

Monday 23 January 2012 – Morning

AS GCE MATHEMATICS (MEI)

4766 Statistics 1

QUESTION PAPER



Candidates answer on the Printed Answer Book.

OCR supplied materials:

- Printed Answer Book 4766
- MEI Examination Formulae and Tables (MF2)

Other materials required:

- Scientific or graphical calculator

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found in the centre of the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.

- The number of marks is given in brackets [] at the end of each question or part question on the Question Paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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Section A (36 marks)

- 1 The mean daily maximum temperatures at a research station over a 12-month period, measured to the nearest degree Celsius, are given below.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
8	15	25	29	31	31	34	36	34	26	15	8

- (i) Construct a sorted stem and leaf diagram to represent these data, taking stem values of 0, 10, [4]
- (ii) Write down the median of these data. [1]
- (iii) The mean of these data is 24.3. Would the mean or the median be a better measure of central tendency of the data? Briefly explain your answer. [2]
- 2 The hourly wages, £x, of a random sample of 60 employees working for a company are summarised as follows.
- $$n = 60 \quad \sum x = 759.00 \quad \sum x^2 = 11\,736.59$$
- (i) Calculate the mean and standard deviation of x. [3]
- (ii) The workers are offered a wage increase of 2%. Use your answers to part (i) to deduce the new mean and standard deviation of the hourly wages after this increase. [2]
- (iii) As an alternative the workers are offered a wage increase of 25p per hour. Write down the new mean and standard deviation of the hourly wages after this 25p increase. [2]

- 3 Jimmy and Alan are playing a tennis match against each other. The winner of the match is the first player to win three sets. Jimmy won the first set and Alan won the second set. For each of the remaining sets, the probability that Jimmy wins a set is
- 0.7 if he won the previous set,
 - 0.4 if Alan won the previous set.

It is not possible to draw a set.

- (i) Draw a probability tree diagram to illustrate the possible outcomes for each of the remaining sets. [3]
- (ii) Find the probability that Alan wins the match. [3]
- (iii) Find the probability that the match ends after exactly four sets have been played. [2]



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- 4 In a food survey, a large number of people are asked whether they like tomato soup, mushroom soup, both or neither. One of these people is selected at random.
- T is the event that this person likes tomato soup.
 - M is the event that this person likes mushroom soup.

You are given that $P(T) = 0.55$, $P(M) = 0.33$ and $P(T | M) = 0.80$.

- (i) Use this information to show that the events T and M are not independent. [1]
- (ii) Find $P(T \cap M)$. [2]
- (iii) Draw a Venn diagram showing the events T and M , and fill in the probability corresponding to each of the four regions of your diagram. [3]

- 5 A couple plan to have at least one child of each sex, after which they will have no more children. However, if they have four children of one sex, they will have no more children. You should assume that each child is equally likely to be of either sex, and that the sexes of the children are independent. The random variable X represents the total number of girls the couple have.

- (i) Show that $P(X = 1) = \frac{11}{16}$. [3]

The table shows the probability distribution of X .

r	0	1	2	3	4
$P(X = r)$	$\frac{1}{16}$	$\frac{11}{16}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$

- (ii) Find $E(X)$ and $\text{Var}(X)$. [5]

Section B (36 marks)

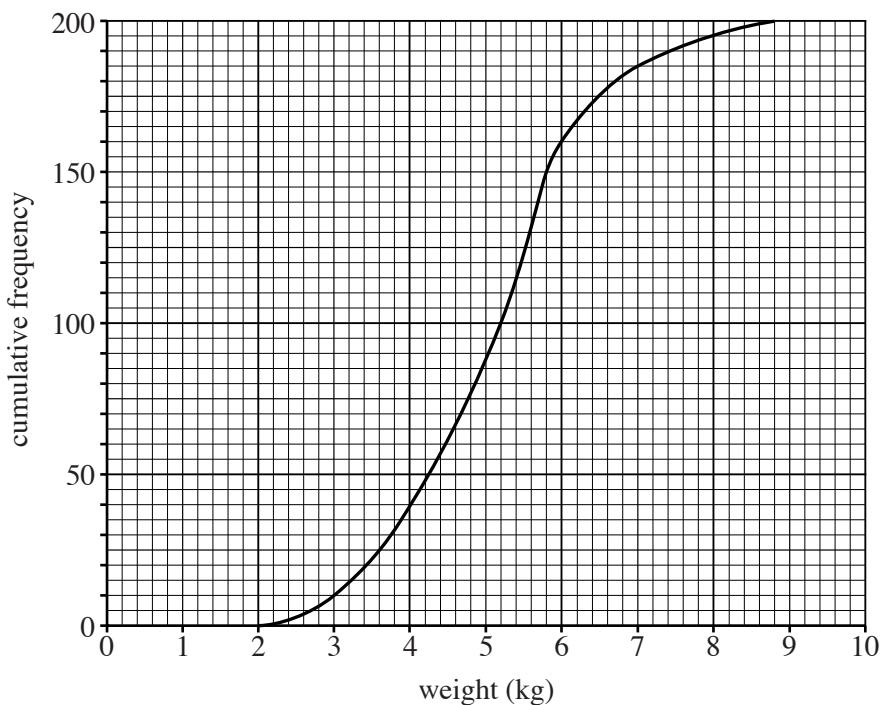
- 6 It is known that 25% of students in a particular city are smokers. A random sample of 20 of the students is selected.

- (i) (A) Find the probability that there are exactly 4 smokers in the sample. [3]
 (B) Find the probability that there are at least 3 but no more than 6 smokers in the sample. [3]
 (C) Write down the expected number of smokers in the sample. [1]

A new health education programme is introduced. This programme aims to reduce the percentage of students in this city who are smokers. After the programme has been running for a year, it is decided to carry out a hypothesis test to assess the effectiveness of the programme. A random sample of 20 students is selected.

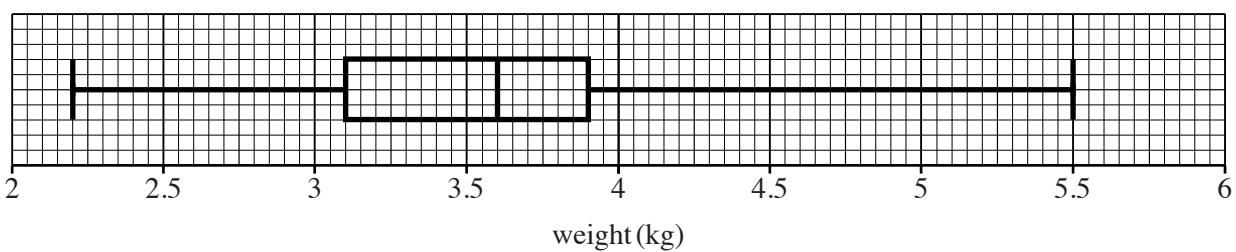
- (ii) (A) Write down suitable null and alternative hypotheses for the test. [3]
 (B) Explain why the alternative hypothesis has the form that it does. [1]
 (iii) Find the critical region for the test at the 5% level, showing all of your calculations. [4]
 (iv) In fact there are 3 smokers in the sample. Complete the test, stating your conclusion clearly. [2]

- 7 The birth weights of 200 lambs from crossbred sheep are illustrated by the cumulative frequency diagram below.



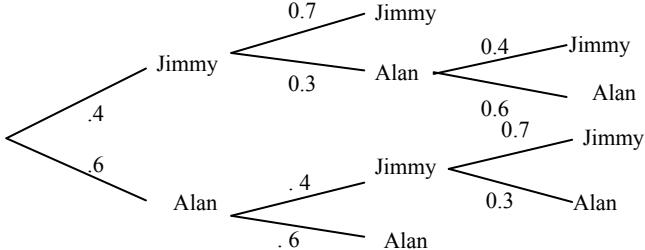
- (i) Estimate the percentage of lambs with birth weight over 6 kg. [2]
- (ii) Estimate the median and interquartile range of the data. [3]
- (iii) Use your answers to part (ii) to show that there are very few, if any, outliers. Comment briefly on whether any outliers should be disregarded in analysing these data. [4]

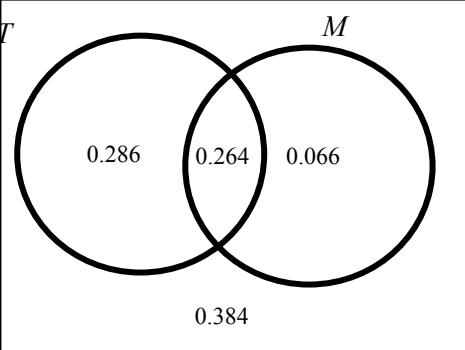
The box and whisker plot shows the birth weights of 100 lambs from Welsh Mountain sheep.



- (iv) Use appropriate measures to compare briefly the central tendencies and variations of the weights of the two types of lamb. [4]
- (v) The weight of the largest Welsh Mountain lamb was originally recorded as 6.5 kg, but then corrected. If this error had not been corrected, how would this have affected your answers to part (iv)? Briefly explain your answer. [2]
- (vi) One lamb of each type is selected at random. Estimate the probability that the birth weight of both lambs is at least 3.9 kg. [4]

Question		Answer	Marks	Guidance	Additional Guidance																								
1	(i)	<table style="margin-left: auto; margin-right: auto;"> <tr> <td style="border-right: 1px solid black; padding-right: 10px;">0</td><td style="padding-right: 10px;">8</td><td style="padding-right: 10px;">8</td><td></td></tr> <tr> <td style="border-right: 1px solid black; padding-right: 10px;">10</td><td style="padding-right: 10px;">5</td><td style="padding-right: 10px;">5</td><td></td></tr> <tr> <td style="border-right: 1px solid black; padding-right: 10px;">20</td><td style="padding-right: 10px;">5</td><td style="padding-right: 10px;">6</td><td style="padding-right: 10px;">9</td></tr> <tr> <td style="border-right: 1px solid black; padding-right: 10px;">30</td><td style="padding-right: 10px;">1</td><td style="padding-right: 10px;">1</td><td style="padding-right: 10px;">4</td></tr> <tr> <td></td><td style="border-right: 1px solid black; padding-right: 10px;"></td><td style="border-right: 1px solid black; padding-right: 10px;"></td><td style="border-right: 1px solid black; padding-right: 10px;">4</td></tr> <tr> <td></td><td style="border-right: 1px solid black; padding-right: 10px;"></td><td style="border-right: 1px solid black; padding-right: 10px;"></td><td style="border-right: 1px solid black; padding-right: 10px;">6</td></tr> </table> <p>Key 20 9 represents 29 degrees Celsius</p>	0	8	8		10	5	5		20	5	6	9	30	1	1	4				4				6	G1 G1 G1 G1 G1 [4]	Stem (in either order) Leaves Sorted and aligned (use paper test if unsure) Key	Do not allow leaves 25 ,26, 29 etc Ignore commas between leaves (indep). Condone 1 error or omission Allow errors in leaves if sorted Condone missing units (Celsius) Allow stem 0, 1, 2, 3
0	8	8																											
10	5	5																											
20	5	6	9																										
30	1	1	4																										
			4																										
			6																										
	(ii)	Median = 27.5	B1 [1]		CAO																								
1	(iii)	The median since the mean is affected by the skewness of the distribution	B1 E1 [2]	For median Allow E2 for mean if supported by very convincing reason EG takes all values into account and no extreme values	Do not allow ‘less affected by extremes or outliers’ unless also mention (positive or negative) skewness. Condone ‘bottom half more spread’ or similar																								
2	(i)	Mean = $\frac{759.00}{60} = £12.65$ $S_{xx} = 11736.59 - \frac{759^2}{60} = 2135.24$ $s = \sqrt{\frac{2135.24}{59}} = £6.02$	B1 M1 A1 [3]	Ignore units For S_{xx} CAO ignore units Allow more accurate answers	CAO Do not allow 759/60 as final answer but allow $12\frac{13}{20}$ M1 for $11736.59 - 60 \times$ their mean ² BUT NOTE M0 if their $S_{xx} < 0$ For s^2 of 36.2 (or better) allow M1A0 with or without working For RMSD of 5.97 or 5.96 (or better) allow M1A0 provided working seen For RMSD ² of 35.6 (or better) allow M1A0 provided working seen																								
2	(ii)	New mean = $12.65 \times 1.02 = £12.90$ New sd = $6.02 \times 1.02 = £6.14$	B1 B1 [2]	FT their mean Awrt 12.90 Allow 12.9 FT their sd	If candidate ‘starts again’ only award marks for CAO Deduct at most 1 mark overall in whole question for overspecification of Mean and 1mark overall for SD																								

Question		Answer	Marks	Guidance	Additional Guidance
2	(iii)	New mean = $12.65 + 0.25 = £12.90$ New sd = £6.02	B1 B1 [2]	FT their mean Awrt 12.90 FT their sd (unless negative) Awrt 6.02	If candidate ‘starts again’ only award marks for CAO Allow sd unchanged (or similar)
3	(i)		G1 G1 G1 [3]	Do a vertical scan and give: First column Second column Final column	All indep All probs must be correct Without extra branches in final column Ignore anything before third set Allow labels ‘win’ and ‘lose’ in place of Jimmy and Alan respectively but if no labels, no marks
3	(ii)	$P(\text{Alan wins})$ $= (0.4 \times 0.3 \times 0.6) + (0.6 \times 0.4 \times 0.3) + (0.6 \times 0.6) = 0.504$	M1 M1 A1 [3]	For any one ‘correct’ product For all three ‘correct’ products and no extras CAO	FT their tree for both M marks Provided correct number of terms in product(s) for both M1’s
3	(iii)	$P(\text{Ends after 4}) = (0.4 \times 0.7) + (0.6 \times 0.6) = 0.28 + 0.36 = 0.64$	M1 A1 [2]	For both products CAO	FT their tree for M mark but not for A mark Provided two terms in each product
4	(i)	Because $P(T M) \neq P(T)$	E1 [1]	Or $0.8 \neq 0.55$	Or $P(T \cap M) (= 0.264) \neq P(T) \times P(M)$, provided 0.264 in (ii) Or $0.264 \neq 0.55 \times 0.33 (= 0.1815)$ Look out for complement methods, etc
4	(ii)	$P(T \cap M) = P(T M) \times P(M) = 0.80 \times 0.33 = 0.264$	M1 A1 [2]	For product CAO	A0 for 0.26

Question		Answer	Marks	Guidance	Additional Guidance
4	(iii)		[3]	G1 For two labelled intersecting circles G1 For at least 2 correct probabilities. FT their $P(T \cap M)$ G1 For remaining probabilities. FT their $P(T \cap M)$, providing probabilities between 0 and 1	Allow labels such as P(T) etc Allow other shapes in place of circles No need for 'box' FT from 0.1815 in (ii) gives 0.3685, 0.1815, 0.1485, 0.3015
5	(i)	$\begin{aligned} P(X=1) &= P(g,b) + P(b,g) + P(b,b,g) + P(b,b,b,g) \\ &= \frac{1}{4} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} = \frac{11}{16} \end{aligned}$ <p>OR</p> $\begin{aligned} P(X=1) &= 1 - P(X \neq 1) = 1 - (Pbbbb) + P(ggb) + P(ggb) + P(gggg)) \\ &= 1 - \left(\frac{1}{16} + \frac{1}{8} + \frac{1}{16} + \frac{1}{16} \right) = \frac{11}{16} \end{aligned}$	[3]	M1 For any two correct fractions M1 For all four correct fractions A1 <i>NB Answer given</i>	Must have correct ref to numbers of boys and girls, not just fractions With no extras Accept 0.6875, not 0.688. Watch for use of B(4, 0.5) $P(X \leq 2) = 0.6875$ which gets M0M0A0.

Question		Answer	Marks	Guidance	Additional Guidance	
5	(ii)	$\begin{aligned} E(X) &= (0 \times \frac{1}{16}) + (1 \times \frac{11}{16}) + (2 \times \frac{1}{8}) + (3 \times \frac{1}{16}) + (4 \times \frac{1}{16}) \\ &= 1\frac{3}{8} = 1.375 \end{aligned}$ $\begin{aligned} E(X^2) &= (0 \times \frac{1}{16}) + (1 \times \frac{11}{16}) + (4 \times \frac{1}{8}) + (9 \times \frac{1}{16}) + (16 \times \frac{1}{16}) \\ &= 2\frac{3}{4} = 2.75 \end{aligned}$ $\text{Var}(X) = 2\frac{3}{4} - \left(1\frac{3}{8}\right)^2 = \frac{55}{64} = 0.859$	M1 A1 M1 M1 A1 [5]	For $\sum rp$ (at least 3 terms correct) A1 CAO Allow 1.38, not 1.4 For $\sum r^2 p$ (at least 3 terms correct) M1 dep for – their $E(X)^2$ A1 FT their $E(X)$ provided $\text{Var}(X) > 0$ 0.86, not 0.9	Allow 22/16 Use of $E(X-\mu)^2$ gets M1 for attempt at $(x-\mu)^2$ should see $(-1.375)^2, (-0.375)^2, (0.625)^2, 1.625^2, 2.625^2$ (if $E(X)$ correct but FT their $E(X)$) (all 5 correct for M1), then M1 for $\sum p(x-\mu)^2$ (at least 3 terms correct) Division by 5 or other spurious value at end gives max M1A1M1M1A0, or M1A0M1M1A0 if $E(X)$ also divided by 5. Unsupported correct answers get 5 marks. Using 1.38 gets Var of 0.8456 gets A1	
6	(i)	(A)	$X \sim B(20, 0.25)$ $P(4 \text{ smokers}) = \binom{20}{4} \times 0.25^4 \times 0.75^{16} = 0.1897$ OR Or from tables = $0.4148 - 0.2252 = 0.1896$	M1 M1 A1 M2 A1 [3]	For $0.25^4 \times 0.75^{16}$ For $\binom{20}{4} \times p^4 \times q^{16}$ CAO For $0.4148 - 0.2252$ CAO	With $p + q = 1$ Also for 4845×0.00003915 Allow 0.19 or better See tables at the website http://www.mei.org.uk/files/pdf/formula_book_mf2.pdf 0.189 gets A0
6	(i)	(B)	$P(3 \leq X \leq 6) = 0.7858 - 0.0913 = 0.6945$	M1 M1 A1 [3]	For $(P(X \leq 6) =) 0.7858$ seen For their $0.7858 - 0.0913$ CAO	Or $P(X=3) + P(X=4) + P(X=5) + P(X=6) = 0.1339 + 0.1897 + 0.2023 + 0.1686 = 0.6945$. M1 for three correct terms (to 2sf). Accept 0.69 or better $P(X \geq 3) - P(X > 6) = 0.9087 - 0.2142 = 0.6945$ Gets M1 M1 A1

Question		Answer	Marks	Guidance	Additional Guidance
6	(i) (C)	$E(X) = np = 20 \times 0.25 = 5$	B1 [1]	CAO	
6	(ii) (A)	<p>Let p = probability that a randomly selected student is a smoker</p> <p>$H_0: p = 0.25$</p> <p>$H_1: p < 0.25$</p>	B1 B1 B1 [3]	<p>For definition of p in context</p> <p>For H_0</p> <p>For H_1</p> <p>Allow complementary probabilities. Mark as per scheme. ie $H_0:p = 0.75$ etc</p>	<p>Minimum needed for B1 is p = probability that student is a smoker.</p> <p>Allow $p = P(\text{student smokes})$ for B1</p> <p>Definition of p must include word probability (or chance or proportion or percentage or likelihood but NOT possibility).</p> <p>Preferably as a separate comment. However can be at end of H_0 as long as it is a clear definition ‘p = the probability that student is a smoker.,NOT just a sentence ‘probability is 0.25’</p> <p>$H_0: p(\text{student is a smoker}) = 0.25$, $H_1: p(\text{student is a smoker}) < 0.25$ gets B0B1B1</p> <p>Allow $p=25\%$, allow θ or π and ρ but not x. However allow any single symbol if defined</p> <p>Allow $H_0 = p=0.25$,</p> <p>Do not allow $H_0: P(X=x) = 0.25$, $H_1: P(X=x) < 0.25$</p> <p>Do not allow $H_0: =0.25$, $=25\%$, $P(0.25)$, $p(0.25)$, $p(x)=0.25$, $x=0.25$ (unless x correctly defined as a probability)</p> <p>Do not allow $H_1: p \leq 0.25$,</p> <p>Do not allow H_0 and H_1 reversed for B marks but can still get E1 below</p> <p>Allow NH and AH in place of H_0 and H_1</p> <p>For hypotheses given in words allow Maximum B0B1B1 and E1 below.</p> <p>Hypotheses in words must include probability (or chance or proportion or percentage) and the figure 0.25 oe.</p>

Question		Answer	Marks	Guidance	Additional Guidance
6	(ii)	H_1 has this form as the programme aims to reduce the proportion of smokers.		E1 [1] Allow 'number' Allow 'aims for a reduction' or similar	E0 if H_1 upper tail or two tailed
6	(iii)	$P(X \leq 1) = 0.0243 < 5\%$ $P(X \leq 2) = 0.0913 > 5\%$ So critical region is {0,1}		B1 B1 M1 A1 [4] For $P(X \leq 1) = 0.0243$ For $P(X \leq 2) = 0.0913$ For at least one comparison with 5% CAO for critical region dep on M1 and at least one B1	With full correct notation. Penalise once for eg $P(X=1)$, $P(X=2)$ Allow any form of statement of CR eg $X \leq 1, X < 2$, annotated number line, etc but not $P(X \leq 1)$ NB USE OF POINT PROBABILITIES gets B0B0M0A0 If no working but correct CR, no marks See additional notes below the scheme for other possibilities
6	(iv)	3 does not lie in the critical region, so not significant, So there is not enough evidence to reject the null hypothesis and we conclude that there is not enough evidence to suggest that the percentage of smokers has decreased.		E1dep E1dep [2] For 3 not in CR or for not significant or reject H_1 For conclusion in context Condone omission of 'not enough evidence' in this case	Dep on correct CR, (correctly obtained) E0E0 for $P(X=3)$ not in CR E0E0 if wrong working after 3 not in CR Alternative scheme $P(X \leq 3) = 0.2252 > 5\%$ so not sig etc. gets E2 for complete method but E0 otherwise.
7	(i)	Percentage = $\frac{40}{200} \times 100 = 20$		M1 A1 [2] For 40 seen or implied CAO	
7	(ii)	Median = 5.2 kg Q1 = 4.2 Q3 = 5.8 Inter-quartile range = $5.8 - 4.2 = 1.6$		B1 B1 B1 [3] For Q1 or Q3 For IQR	Allow 4.2 to 4.3 for Q1 Dep on both quartiles correct

Question		Answer	Marks	Guidance	Additional Guidance
7	(iii)	<p>Lower limit $4.2 - (1.5 \times 1.6) = 1.8$ Upper limit $5.8 + (1.5 \times 1.6) = 8.2$ So there are one or more outliers (if any lamb weighs more than 8.2 kg)</p> <p>Should not be disregarded because: 'Nothing to suggest they are not genuine items of data' Allow other convincing reasons such as very few so will not make much difference</p>	B1 B1 E1 E1 [4]	For 1.8 ft For 8.2 ft Dep on their 1.8 and 8.2 Allow any number of outliers ≤ 5 Indep Must give reason.	Any use of <u>median</u> ± 1.5 IQR scores B0 B0 E0 E0 if say some outliers at bottom end, unless lower limit > 2.0 If FT leads to limits above 9.0 <u>and</u> below 2.0 then E0 No marks for ± 2 or 3 IQR With 4.3 and 5.8 lower = 2.05 and upper = 8.05 In this part FT their values from (ii) if sensibly obtained but not from location ie 12.5, 37.5 No marks for use of mean $\pm 2s$
7	(iv)	Median for Welsh Mountain = 3.6 IQR for Welsh Mountain = 0.8 Welsh Mountain lambs have lower average weight than crossbred Welsh Mountain lambs also have lower variation in weight than crossbred	B1 B1 E1 indep E1 indep [4]	Must imply average or CT, not just median. Allow generally lighter Must imply spread or variation, not just IQR or range Allow correct comment on consistency	FT their medians FT their IQRs Can get max B1B0E1E1 for use of range
7	(v)	Median unchanged IQR unchanged OR range or spread increased	E1 E1 [2]	even if used IQR in (iv)	E2 for 'Both comparisons remain the same' E1 for 'the range remains smaller'

Question		Answer	Marks	Guidance	Additional Guidance
7	(vi)	$P(\text{Crossbred} > 3.9) = \frac{165}{200}$ $P(\text{Welsh Mountain} > 3.9) = \frac{1}{4}$ $P(\text{Both} > 3.9) = \frac{165}{200} \times \frac{1}{4} = \frac{165}{800} = \frac{33}{160} = 0.206$	B1 B1 M1 A1 [4]	For product of their probabilities , provided one is correct CAO	Allow 162 to 165 out of 200 Allow answers in range 0.2025 to 0.20625 with correct working

NOTE RE OVER-SPECIFICATION OF ANSWERS

If answers are grossly over-specified , deduct the final answer mark in every case. Probabilities should also be rounded to a sensible degree of accuracy. In general final non probability answers should not be given to more than 4 significant figures. Allow probabilities given to 5 sig fig.

Additional notes re Q6 parts iii, iv:

Smallest critical region method for part (iii):

Smallest critical region that 1 could fall into has size 0.0243 gets B1,

Smallest critical region that 2 could fall has size 0.0913 gets B1, This is $> 5\%$ or above $< 5\%$ gets M1, A1 as per scheme

Use of k method with no probabilities quoted:

$P(X \leq k) > 5\%$ and $P(X \leq k - 1) < 5\%$ followed by $k = 2$ gets SC1

so CR is $\{0, 1\}$ gets another SC1 dep on first SC1

Use of k method with one probability quoted:

Mark as per scheme – max B0B1M1A1

Two tailed test with $H_1: p \neq 0.25$

Gets SC2 for fully correct FT with working as follows $P(X \leq 1) = 0.0243 < 0.025$ and $P(X \geq 10) = 0.0139 > 0.025$ B1 CR is $\{0, 1, 10, 11, \dots, 20\}$

(iv) Final 2 marks Max M1A1.

Two tailed test done but with correct $H_1: p < 0.25$

- (ii) gets max B1B1B1E1
- (iii) if compare with 5% ignore work on upper tail and mark lower tail as per scheme but if include upper tail in CR then A0
if compare with 2.5% no marks B0B0M0A0
- (iv) Final 2 marks can get M1A1 if correct CR, or SC2 if they start again, provided that they compare with 5%, not 2.5%.

Lower or upper tailed test with $H_1: p > 0.25$ and 6(ii)B wrong way around

- (ii) gets max B1B1B0E0
- (iii) no marks B0B0M0A0
- (iv) Final 2 marks get M0A0

Lower tailed test with $H_1: p > 0.25$ and 6(ii)B right way around

- (ii) gets max B1B1B0E0 , note E0, not E1
- (iii) and (iv) Mark as per scheme, so full marks possible

Line diagram method for (iii)

No marks unless some 0.0243 shown on diagram, then B1 for squiggly line between 1and 2 or on 1, B1_{dep} for arrow pointing to left, M1 0.0243 seen on diagram from squiggly line or from 1, A1 for CR written down in words/symbols. . **If 0.0243 and 0.0913 both seen and no other marks earned give B1.**

- (iv) M1A1 as per scheme

Bar chart method for (iii)

No marks unless 0.0243 shown on diagram, then B1 for line clearly on boundary between 1 and 2 or within 1 block, B1_{dep} for arrow pointing to left, M1 0.0243 seen on diagram from boundary line or from 1, A1 for CR written down in words/ symbols. **If 0.0243 and 0.0913 both seen and no other marks earned give B1.**

- (iv) M1A1 as per scheme.