OCR
Oxford Cambridge and RSA

Wednesday 24 May 2017 – Morning

AS GCE MATHEMATICS (MEI)

4766/01 Statistics 1

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4766/01
- 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 inside 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**. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- 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 barcodes.
- 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

- Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.

Section A (36 marks)

1 The numbers of units of electricity, x kWh (kilowatt-hours), used by 50 customers of an energy firm in a period of one month are summarised as follows.

$$\Sigma x = 17\,100 \qquad \Sigma x^2 = 6\,115\,108$$

(i) Calculate the mean and standard deviation of x. **[3]**

(ii) The cost, £y, of the electricity used by each customer is given by the formula $y = 0.108x + 7.2$. Use your answers to part **(i)** to deduce the mean and standard deviation of the costs of the electricity used by these customers. **[3]**

2 Tom is carrying out a survey into the way in which students travel to school. He selects 50 students and asks each of them 'How did you get to school this morning?' The results are given in the table below.

Walk	Cycle	Bus	Car
17	9	13	11

Tom then randomly selects 4 of these students to interview in more detail.

(i) Find the number of ways in which Tom can select the 4 students. **[2]**

(ii) Find the probability that all 4 of these students walked to school. **[2]**

(iii) Find the probability that at least 2 of the 4 students used the same method to get to school. **[4]**

3 Two fair four-sided dice, with faces numbered 1 to 4, are thrown. The random variable X denotes the difference between the scores on the two dice.

(i) Show that $P(X = 1) = \frac{3}{8}$. **[2]**

The table shows the complete probability distribution of X.

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

(ii) Find $E(X)$ and $Var(X)$. **[5]**

4 Every day Axel takes the train to work. The probability that he gets a seat on his journey to work is 0.4. The probability that he gets a seat on his journey back home from work is 0.8, independently of whether he gets a seat on his journey to work.

(i) Find the probability that Axel gets a seat on his journey home, but not on his journey to work. **[2]**

(ii) Find the probability that he gets a seat on at least one of the journeys on a day. **[3]**

(iii) Given that he gets a seat on at least one of the journeys on a day, find the probability that he gets a seat on both journeys. **[3]**

5 Sakura and Emily are playing a table tennis match. The winner of the match is the first player to win three games. The probability that Sakura wins a game is 0.55, independently of all other games. Games cannot be drawn.

(i) Find the probability that Sakura wins the match in three games. **[2]**

(ii) Find the probability that Emily wins the match. **[5]**

Section B (36 marks)

6 The table below shows the maximum daily level of the pollutant nitrogen dioxide in Marylebone Road in London in 2015. The levels are measured in micrograms per cubic metre ($\mu g/m^3$). There were 7 days where no figures were available.

Pollutant level (x $\mu g/m^3$)	$40 \leqslant x < 80$	$80 \leqslant x < 120$	$120 \leqslant x < 140$	$140 \leqslant x < 180$	$180 \leqslant x < 220$	$220 \leqslant x \leqslant 300$
Frequency	29	74	52	129	64	10

(i) Draw a cumulative frequency diagram to illustrate the data. **[5]**

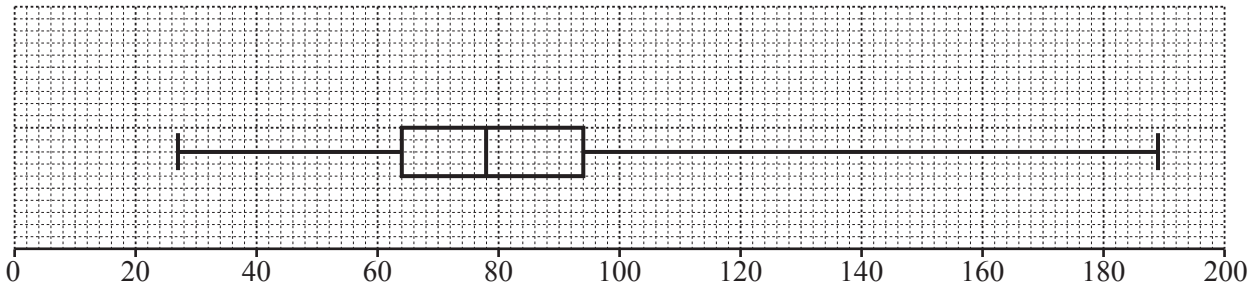
(ii) Levels of nitrogen dioxide below 200 are classified as low. Estimate the proportion of days on which the level was low. **[2]**

(iii) Use your diagram to estimate the median and interquartile range of the data. **[3]**

(iv) For each end of the distribution, explain whether outliers definitely exist, may possibly exist or definitely do not exist. **[4]**

(v) Draw a box and whisker plot to illustrate the data. **[3]**

The box and whisker plot below shows similar data for a roadside location in Tower Hamlets in London.



(vi) Compare the skewness of the data from the two locations. **[2]**

7 A type of shampoo is known to relieve the symptoms of 75% of dogs who suffer from a particular minor allergy.

(i) 12 dogs who suffer from this allergy are selected at random. Find the probability that the number of these dogs who have their symptoms relieved is

(*A*) exactly 9, **[3]**

(*B*) at least 9. **[2]**

A new type of shampoo has been developed to treat the allergy. A hypothesis test is to be carried out to determine whether it relieves the symptoms of a higher proportion of dogs who suffer from the allergy.

(ii) Write down suitable null and alternative hypotheses for the test. Give a reason for your choice of alternative hypothesis. **[4]**

A random sample of n dogs who suffer from the allergy is selected.

(iii) (*A*) Given that $n = 18$ and the symptoms of 16 dogs are relieved, carry out the test at the 10% significance level. **[4]**

(*B*) Given instead that $n = 50$ and the symptoms of 42 dogs are relieved, carry out the test at the 10% significance level. You may use the information that, for $X \sim \mathrm{B}(50, 0.75)$,

$\mathrm{P}(X = 41) = 0.0721$, $\mathrm{P}(X = 42) = 0.0463$, $\mathrm{P}(X \leqslant 41) = 0.9084$, $\mathrm{P}(X \leqslant 42) = 0.9547$. **[4]**

END OF QUESTION PAPER

OCR
Oxford Cambridge and RSA

Wednesday 24 May 2017 – Morning

AS GCE MATHEMATICS (MEI)

4766/01 Statistics 1

PRINTED ANSWER BOOK

Candidates answer on this Printed Answer Book.

OCR supplied materials:
- Question Paper 4766/01 (inserted)
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

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

- The Question Paper will be found inside 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**. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- 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 barcodes.
- 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.

Section A (36 marks)

1 (i)	
1 (ii)	

2 (i)	
2 (ii)	
2 (iii)	

3 (i)	
3 (ii)	

4 (i)	
4 (ii)	
4 (iii)	

5 (i)

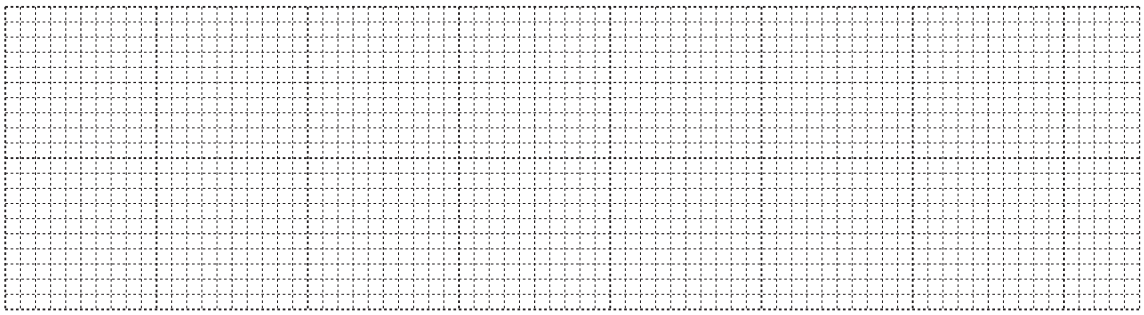
5 (ii)

Section B (36 marks)

6 (i)

6 (ii)	
6 (iii)	
6 (iv)	

6 (v)



6 (vi)

7 (i) (*A*)

7 (i) (*B*)

7 (ii)

7 (iii) (*A*)

7 (iii) (*B*)

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

OCR
Oxford Cambridge and RSA

GCE

Mathematics (MEI)

Unit **4766**: Statistics 1

Advanced Subsidiary GCE

Mark Scheme for June 2017

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations and abbreviations

Annotation in RM Assessor	**Meaning**
✓and ✗	
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working
M0, M1	Method mark awarded 0, 1
A0, A1	Accuracy mark awarded 0, 1
B0, B1	Independent mark awarded 0, 1
SC	Special case
^	Omission sign
MR	Misread
Highlighting	
Other abbreviations in mark scheme	**Meaning**
E1	Mark for explaining Use B1 in RM assessor
U1	Mark for correct units
G1	Mark for a correct feature on a graph Use B1 in RM assessor
M1 dep*	Method mark dependent on a previous mark, indicated by *
cao	Correct answer only
oe	Or equivalent
rot	Rounded or truncated
soi	Seen or implied
www	Without wrong working

Subject-specific Marking Instructions for GCE Mathematics (MEI) Statistics strand

a Annotations should be used whenever appropriate during your marking.

The A, M and B annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks. It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.

For subsequent marking you must make it clear how you have arrived at the mark you have awarded.

b An element of professional judgement is required in the marking of any written paper. Remember that the mark scheme is designed to assist in marking incorrect solutions. Correct *solutions* leading to correct answers are awarded full marks but work must not be judged on the answer alone, and answers that are given in the question, especially, must be validly obtained; key steps in the working must always be looked at and anything unfamiliar must be investigated thoroughly.

Correct but unfamiliar or unexpected methods are often signalled by a correct result following an *apparently* incorrect method. Such work must be carefully assessed. When a candidate adopts a method which does not correspond to the mark scheme, award marks according to the spirit of the basic scheme; if you are in any doubt whatsoever (especially if several marks or candidates are involved) you should contact your Team Leader.

c The following types of marks are available.

M
A suitable method has been selected and *applied* in a manner which shows that the method is essentially understood. Method marks are not usually lost for numerical errors, algebraic slips or errors in units. However, it is not usually sufficient for a candidate just to indicate an intention of using some method or just to quote a formula; the formula or idea must be applied to the specific problem in hand, eg by substituting the relevant quantities into the formula. In some cases the nature of the errors allowed for the award of an M mark may be specified.

A
Accuracy mark, awarded for a correct answer or intermediate step correctly obtained. Accuracy marks cannot be given unless the associated Method mark is earned (or implied). Therefore M0 A1 cannot ever be awarded.

B
Mark for a correct result or statement independent of Method marks.

E

A given result is to be established or a result has to be explained. This usually requires more working or explanation than the establishment of an unknown result.

Unless otherwise indicated, marks once gained cannot subsequently be lost, eg wrong working following a correct form of answer is ignored. Sometimes this is reinforced in the mark scheme by the abbreviation isw. However, this would not apply to a case where a candidate passes through the correct answer as part of a wrong argument.

d When a part of a question has two or more 'method' steps, the M marks are in principle independent unless the scheme specifically says otherwise; and similarly where there are several B marks allocated. (The notation 'dep *' is used to indicate that a particular mark is dependent on an earlier, asterisked, mark in the scheme.) Of course, in practice it may happen that when a candidate has once gone wrong in a part of a question, the work from there on is worthless so that no more marks can sensibly be given. On the other hand, when two or more steps are successfully run together by the candidate, the earlier marks are implied and full credit must be given.

e The abbreviation ft implies that the A or B mark indicated is allowed for work correctly following on from previously incorrect results. Otherwise, A and B marks are given for correct work only — differences in notation are of course permitted. A (accuracy) marks are not given for answers obtained from incorrect working. When A or B marks are awarded for work at an intermediate stage of a solution, there may be various alternatives that are equally acceptable. In such cases, exactly what is acceptable will be detailed in the mark scheme rationale. If this is not the case please consult your Team Leader.

Sometimes the answer to one part of a question is used in a later part of the same question. In this case, A marks will often be 'follow through'. In such cases you must ensure that you refer back to the answer of the previous part question even if this is not shown within the image zone. You may find it easier to mark follow through questions candidate-by-candidate rather than question-by-question.

f Wrong or missing units in an answer should not lead to the loss of a mark unless the scheme specifically indicates otherwise.

Candidates are expected to give numerical answers to an appropriate degree of accuracy. 3 significant figures may often be the norm for this, but this always needs to be considered in the context of the problem in hand. For example, in quoting probabilities from Normal tables, we generally expect *some* evidence of interpolation and so quotation to 4 decimal places will often be appropriate. But even this does not always apply – quotations of the standard critical points for significance tests such as 1.96, 1.645, 2.576 (maybe even 2.58 – but not 2.57) will commonly suffice, especially if the calculated value of a test statistic is nowhere near any of these values. Sensible discretion *must* be exercised in such cases.

Discretion must also be exercised in the case of small variations in the degree of accuracy to which an answer is given. For example, if 3 significant figures are expected (either because of an explicit instruction or because the general context of a problem demands it) but only 2 are given, loss of an accuracy ("A") mark is likely to be appropriate; but if 4 significant figures

are given, this should not normally be penalised. Likewise, answers which are slightly deviant from what is expected in a very minor manner (for example a Normal probability given, after an attempt at interpolation, as 0.6418 whereas 0.6417 was expected) should not be penalised. However, answers which are *grossly* over- or under-specified should normally result in the loss of a mark. This includes cases such as, for example, insistence that the value of a test statistic is (say) 2.128888446667 merely because that is the value that happened to come off the candidate's calculator. Note that this applies to answers that are given as final stages of calculations; intermediate working should usually be carried out, and quoted, to a greater degree of accuracy to avoid the danger of premature approximation.

The situation regarding any particular cases where the accuracy of the answer may be a marking issue should be detailed in the mark scheme rationale. If in doubt, contact your Team Leader.

g Rules for replaced work

If a candidate attempts a question more than once, and indicates which attempt he/she wishes to be marked, then examiners should do as the candidate requests.

If there are two or more attempts at a question which have not been crossed out, examiners should mark what appears to be the last (complete) attempt and ignore the others.

NB Follow these maths-specific instructions rather than those in the assessor handbook.

h Genuine misreading (of numbers or symbols, occasionally even of text) occurs. If this results in the object and/or difficulty of the question being considerably changed, it is likely that all the marks for that question, or section of the question, will be lost. However, misreads are often such that the object and/or difficulty remain substantially unaltered; these cases are considered below.

The simple rule is that *all* method ("M") marks [and of course all independent ("B") marks] remain accessible but at least some accuracy ("A") marks do not. It is difficult to legislate in an overall sense beyond this global statement because misreads, even when the object and/or difficulty remains unchanged, can vary greatly in their effects. For example, a misread of 1.02 as 10.2 (perhaps as a quoted value of a sample mean) may well be catastrophic; whereas a misread of 1.6748 as 1.6746 may have so slight an effect as to be almost unnoticeable in the candidate's work.

A misread should normally attract *some* penalty, though this would often be only 1 mark and should rarely if ever be more than 2. Commonly in sections of questions where there is a numerical answer either at the end of the section or to be obtained and commented on (eg the value of a test statistic), this answer will have an "A" mark that may actually be designated as "cao" [correct answer only]. This should be interpreted *strictly* – if the misread has led to failure to obtain this value, then this "A" mark must be withheld even if all method marks have been earned. It will also often be the case that such a mark is implicitly "cao"

even if not explicitly designated as such.

On the other hand, we commonly allow "fresh starts" within a question or part of question. For example, a follow-through of the candidate's value of a test statistic is generally allowed (and often explicitly stated as such within the marking scheme), so that the candidate may exhibit knowledge of how to compare it with a critical value and draw conclusions. Such "fresh starts" are not affected by any earlier misreads.

A misread may be of a symbol rather than a number – for example, an algebraic symbol in a mathematical expression. Such misreads are more likely to bring about a considerable change in the object and/or difficulty of the question; but, if they do not, they should be treated as far as possible in the same way as numerical misreads, *mutatis mutandis*. This also applied to misreads of text, which are fairly rare but can cause major problems in fair marking.

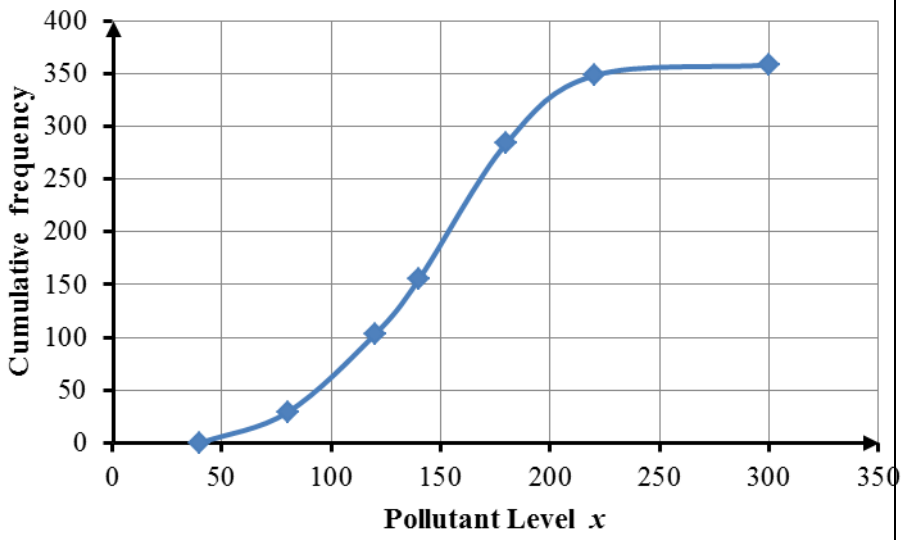
The situation regarding any particular cases that arise while you are marking for which you feel you need detailed guidance should be discussed with your Team Leader.

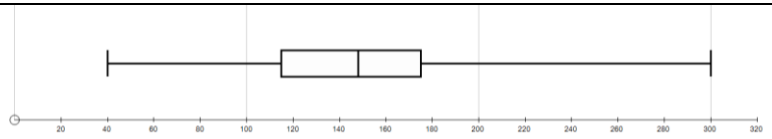
Note that a miscopy of the candidate's own working is not a misread but an accuracy error.

Question			Answer	Marks	Guidance
1	(i)		Mean $= \frac{17100}{50} = 342$ Sxx $= 6115108 - \frac{17100^2}{50} = 266908$ s $= \sqrt{\frac{266908}{49}} = \sqrt{5447.10} = 73.8$ (73.8044…)	B1 M1 A1 **[3]**	Ignore units CAO For Sxx M1 for 6115108 - 50 × their mean^2 BUT NOTE M0 if their $S_{xx} < 0$ CAO ignore units M1A0 for RMSD = 73.1 (73.062…)
1	(ii)		New mean = (0.108 × 342) + 7.2 = £44.14 New sd = 0.108 × 73.8 = £7.97 Using RMSD gives £7.89 Using variance gives 588.29	B1 M1 A1 **[3]**	FT their mean Allow £44.1 or better provided answer is positive FT their sd (unless negative)for M1 and A1 NB If candidate 'starts again' only award marks for CAO Do not penalise lack of units in mean or sd Deduct at most 1 mark overall in whole question for over-specification of either mean or SD or both
2	(i)		$\binom{50}{4} = \frac{50!}{4!46!} = 230300$	M1 A1 **[2]**	
2	(ii)		$\frac{17}{50} \times \frac{16}{49} \times \frac{15}{48} \times \frac{14}{47} = \frac{17}{1645} = 0.0103$ Or: $\binom{17}{4} \div \binom{50}{4} = \frac{2380}{230300} = 0.0103$	M1 A1 **[2]** M1 A1	17/50 × or 0.34× <u>NB</u> $\left(\frac{17}{50}\right)^4$ or 0.34^4 scores M1A0 But M0 if part of a binomial expression CAO Uncancelled fraction gets M1A0 Uncancelled fraction gets M1A0 Allow 0.010 with working but not 0.01

Question			Answer	Marks	Guidance
2	(iii)		$1-4!\times\frac{17}{50}\times\frac{9}{49}\times\frac{13}{48}\times\frac{11}{47}$ $=1-24\times0.0003958..$ = 1 – 0.09500217 = 0.905 (0.904997…) Or: $1-\left[\binom{17}{1}\times\binom{9}{1}\times\binom{13}{1}\times\binom{11}{1}\div\binom{50}{4}\right]$ = 1 – 0.09500 = 0.905	M1 M1 M1 A1 **[4]** M1 M1 M1 A1	For correct product For ×4! For 1 – with product of four fractions but with or without a coefficient CAO If denominators all 50 then max M0M1M1A0 Allow 0.90 with working For product of four correct nCr terms For division of product of four nCr terms by 50C4 For 1 - product of four nCr terms divided by 50C4
3	(i)		Possibilities are (1,2), (2,3), (3,4), (2,1), (3,2), (4,3) So 6 out of 16 or $^3/_8$ **NB ANSWER GIVEN**	M1 A1 **[2]**	Or M1 for table showing scores on both dice and differences SC1 for stating 3 different ways of getting diff of 1 and 2 ways round for each and 16 possibilities altogether so $^3/_8$ or similar
3	(ii)		$E(X) = \left(0\times\frac{1}{4}\right)+\left(1\times\frac{3}{8}\right)+\left(2\times\frac{1}{4}\right)+\left(3\times\frac{1}{8}\right)=\frac{10}{8}=\frac{5}{4}=1.25$ $E(X^2) = \left(0\times\frac{1}{4}\right)+\left(1\times\frac{3}{8}\right)+\left(4\times\frac{1}{4}\right)+\left(9\times\frac{1}{8}\right) = \frac{10}{4}=2.5$ Var(X) = $2.5-1.25^2$ = 0.9375 or $\frac{10}{4}-\left(\frac{5}{4}\right)^2=\frac{15}{16}$ = 0.9375 Allow 0.938. Condone 0.94	M1 A1 M1* M1* dep A1 **[5]**	For Σrp (at least 3 terms correct) CAO For Σr^2p (at least 3 terms correct) for – their $(E(X))^2$ FT their E(X) provided Var(X) > 0 Use of $E(X-\mu)^2$ gets M1 for attempt at $(x-\mu)^2$ should see $(-1.25)^2$, $(-0.25)^2$, $(0.75)^2$, $(1.75)^2$ (if E(X) wrong FT their E(X)) (all 4 correct for M1), then M1 for $\Sigma p(x-\mu)^2$ (at least 3 terms correct) Division by 4 or other spurious value at end and/or rooting final answer gives max M1A1M1M1A0, or

Question			Answer	Marks	Guidance
					M1A0M1M1A0 if E(X) also divided by 4. Unsupported correct answers get 5 marks (Probably from calculator)
4	(i)		Probability = $(1 - 0.4) \times 0.8 = 0.48 \left(= \frac{12}{25}\right)$	M1 A1 **[2]**	
4	(ii)		*Either:* $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ $= 0.4 + 0.8 - 0.4 \times 0.8$ $= 0.88 \left(= \frac{22}{25}\right)$ *Or:* $P(A \cup B) = 0.4 \times 0.8 + 0.6 \times 0.8 + 0.4 \times 0.2$ $= 0.32 + 0.48 + 0.08 = 0.88$ *Or:* $P(A \cup B) = 1 - P(A' \cap B')$ $= 1 - 0.6 \times 0.2 = 1 - 0.12 = 0.88$	M1 M1 A1 CAO **[3]** M1 M1 A1 M1 M1 A1	for use of formula for 0.4×0.8 For any two terms For all three terms For 0.6×0.2 For complete method
4	(iii)		$P(A\|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.32}{0.88} = \frac{4}{11} = 0.364 = (0.3636...)$	M1 M1 A1FT **[3]**	For numerator As part of fraction (with denominator) For denominator As part of fraction (with numerator) FT their answer to part (ii) Accept $0.\dot{3}\dot{6}$ (dots above) Accept 0.36 with correct working
5	(i)		$0.55^3 = 0.166 \quad (0.166375) \left(= \frac{1331}{8000}\right)$	M1 A1 **[2]**	For 0.55^3 Accept 0.17 with working Condone answer of 0.166375 (over-specified)
5	(ii)		P(Wins in 3 games) = $0.45^3 = 0.091125$ P(Wins in 4 games) = $3 \times 0.45^2 \times 0.55 \times 0.45 = 0.150356$ P(Wins in 5 games) = $6 \times 0.45^2 \times 0.55^2 \times 0.45 = 0.165392$ NB Answer if no coefficients used is 0.168809… = 0.091125 + 3 x 0.05011875 + 6 x 0.0275653125 P(Emily wins) = 0.407 (0.406873..) 1 – P(Sakura wins) can get all marks (use similar scheme) so eg $1 - 0.55^3$ gets M1M0M0M0A0	M1 M1 M1 M1 A1 **[5]**	For P(Wins in 3 games) P(Wins in 4 games) with any or no coefficient P(Wins in 5 games) with any or no coefficient For either coefficient correct CAO SC2 for P(Sakura wins) = 0.593 (0.593126…)

Question			Answer	Marks	Guidance
6	(i)		<table><tr><td>Upper bound</td><td>40</td><td>80</td><td>120</td><td>140</td><td>180</td><td>220</td><td>300</td></tr><tr><td>Cumulative frequency</td><td>0</td><td>29</td><td>103</td><td>155</td><td>284</td><td>348</td><td>358</td></tr></table>  NB If you receive a script where the graph is drawn on lined paper, rather than on the grid, please mark it and then refer it to your team leader BEFORE you submit it.	B1 G1 G1 G1 G1 [5]	Cumulative frequencies All correct. May be implied from graph. Condone omission of 0 at this stage. For points Plotted as (UCB, their cf). Ignore (40,0) at this stage. No midpoint or LCB plots or non-linear scales Plotted within ½ small square If cf not given then allow B1G1 for all correct For joining points (within ½ a square) For joining all of 'their points' (line or smooth curve) AND now including (40,0) Not for midpoint or LCB plots or non-linear scales For scales Linear horizontal scale. Allow if start at 40 (no inequality scales - Not even <40, <60, <80 …) Linear vertical scale Allow full credit if axes reversed correctly For labels Pollutant level or *x* and Cumulative frequency or just CF or similar but not frequency or fd nor cumulative fd All four dep on attempt at cumulative frequency. Mid-point or LCB plots or cum freq bars may score first and last two marks **NOTE With one error in cfs last 4 marks still available (EG 0, 29, 103, 145, 274, 338, 348)**
6	(ii)		Estimate from curve is 327 Proportion = 327/358 = 0.913 or 91.3% 315/368 = 87.99% 316/358 = 88.3% NB Linear interpolation gives 284 + ½×64 = 316	M1 A1 **[2]**	**Allow 315 to 330 without checking graph (unless non-linear scales in which case allow 316 by LI)** **Otherwise FT their graph** within one square (allow a slight slip in scales - contact TL if unsure) **Max M1A0 if final answer given as a fraction**

Question			Answer	Marks	Guidance
6	(iii)		Median =148 **Allow 145 to 152 without checking graph** Q_1 = 115 **Allow 110 to 115 without checking graph** Q_3 = 175 **Allow 175 to 180 without checking graph** IQR = 60 If quartiles not specified give B1B0 for 'IQR is 115 < x < 175' or similar If answer only for IQR, check if quartiles given in part (iv) or (v) – if not then check graph No marks if non-linear scales	B1 B1 B1 **[3]**	For Q1 or Q3 For IQR FT their cf graph for all 3 marks within one square (on both scales) (allow a slight slip in scales - contact TL if unsure)
6	(iv)		Lower limit $Q_1 - 1.5 \times IQR$ '115 – (1.5 × 60)' (= 25) Upper limit $Q_3 + 1.5 \times IQR$ '175 + (1.5 × 60)' (= 265) There are definitely no outliers at the lower end as the lowest data value is 40 which is below the lower limit. It is uncertain whether there are outliers at the upper end as the highest class includes the upper limit. Use of mean= 145.08 and sd = 45.09 gives 54.9 and 235.26 for M2 So could be some outliers at lower and could be some at upper end but not sure. E1E1	M1 M1 A1 A1 **[4]**	FT their quartiles provided between 40 and 300 Allow 'No values below (their) 25' for first A1 Allow 'Lower limit = (their) 25 so no outliers' You must be convinced that comments about no outliers refer to **lower tail only**. Allow additional comment that since some data is lost there could be one or more outliers If their lower limit >40 then A0 Do not allow 'There IS at least one outlier.' oe There must be an element of doubt. However, condone 'There is probably at least one outlier.' You must be convinced that comments about some outliers refer to upper tail only. If their upper limit <220 or >300 then A0
6	(v)		 Pollution level	G1* G1*dp G1*dp	FT their median and quartiles provided between 40 and 300 and Q_1 < median < Q_3 Can restart from graph For linear scale shown. Dep on attempt at box and whisker plot with at least a box and one whisker. Condone lack of label. For boxes (Q_1, median, Q_3) in correct positions, within half a square

Question			Answer	Marks	Guidance
				[3]	For whiskers at 40 and 300 within half a square Upper whisker could be partially dotted
6	**(vi)**		The readings from Tower Hamlets show (stronger) positive skewness The readings from Marylebone Road show little evidence of skewness Accept 'No skewness' For 2 marks must suggest that TH has higher positive skew than MR	E1 E1 **[2]**	 Allow '<u>slight</u> positive skewness' Do <u>not</u> FT their diagram but must have boxplot in part (v) to get second mark 'TH shows more evidence of positive skewness than MR' gets E2
7	**(i)**	**(*A*)**	$X \sim B(12, 0.75)$ $P(X = 9) = \binom{12}{9} \times 0.75^9 \times 0.25^3 = 0.258\ (0.258103\ldots)$ Or: From tables $P(X \leq 9) - P(X \leq 8) = 0.6093 - 0.3512 = 0.2581$	 M1 M1 A1 M2 A1 **[3]**	 For $0.75^9 \times 0.25^3$ For $\binom{12}{9} \times p^9 \times q^3$ With $p + q = 1$ Also for $220 \times 0.00117\ldots$ Allow 0.26 or better with working CAO For 0.6093 – 0.3512 CAO
7	**(i)**	**(*B*)**	$P(X \geq 9) = 1 - P(X \leq 8) = 1 - 0.3512 = 0.6488$	M1 A1 **[2]**	For 0.3512 CAO Accept 0.649 and 0.65 with working For $P(X=9) + P(X=10) + P(X=11) + P(X=12)$ allow M1A1 for awrt 0.649. Otherwise M0A0.
7	**(ii)**		(Let $X \sim B(18, 0.75)$) Let p = probability of dog having allergy relieved by the new shampoo (for population) H_0: $p = 0.75$ H_1: $p > 0.75$ H_1 has this form as the test is to determine whether the new shampoo relieves	 B1 B1 B1 E1	 For definition of p (in context) Do NOT allow <u>number</u> in place of probability. See below for additional notes For H_0 For H_1 Dep on > 0.75 used in H_1

Question			Answer	Marks	Guidance
			the symptoms of a higher proportion of dogs who suffer from the allergy. For use of B(18, 0.25), please consult your Team Leader	**[4]**	E0 for simply stating H_1 in words Condone number instead of proportion. Do Not allow just 'proportion will be higher' or similar.
7	**(iii)**	**(*A*)**	$P(X \geq 16) = 1 - P(X \leq 15) = 1 - 0.8647 = 0.1353$ $0.1353 > 0.1$ So not significant. Accept H_0 Conclude that there is not enough evidence to support the idea that the new shampoo relieves the symptoms of a higher proportion of dogs who suffer from the allergy. $0.8647 < 0.9$ scores M2 and can get A1 E1 if $P(X \leq 15)$ oe seen and all correct	M1* *M1dep A1* E1dep **[4]**	For sight of 0.1353 or 0.135 For (explicit) comparison with 10% or 0.1 Do NOT FT wrong H_1 but first mark available if H_1 or H_0 wrong For A1 need $P(X \geq 16)$ somewhere oe eg $P(\geq 16)$ Allow SC2 for clearly indicating use of B(18, 0.75) but with no mention of 0.1353 with convincing reasoning and final answer correct No marks if point probabilities used. Do not condone number instead of proportion Must include 'not enough evidence' oe
			ALTERNATIVE METHOD Provided they are using CR method $P(X \geq 16) = 0.1353$ $P(X \geq 17) = 0.0395$ OR 0.8647 and 0.9605 $0.1353 > 0.1$ or $0.0395 < 0.1$ OR $0.8647 < 0.9$ or $0.9605 > 0.9$ So critical region is {17, 18} so not significant. or 16 not in CR so not significant Conclude that there is enough evidence to support the idea that the new shampoo relieves the symptoms of a higher proportion of dogs who suffer from the allergy.	B1 M1 A1* E1* dep	For both probabilities Do not insist on correct notation as candidates have to work out two probabilities for full marks. For at least one comparison with 10% Allow comparison in form of statement 'critical region at 10% level is …' CAO dep on the two correct probabilities Ignore any work on lower critical region No marks if CR not justified. However SC2 above still applies Condone $X \geq 17$, , oe but not $P(X \geq 17)$ etc Assume using first method unless you are convinced that candidate is using CR method. No marks if point probabilities used
7	**(iii)**	**(*B*)**	$P(X \geq 42) = 1 - P(X \leq 41) = 1 - 0.9084 = 0.0916$	B1	For use of $P(X \leq 41)$

Question			Answer	Marks	Guidance
			$0.0916 < 0.1$ or $0.9084 > 0.9$ So significant. Reject H_0 Conclude that there is enough evidence to support the idea that the new shampoo relieves the symptoms of a higher proportion of dogs who suffer from the allergy.	M1* A1* E1*dep **[4]**	For comparison with 10% dep on first two marks NB If more than one attempt please mark the final one. Do not penalise 'number' rather than 'proportion' twice in parts A and B NB No marks for critical region method unless find P($X \leq 40$) = 0.9084 – 0.0721 = 0.8363 in which case follow above scheme for part (iii)(*A*) so should have 0.1637 >0.1 and 0.0916 < 0.1 or 0.8363 < 0.9 and 0.9084 > 0.9 etc (giving CR{42, 43, 44, 45, 46, 47, 48, 49, 50})

NOTE RE OVER-SPECIFICATION OF ANSWERS

If answers are grossly over-specified, deduct the final answer mark. Note in Q1 only deduct 1 mark altogether even if both mean and sd over-specified. 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.(and condone 6 sig fig in Q5(i)). **You must highlight any over-specified answers.**

ANNOTATION RULES

See note 12 above and particularly 12a. Remember to put full annotation on all practice and standardisation scripts unless the candidate has scored full marks or zero. In addition for all marking in Q6(i) and Q6(v) if the candidate has not scored full marks then show which B marks have been awarded in the right hand margin, in the same order as they are given in the mark scheme. You should indicate any errors made.

Reminder of note 7 above which is a change from previous years:

Award No Response (NR) if:

- there is nothing written in the answer space

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

.

Additional notes re Q7 part ii

Minimum needed for B1 is *p* = probability allergy relieved
Allow *p* = P(allergy relieved)
Definition of *p* must include word probability (or chance or proportion or percentage or likelihood but NOT possibility, number or amount).

Preferably given as a separate comment. However can be at end of H_0 as long as it is a clear definition 'p = the probability that the allergy is relieved .'
Do NOT allow 'p = the probability that the allergy is relieved is greater'
Allow p=75%, allow only p or θ or π or ρ. However allow any single symbol <u>if defined</u> (including x)
Allow $H_0 = p$=0.75, Allow NH and AH in place of H_0 and H_1
Do not allow H_0 : P(X=x) = 0.75
Do not allow H_0: =0.75, =75%, P(0.0.75), p(x)=0.75, x=0.75 (unless x correctly defined as a probability)
Do not allow H_0 and H_1 reversed
For hypotheses given in words allow Maximum B0B1B1
Hypotheses in words must include probability (or chance or proportion or percentage or %) and the figure 0.75 oe
Thus eg H_0 : P(allergy relieved) = 0.75, H_1 : P(allergy relieved) > 0.75 gets B0B1B1

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

4766 Statistics 1

General Comments:

As in the last two years, the majority of candidates were well prepared for this paper, with a large number scoring at least 60 marks out of 72. There was no evidence of candidates being unable to complete the paper in the allocated time. Most candidates had adequate space in the answer booklet without having to use additional sheets. Candidates who did need additional space usually used the last page of the answer book, but a few did not, presumably not realising that it was available, and instead used additional sheets. Losing a mark due to over-specification was mainly seen in question 1, although the majority of candidates realised that they should give their answers to 4 significant figures or less. Only a very few candidates lost a mark for giving probabilities to more than 5 significant figures.

Candidates usually scored very well on question 1 on mean and standard deviation, question 3ii on finding expectation and variance, question 4 on probability (including fairly well in part (iii) on conditional probability), and question 7 part (i) on the binomial distribution. Part (ii) of question 7, where candidates had to state hypotheses and define *p*, was well answered. This is very pleasing, as up until recently, this topic has caused problems for many candidates.

Question 6, which is largely covering work candidates will have met at GCSE was less well done than expected at this level, largely through poor drawing of the cumulative graph. There were many examples of poor choices of scales (and interpretation of scales by candidates), plotting at midpoints (and lower bounds) as well as omitting the point (40,0) when drawing their curve

Other questions on which candidates did not score so highly included question 2 part (iii) on probability and question 5 part (ii) again on probability.

The majority of candidates used correct notation. However poor interpretative skills let down many candidates. They have, in most cases, been well prepared for calculations required in the paper but struggled to gain full credit when required to analyse their findings. Literacy and handwriting were often not of a good standard.

Comments on Individual Questions:

Q1(i) Nearly all candidates worked out the mean correctly. Many candidates also found the standard deviation but some over-specified the answer thus losing a mark. A minority of candidates made an error in the formula for standard deviation or worked out the RMSD. It was encouraging to see most candidates recalling and using correct formulae.

Q1(ii) Most candidates used the transformation to obtain the correct mean. Many candidates also obtained the correct standard deviation, with a pleasingly small number mistakenly adding 7.2 to their final answer. Some candidates lost marks for over-specification, although there was only a penalty of 1 mark in the whole question for this error. It was encouraging to see most candidates giving answers to an appropriate degree of accuracy.

Q2(i) This part was answered well by the majority of the candidates. A small minority of the candidates used permutations instead of combinations and a very few simply gave an answer of 4! = 24.

Q2(ii) This was answered well by many candidates. However a common misconception was to assume 'with replacement' probability giving an answer of $0.34^4 = 0.0134$. A few candidates gave their answer in fractional form but failed to cancel, hence losing the accuracy mark.

Q2(iii) This question was found to be rather difficult. Many candidates wrote more than one page as they attempted to find all the probabilities of two or more using the same method, almost always without success. In fact around half of the candidature scored zero on this question part. A fair number of candidates did find the correct product and took their answer away from 1, but few found the correct multiplier of 4!, and thus only gained 2 marks.

Q3(i) Many candidates failed to provide a convincing argument for the value of P(X = 1). Some candidates subtracted the sum of the other probabilities from 1. Many others found three possibilities but then stated that there were 8 possibilities in total, rather than 16. Mention of '2 ways round' or equivalent gained one mark. The best answers drew a sample space diagram and highlighted those differences equalling 1. A list of all six possibilities with sound workings was also a successful response to this part.

Q3(ii) This part was generally well-answered with around 90% of candidates getting full marks. Most correctly found E(X) and, in many cases, Var(X), although a number of candidates only found E(X^2). A small number found E(X^2) - E(X). Very few candidates attempted to find E$(X- \mu)^2$ and those who did were rarely successful.

Q4(i) Most candidates found the correct probability although a few did incorrectly find $0.4 \times 0.8 = 0.32$ or $0.4 \times 0.2 = 0.08$.

Q4(ii) This part was again very well answered. Many candidates gave the correct method and answer. A minority of the candidates gave an answer of 0.56 by adding two terms rather than three terms. These candidates missed out the 0.32 term.

Q4(iii) It is pleasing to report that this conditional probability question was well-answered by many candidates, two thirds whom gained full credit. Most recognised that they had to divide by the probability found in part (ii) although a few did not use the correct numerator. Those who found the correct probability sometimes lost the accuracy answer for poor rounding, giving, for example, a final answer of 0.366 rather than 0.364.

Q5(i) Around 95% of candidates answered this correctly. Most gave a decimal answer of 0.166 or 0.1664.

Q5(ii) This caused numerous problems for many candidates – time was spent drawing tree diagrams and trying to list all combinations. Most candidates found the probability of Emily winning in 3 games, 0.45^3, and thus gained a mark. A large number also found the probability of her winning in 4 games (in some order) and in 5 games (in some order). The number of valid combinations was frequently wrong - sometimes failing to find them all systematically and often using ${}^4C_3$ and ${}^5C_3$. Some candidates used 1-P(Sakura wins) and these candidates achieved mostly between 1 and 3 marks with mistakes with the coefficients resulting in not gaining full credit. An elegant solution seen was from a candidate who stated that Emily must win the last game and so worked on the possible ways of Emily winning two of the previous matches.

Q6(i) The majority of candidates made a good attempt at the graph. Very few failed to recognise that cumulative frequency was required, with only an occasional histogram or frequency graph seen. The values for the cumulative frequency were on the whole correctly calculated but a few tried to make them up to 365, failing to read the question correctly. The scales were usually linear but some chose difficult intervals, especially on the vertical scale, for example intervals of 24. Labelling was not as successful; missing labels or labelling the vertical scale as frequency was common. A number of candidates used mid-points rather than upper boundaries for plotting and a few used lower boundaries. Even if correct boundaries were used, the point (40,0) was often omitted

with candidates either not joining their graph to the axis or joining it to (0,0). Just one third of candidates scored full marks in this question.

Q6(ii) Candidates were fairly even spread between reading off the graph or using linear interpolation to find the cumulative frequency for $x = 200$. A sufficiently accurate value was usually obtained from the graph, but many responses stopped short of even writing it as a fraction over 358, let alone converting this value into a proportion (decimal or percentage).

Q6(iii) This was a generally well done. The main problems were caused by unhelpful scales chosen in part (i), which candidates then interpreted wrongly in this part. Some candidates used cumulative frequencies of 100, 200 and 300, rather than the correct values to find the median and quartiles.

Q6(iv) This was again generally well done with most candidates correctly calculating the outlier limits. Most responses correctly stated that there were no outliers at the lower end but some stated that there were definitely outliers at the upper end rather than that there may be some. A number of candidates used the median instead of the lower and upper quartiles to find the limits and others used 2 × IQR, rather than 1.5 × IQR. A very few candidates found the mean and standard deviation and then using these, found the limits correctly.

Q6(v) Although this part was generally answered well, a minority of candidates lost the final mark by not having the end of the whiskers plotted at 40 and/or 300, often plotting these at 29 and/or 358. Some candidates did not show a horizontal scale, making their response difficult to mark. Other candidates had trouble drawing the box and whisker diagram due the lack of a ruler.

Q6(vi) Many candidates struggled to answer the question which was asked. Often zero marks were scored as the candidate wrote a short essay with no mention of skewness. Being precise and talking about both locations generally gained the marks. Some candidates still referred to it as left and right skew or mixed up positive and negative. The question did ask for a comparison, which was generally missed.

Q7(i)A Around 90% of candidates gained full marks here, with most using the formula, rather than tables.

Q7(i)B Again this was well answered, usually by use of cumulative probability tables, although some candidates did calculate the four probabilities, usually summing them correctly. A few candidates forgot to subtract from 1, and a few just subtracted $P(X = 8)$ from 1 rather than $P(X \leq 8)$.

Q7(ii) Candidates did well on this part, with over 80% gaining at least 3 marks out of 4. Most candidates scored the first two marks for the hypotheses, with many knowing that they needed to define p, thus scoring the third mark, although some definitions were wrong. For example 'p = the probability that dogs suffer from the allergy'. A valid explanation of the reason for the form of the alternative hypothesis was usually given, even if not always very well worded.

Q7(iii)A Approximately half of the candidates scored full marks in this part and also the final part. Most candidates started off correctly by using 0.1353, but there were still quite a few who used point probabilities, scoring zero. The use of 0.0395 was not uncommon, again scoring zero. There were a few candidates who did not compare their probability to the significance level and so could only be awarded one mark. Some candidates used the critical region method and in this part the two correct probabilities were used most of the

time and compared with the significance level. The final mark was often lost due to failure to provide a statement, failure to include context or failure to include an element of doubt.

Q7(iii)B The majority of candidates used 0.0916 but there again there were quite a lot of candidates who used point probabilities. Some candidates used a critical region method but there were far too many who didn't use the correct two cumulative probabilities, but just 0.0916 and 0.0453, comparing both to 0.1. To score marks using the critical region method candidates needed to compare both 0.0916 and 0.1637 to 0.1 to justify the critical region.

Unit level raw mark and UMS grade boundaries June 2017 series

For more information about results and grade calculations, see www.ocr.org.uk/ocr-for/learners-and-parents/getting-your-results

AS GCE / Advanced GCE / AS GCE Double Award / Advanced GCE Double Award

GCE Mathematics (MEI)

				Max Mark	a	b	c	d	e	u
4751	01	C1 – MEI Introduction to advanced mathematics (AS)	Raw	72	63	58	53	49	45	0
			UMS	100	80	70	60	50	40	0
4752	01	C2 – MEI Concepts for advanced mathematics (AS)	Raw	72	55	49	44	39	34	0
			UMS	100	80	70	60	50	40	0
4753	01	(C3) MEI Methods for Advanced Mathematics with Coursework: Written Paper	Raw	72	54	49	45	41	36	0
4753	02	(C3) MEI Methods for Advanced Mathematics with Coursework: Coursework	Raw	18	15	13	11	9	8	0
4753	82	(C3) MEI Methods for Advanced Mathematics with Coursework: Carried Forward Coursework Mark	Raw	18	15	13	11	9	8	0
			UMS	100	80	70	60	50	40	0
4754	01	C4 – MEI Applications of advanced mathematics (A2)	Raw	90	67	61	55	49	43	0
			UMS	100	80	70	60	50	40	0
4755	01	FP1 – MEI Further concepts for advanced mathematics (AS)	Raw	72	57	52	47	42	38	0
			UMS	100	80	70	60	50	40	0
4756	01	FP2 – MEI Further methods for advanced mathematics (A2)	Raw	72	65	58	52	46	40	0
			UMS	100	80	70	60	50	40	0
4757	01	FP3 – MEI Further applications of advanced mathematics (A2)	Raw	72	64	56	48	41	34	0
			UMS	100	80	70	60	50	40	0
4758	01	(DE) MEI Differential Equations with Coursework: Written Paper	Raw	72	63	56	50	44	37	0
4758	02	(DE) MEI Differential Equations with Coursework: Coursework	Raw	18	15	13	11	9	8	0
4758	82	(DE) MEI Differential Equations with Coursework: Carried Forward Coursework Mark	Raw	18	15	13	11	9	8	0
			UMS	100	80	70	60	50	40	0
4761	01	M1 – MEI Mechanics 1 (AS)	Raw	72	57	49	41	34	27	0
			UMS	100	80	70	60	50	40	0
4762	01	M2 – MEI Mechanics 2 (A2)	Raw	72	56	48	41	34	27	0
			UMS	100	80	70	60	50	40	0
4763	01	M3 – MEI Mechanics 3 (A2)	Raw	72	58	50	43	36	29	0
			UMS	100	80	70	60	50	40	0
4764	01	M4 – MEI Mechanics 4 (A2)	Raw	72	53	45	38	31	24	0
			UMS	100	80	70	60	50	40	0
4766	01	S1 – MEI Statistics 1 (AS)	Raw	72	61	55	49	43	37	0
			UMS	100	80	70	60	50	40	0
4767	01	S2 – MEI Statistics 2 (A2)	Raw	72	56	50	45	40	35	0
			UMS	100	80	70	60	50	40	0
4768	01	S3 – MEI Statistics 3 (A2)	Raw	72	63	57	51	46	41	0
			UMS	100	80	70	60	50	40	0
4769	01	S4 – MEI Statistics 4 (A2)	Raw	72	56	49	42	35	28	0
			UMS	100	80	70	60	50	40	0
4771	01	D1 – MEI Decision mathematics 1 (AS)	Raw	72	52	46	41	36	31	0
			UMS	100	80	70	60	50	40	0
4772	01	D2 – MEI Decision mathematics 2 (A2)	Raw	72	53	48	43	39	35	0
			UMS	100	80	70	60	50	40	0
4773	01	DC – MEI Decision mathematics computation (A2)	Raw	72	46	40	34	29	24	0
			UMS	100	80	70	60	50	40	0
4776	01	(NM) MEI Numerical Methods with Coursework: Written Paper	Raw	72	58	53	48	43	37	0
4776	02	(NM) MEI Numerical Methods with Coursework: Coursework	Raw	18	14	12	10	8	7	0
4776	82	(NM) MEI Numerical Methods with Coursework: Carried Forward Coursework Mark	Raw	18	14	12	10	8	7	0
			UMS	100	80	70	60	50	40	0
4777	01	NC – MEI Numerical computation (A2)	Raw	72	55	48	41	34	27	0

		UMS	100	80	70	60	50	40	0
4798	01 FPT - Further pure mathematics with technology (A2)	Raw	72	57	49	41	33	26	0
		UMS	100	80	70	60	50	40	0

GCE Statistics (MEI)

			Max Mark	a	b	c	d	e	u
G241	01 Statistics 1 MEI (Z1)	Raw	72	61	55	49	43	37	0
		UMS	100	80	70	60	50	40	0
G242	01 Statistics 2 MEI (Z2)	Raw	72	55	48	41	34	27	0
		UMS	100	80	70	60	50	40	0
G243	01 Statistics 3 MEI (Z3)	Raw	72	56	48	41	34	27	0
		UMS	100	80	70	60	50	40	0

GCE Quantitative Methods (MEI)

			Max Mark	a	b	c	d	e	u
G244	01 Introduction to Quantitative Methods MEI	Raw	72	58	50	43	36	28	0
G244	02 Introduction to Quantitative Methods MEI	Raw	18	14	12	10	8	7	0
		UMS	100	80	70	60	50	40	0
G245	01 Statistics 1 MEI	Raw	72	61	55	49	43	37	0
		UMS	100	80	70	60	50	40	0
G246	01 Decision 1 MEI	Raw	72	52	46	41	36	31	0
		UMS	100	80	70	60	50	40	0

Level 3 Certificate and FSMQ raw mark grade boundaries June 2017 series

For more information about results and grade calculations, see www.ocr.org.uk/ocr-for/learners-and-parents/getting-your-results

Level 3 Certificate Mathematics for Engineering

			Max Mark	a*	a	b	c	d	e	u
H860	01	Mathematics for Engineering	This unit has no entries in June 2017							
H860	02	Mathematics for Engineering								

Level 3 Certificate Mathematical Techniques and Applications for Engineers

				Max Mark	a*	a	b	c	d	e	u
H865	01	Component 1	Raw	60	48	42	36	30	24	18	0

Level 3 Certificate Mathematics - Quantitative Reasoning (MEI) (GQ Reform)

				Max Mark	a	b	c	d	e	u
H866	01	Introduction to quantitative reasoning	Raw	72	54	47	40	34	28	0
H866	02	Critical maths	Raw	60*	48	42	36	30	24	0
		*Component 02 is weighted to give marks out of 72	Overall	144	112	97	83	70	57	0

Level 3 Certificate Mathematics - Quantitive Problem Solving (MEI) (GQ Reform)

				Max Mark	a	b	c	d	e	u
H867	01	Introduction to quantitative reasoning	Raw	72	54	47	40	34	28	0
H867	02	Statistical problem solving	Raw	60*	41	36	31	27	23	0
		*Component 02 is weighted to give marks out of 72	Overall	144	103	90	77	66	56	0

Advanced Free Standing Mathematics Qualification (FSMQ)

				Max Mark	a	b	c	d	e	u
6993	01	Additional Mathematics	Raw	100	72	63	55	47	39	0

Intermediate Free Standing Mathematics Qualification (FSMQ)

				Max Mark	a	b	c	d	e	u
6989	01	Foundations of Advanced Mathematics (MEI)	Raw	40	35	30	25	20	16	0