

**ADVANCED SUBSIDIARY GCE
MATHEMATICS (MEI)**

Statistics 1

4766

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

**Thursday 26 May 2011
Morning**

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. 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.

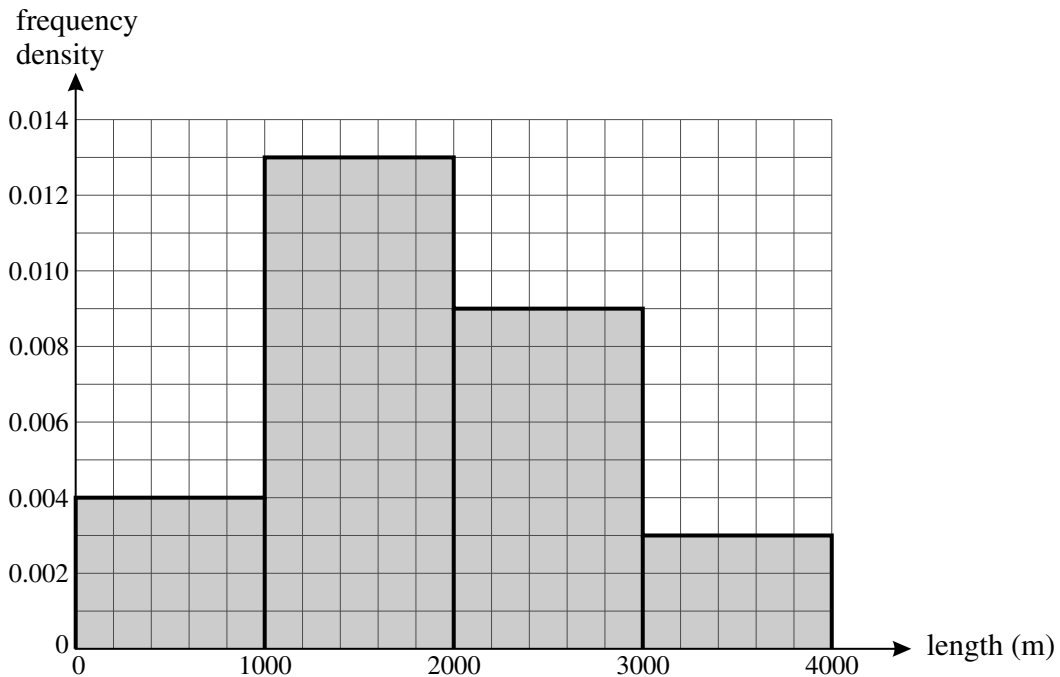
- The number of marks is given in brackets [] at the end of each question or part question on the question paper.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for 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

- Do not send this question paper for marking; it should be retained in the centre or destroyed.

Section A (36 marks)

- 1 In the Paris-Roubaix cycling race, there are a number of sections of cobbled road. The lengths of these sections, measured in metres, are illustrated in the histogram.



- (i) Find the number of sections which are between 1000 and 2000 metres in length. [2]
- (ii) Name the type of skewness suggested by the histogram. [1]
- (iii) State the minimum and maximum possible values of the midrange. [2]
- 2 I have 5 books, each by a different author. The authors are Austen, Brontë, Clarke, Dickens and Eliot.
- (i) If I arrange the books in a random order on my bookshelf, find the probability that the authors are in alphabetical order with Austen on the left. [2]
- (ii) If I choose two of the books at random, find the probability that I choose the books written by Austen and Brontë. [3]
- 3 25% of the plants of a particular species have red flowers. A random sample of 6 plants is selected.
- (i) Find the probability that there are no plants with red flowers in the sample. [2]
- (ii) If 50 random samples of 6 plants are selected, find the expected number of samples in which there are no plants with red flowers. [2]

- 4 Two fair six-sided dice are thrown. The random variable X denotes the difference between the scores on the two dice. The table shows the probability distribution of X .

r	0	1	2	3	4	5
$P(X = r)$	$\frac{1}{6}$	$\frac{5}{18}$	$\frac{2}{9}$	$\frac{1}{6}$	$\frac{1}{9}$	$\frac{1}{18}$

- (i) Draw a vertical line chart to illustrate the probability distribution. [2]
- (ii) Use a probability argument to show that
- (A) $P(X = 1) = \frac{5}{18}$, [2]
- (B) $P(X = 0) = \frac{1}{6}$. [1]
- (iii) Find the mean value of X . [2]
- 5 In a recent survey, a large number of working people were asked whether they worked full-time or part-time, with part-time being defined as less than 25 hours per week. One of the respondents is selected at random.
- W is the event that this person works part-time.
 - F is the event that this person is female.

You are given that $P(W) = 0.14$, $P(F) = 0.41$ and $P(W \cap F) = 0.11$.

- (i) Draw a Venn diagram showing the events W and F , and fill in the probability corresponding to each of the four regions of your diagram. [3]
- (ii) Determine whether the events W and F are independent. [2]
- (iii) Find $P(W | F)$ and explain what this probability represents. [3]
- 6 The numbers of eggs laid by a sample of 70 female herring gulls are shown in the table.

Number of eggs	1	2	3	4
Frequency	10	40	15	5

- (i) Find the mean and standard deviation of the number of eggs laid per gull. [5]
- (ii) The sample did not include female herring gulls that laid no eggs. How would the mean and standard deviation change if these gulls were included? [2]

Section B (36 marks)

7 Any patient who fails to turn up for an outpatient appointment at a hospital is described as a 'no-show'. At a particular hospital, on average 15% of patients are no-shows. A random sample of 20 patients who have outpatient appointments is selected.

(i) Find the probability that

(A) there is exactly 1 no-show in the sample, [3]

(B) there are at least 2 no-shows in the sample. [2]

The hospital management introduces a policy of telephoning patients before appointments. It is hoped that this will reduce the proportion of no-shows. In order to check this, a random sample of n patients is selected. The number of no-shows in the sample is recorded and a hypothesis test is carried out at the 5% level.

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

(iii) In the case that $n = 20$ and the number of no-shows in the sample is 1, carry out the test. [4]

(iv) In another case, where n is large, the number of no-shows in the sample is 6 and the critical value for the test is 8. Complete the test. [3]

(v) In the case that $n \leq 18$, explain why there is no point in carrying out the test at the 5% level. [2]

8 The heating quality of the coal in a sample of 50 sacks is measured in suitable units. The data are summarised below.

Heating quality (x)	$9.1 \leq x \leq 9.3$	$9.3 < x \leq 9.5$	$9.5 < x \leq 9.7$	$9.7 < x \leq 9.9$	$9.9 < x \leq 10.1$
Frequency	5	7	15	16	7

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

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

(iii) Show that there are no outliers in the sample. [3]

(iv) Three of these 50 sacks are selected at random. Find the probability that

(A) in all three, the heating quality x is more than 9.5, [3]

(B) in at least two, the heating quality x is more than 9.5. [4]

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