	Answer	Additional guidance	Mark
1	B1 Qu 1 is leading/biased B1 Qu 2 does not contain a time frame B1 Qu 3 is a sensitive question (people may not want to say why they were in hospital) OR there are lots of missing options so lots of people will tick other	B3 for a complete assessment that the questions are not appropriate and the reason why for each question (B2 for an incomplete response with 2 out of 3 bullet points correct B1 for an incomplete response with 1 out of 3 bullet points correct)	**(3)**

Question	Answer		Additional guidance	Mark
2				
	B1	Correct comparison of average eg Wilbur Farm has larger litters on average, OR Wilbur mode (10) > Napoleon mode (8)	1st B1 for a correct comparison of average. Must see a word implying average. (eg 'Wilbur Farm has larger litters' alone is B0)	**(2)**
	B1	Correct comparison of dispersion eg Napoleon Farm has a greater spread of litter size, OR Napoleon range (6) > Wilbur range (4)	2nd B1 for a correct comparison of dispersion. May refer to spread/range/variation. For each mark, listing alone (eg mode/range) without comparison scores B0	

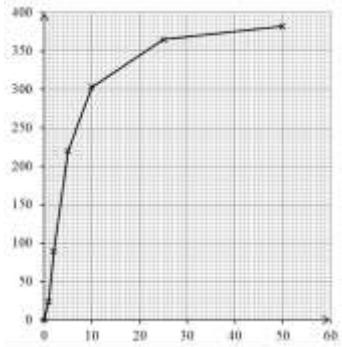
Question		Answer		Additional guidance	Mark
3	**(a)**	B1	Each (student) has the same chance of selection, oe	B1 for a correct equivalent explanation of randomness	**(1)**
	(b)	B1	All the students at her school	B1 for an answer indicating **all** the students, BUT an answer indicating population size (850) alone scores B0	**(1)**
	(c)	B1	One number (940) is out of range (so cannot be used)	1st B1 for a statement recognising that only numbers on the sampling frame can be used	**(2)**
		B1	One number (310) is repeated (so needs replacing)	2nd B1 for recognising the repeated number has to be rejected.	
	(d)	B2	Terri's method is not appropriate as the large population would make it impracticable	B2 for a complete answer rejecting Terri's idea with an appropriate reason. eg it would take too long. OR B1 for an incomplete answer, eg correct reasoning without a conclusion, OR correct conclusion with an attempt at reasoning.	**(2)**

Question	Answer	Additional guidance	Mark
4 **(a)**	M1 $\frac{890}{781} \times 100$ A1 114	M1 for correct calculation for index number A1 for an answer in the range 113.9 to 114.0	**(2)**
(b)	B1 ft eg both prices have increased OR male price has gone up by a greater percentage B1 ft eg male price has gone up by 14%	B1 ft for a statement implying that both prices have increased B1 ft for giving correct percentage for at least one index number Note: male prices have gone up by 1% more than female prices scores B2	**(2)**

Question	Answer	Additional guidance	Mark
5 **(a)**	B1 for 0.7, 0.4 and 0.8 in correct positions		**(1)**
(b)	M1 0.3×0.6 or "0.7" × "0.8" M1 0.3×0.6 + "0.7" × "0.8" A1 ft 0.74	1st M1 for a correct product of (their) probabilities 2nd M1 for complete method using their probabilities Allow ft provided probabilities are between 0 and 1	**(3)**

Question		Answer		Additional guidance	Mark
6	**(a)**	B1	eg 'allows two data sets to be compared easily'	B1 for a suitable reason	**(1)**
	(b)	B1 B1 B1	$a = 53$ $b = 43$ $c = 62$	B1 for each correct value found	**(3)**
	(c)	B1	eg '$\frac{1}{2}$ as sample median is likely to be the same as the population median since it is a random sample'	B1 for $\frac{1}{2}$ and correct supporting reason (accept $\frac{12}{25}$ from the stem and leaf diagram)	**(1)**

Question	Answer	Additional guidance	Mark
7 (a)(i)	M1 $\frac{23430 + 22880 + 27430 + 25710}{4}$ A1 24862.5	M1 for summing the correct four quarters and dividing by 4 A1 for 24900, 24860, 24863 or 24862.5	(2)
(ii)	B1 ft for correctly plotting their point at height '24862.5' between Q2 and Q3 2016		(1)
(b)	B1 for reference to the truncated vertical axis OR reference to the graph only showing houses sold over £40 000	B1 for a correct comment assessing why the graph is misleading	(1)
(c)	B1 for quarter 3		(1)
(d)	B1 Upwards oe B1 The number of houses sold is increasing as time goes by	B1 for a correct description of the trend. Accept positive but positive correlation is B0 B1 for a contextualised interpretation	(2)
(e)	B1 for correctly identifying a problem with extrapolation eg • the trend may not continue	B1 for a correct comment on the problems of extrapolation	(1)

Question		Answer	Additional guidance	Mark
8	**(a)**	B1 89, 220, 303, 365, 382	B1 for all correct cumulative frequencies	**(1)**
	(b)	B1 for correct horizontal plots B1 ft for correct vertical plots B1 ft for correct cumulative frequency graph allow with straight lines or curve  	B1 for correct horizontal plots B1 ft for correct vertical plots ($\frac{1}{2}$ square tolerance for plots) **SC** if B0 B0 then six correct points out of seven is B1 B1 ft for correct cumulative frequency graph allow with straight lines or curve must be increasing curve for the ft	**(3)**

Question	Answer	Additional guidance	Mark
9 (a)	M1 for box with two whiskers AND at least two values plotted correctly A1 for all correct		**(2)**
(b)	B1 for eg • median reaction time for 30-39 year olds is greater than for 20-29 year olds • median reaction times increase as age increases B1 for eg • IQR for 40-49 year olds greater than IQR for 20-29 year olds • 30-39 year olds have the greatest IQR • range for 30-39 year olds greater than range for 20-29 year olds • range of reaction times increases as age increases B1 for eg • 20-29 year olds positively skewed, 30-39 year olds negatively skewed B1 for eg reaction times increase as you get older (on average) OR reaction times for the 20-29 year olds most consistent	B1 for a correct statistical statement comparing the medians B1 for a correct comparison of the IQRs or ranges B1 for a correct comparison of the skews Allow positive or negative skew for 40-49 year olds box plot B1 for a correct contextual interpretation comparing medians or IQR/ranges/skews	**(3)**

<table>
<tr><th>Question</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>10 (a)</td><td>
<table>
<tr><th>Country</th><th>GDP rank</th><th>d</th><th>Σd^2</th></tr>
<tr><td>Norway</td><td>2</td><td>–1</td><td>1</td></tr>
<tr><td>Denmark</td><td>4</td><td>–2</td><td>4</td></tr>
<tr><td>Iceland</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td>Switzerland</td><td>1</td><td>3</td><td>9</td></tr>
<tr><td>Finland</td><td>6</td><td>–1</td><td>1</td></tr>
<tr><td>Netherlands</td><td>5</td><td>1</td><td>1</td></tr>
<tr><td>Canada</td><td>7</td><td>0</td><td>0</td></tr>
<tr><td>New Zealand</td><td>8</td><td>0</td><td>0</td></tr>
</table>
B1 GDP rank 2, 4, 3, 1, 6, 5, 7, 8

M1 differences –1, –2, 0, 3, –1, 1, 0, 0

M1 $1-\frac{6\times'16'}{8\times(8^2-1)}$

A1 0.81
</td><td>B1 for GDP rank correct (allow reversed ranks 7, 5, 6, 8, 3, 4, 2, 1)

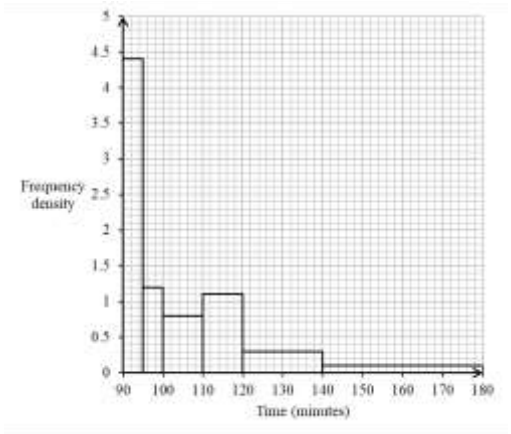
M1 for difference in ranks (condone one slip and allow ±). Can be implied by $\sum d^2 = 16$ (or $\sum d^2 = 152$ for reversed ranks)

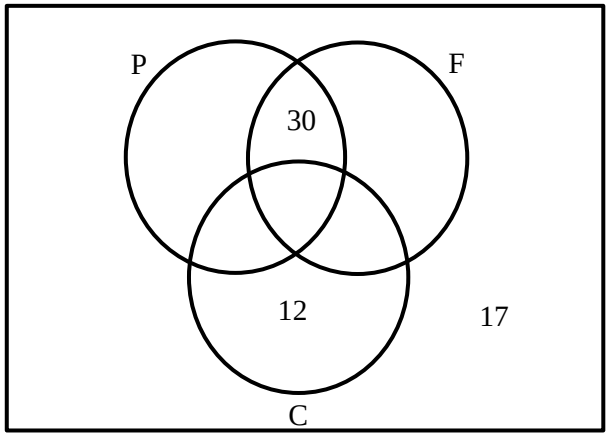
M1 for demonstrating correct use of Spearman's formula

A1 for awrt 0.81 (allow awrt – 0.81 for reversed ranks)</td><td>(4)</td></tr>
<tr><td>(b)</td><td>B1 Positive correlation
B1 The wealthier the country the happier the country (for the sampled people)</td><td>B1 for correct description of correlation
B1 for correct interpretation of the correlation</td><td>(2)</td></tr>
<tr><td>(c)</td><td>B1 The result is outside the range $-1 \leq r \leq 1$</td><td>B1 for correct interpretation of the correlation coefficient, allow the result is bigger than 1</td><td>(1)</td></tr>
</table>

Question	Answer	Additional guidance	Mark
11 **(a)**	M1 for $\frac{100}{n} = \frac{12}{60}$ oe A1 for 500		**(2)**
(b)	B2 for reliable/not reliable with a correct supporting reason eg reliable and samples are a good size/reliable and time interval between samples is not too long/not reliable and may catch greater proportion of injured or ill turtles so not random OR if B2 not earned B1 for reliable/not reliable with an attempt at a reason OR for identifying a factor which would impact reliability without a conclusion	B2 for a correct comment assessing the reliability of the conclusion OR if B2 not earned B1 for an incomplete attempt to assess the reliability of the conclusion	**(2)**

Question	Answer	Additional guidance	Mark
12 (a)	B2 for reference to (most) areas with high numbers of bees corresponding to areas with high concentrations of wild flowers AND reference to the area at the bottom right (A4-A6, B4-B6) having a high concentration of bees, but a low concentration of wild flowers OR if B2 not earned... B1 for reference to (most) areas with high numbers of bees corresponding to areas with high concentrations of wild flowers OR reference to the area at the bottom left (A4-A6, B4-B6) having a high concentration of bees, but a low concentration of wild flowers	B2 for a complete answer assessing the conclusion based on the diagram OR if B2 not earned... B1 for an incomplete answer assessing the conclusion based on the diagram	**(2)**

Question	Answer	Additional guidance	Mark
13 (a)	B2 Histogram with unequal class widths is best choice since data is continuous and unequal class widths will reduce the number of rectangles where frequency densities are low.	B2 for a decision of histogram with both supporting reasons (B1 for decision of histogram with just one supporting reason)	**(2)**
(b)	M1 freq density = freq ⁄ cw 22 ÷ 5 etc. A1 fd 4.4, 1.2, 0.8, 1.1, 0.3, 0.1 A2 	M1 for attempt at a calculation of freq density = freq ⁄ cw implied by any correct fd or bar height 4.4, 1.2, 0.8, 1.1, 0.3, 0.1 (allow multiples of these) A1 all correct fd may be implied by graph A2 for correct histogram – tolerance $\frac{1}{2}$ square (A1 for at least 3 bars correct width and height)	**(4)**

Question	Answer	Additional guidance	Mark
14 (a)	B1 3 people played the piano and played the clarinet but did not play the flute	B1 for correct interpretation of the region 3 is in	**(1)**
(b)	B2  	B2 for all three correct values (B1 for one correct)	**(2)**
(c)	M1 3 + 7 + 9 + '30' or 49 A1 ft $\frac{7}{49}$ oe	M1 for addition of regions containing people that play at least two instruments A1 ft their Venn diagram	**(2)**