

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

AS GCE

4766/01

MATHEMATICS (MEI)

Statistics 1

QUESTION PAPER

WEDNESDAY 23 MAY 2018:

Morning

DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED 24pt

Candidates answer on the Printed Answer Book sent with the standard paper or any suitable paper provided by the centre. The centre may enlarge the Printed Answer Book.

OCR SUPPLIED MATERIALS:

MEI Examination Formulae and Tables (MF2)
sent with standard paper

Insert for question **7(v)**

Loose sheet for question **7**.

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF



INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book or on the paper provided. Please write clearly and in capital letters.

If you use the Printed Answer Book, write your answer to each question in the space provided. 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.

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

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**.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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SECTION A (36 marks)

- 1** During a storm in the English Channel, the heights in metres of a random sample of 20 waves were measured. The heights are given below.

9.5	8.8	8.9	8.0	7.3	8.5	7.4	8.6
9.0	7.7	6.9	8.0	6.7	8.8	7.8	9.0
9.2	5.9	8.3	9.3				

- (i) Construct a sorted stem and leaf diagram to represent these data, taking stem values of 5, 6, 7, 8, 9. **[3]**
- (ii) Comment on the skewness of the data. **[1]**
- (iii) Write down the median and midrange of the data. **[2]**
- (iv) Give one reason why the median is a better measure of central tendency for these data than the midrange. **[1]**

- 2** Each morning, Peter either cycles or drives to work. For any day, the probability that he drives is 0.25. If he drives, the probability that he arrives late for work is 0.2. The overall probability that he is late for work on any day is 0.08.

For a randomly chosen day,

D is the event that Peter drives to work,

L is the event that Peter arrives late for work.

(i) (A) Find $P(D \cap L)$. **[2]**

(B) Draw a Venn diagram showing the events D and L , and fill in the probability corresponding to each of the four regions of your diagram. **[3]**

(ii) Determine whether or not the events D and L are independent, justifying your answer. **[2]**

3 A wheelchair rugby squad of 12 people has to be chosen from a group of 14 women and 11 men.

(i) How many different squads are possible? **[2]**

(ii) The team coach decides that the squad must consist of equal numbers of women and men.

(A) How many different squads are possible now? **[2]**

(B) There are 4 players from the squad on the court at any time. Assuming that all possibilities are equally likely, find the probability that all of the players from the squad who are on the court are women. **[3]**

- 4** The probability distribution of the random variable X is given by the formula

$$P(X = r) = k(r^3 - 1) \text{ for } r = 2, 3, 4, 5.$$

- (i)** Show that the value of k is $\frac{1}{220}$ and, using this value of k , show the probability distribution of X in a table, giving the probabilities as exact fractions. **[3]**
- (ii)** Find $E(X)$ and $\text{Var}(X)$. **[5]**

5 The probability of someone who lives in a particular city being a car owner is 0.3. The probability of someone who lives in the countryside surrounding the city being a car owner is 0.75. Two people who live in the city and two people who live in the surrounding countryside are selected at random.

- (i)** Find the probability that exactly one of these four people is a car owner. **[4]**
- (ii)** Given that exactly one of the four people is a car owner, find the probability that this person lives in the city. **[3]**

SECTION B (36 marks)

6 According to a survey ‘Drinking Habits Amongst Adults, 2012’ by the Office for National Statistics, 50% of males between the ages of 16 and 24 had drunk alcohol in the previous week.

(i) Assuming that the same figure applies now, find the probability that in a random sample of 20 males between the ages of 16 and 24, the number who have drunk alcohol in the previous week is

(A) exactly 8, **[2]**

(B) at least 8. **[2]**

A student thinks that if a survey were to be carried out now, the figure would be lower than 50%. She selects a random sample of 20 males in this age group and asks each of them whether they have drunk alcohol in the last week. The number of them who say that they have drunk alcohol in the last week is 6.

- (ii) Carry out a hypothesis test at the 5% significance level to investigate the student's belief. Give a reason for your choice of alternative hypothesis. **[9]**

(iii) A teacher at the school attended by the student suggests that she should have used a larger sample. A new random sample of 100 males between the ages of 16 and 24 is selected. The number of them who say that they have drunk alcohol in the previous week is 41. Using the same hypotheses as in part (ii), carry out another test at the 5% significance level. You may use the information that for $X \sim B(100, 0.5)$,

$$P(X = 40) = 0.0108,$$

$$P(X = 41) = 0.0159,$$

$$P(X < 41) = 0.0284,$$

$$P(X \leq 41) = 0.0443. \quad \mathbf{[4]}$$

7 The table on the Loose Sheet shows the resting heart rates, x , measured in beats per minute (BPM), of a sample of 4-year-old children. The histogram on the Loose Sheet illustrates these data.

- (i)** Find the value of a . **[1]**
- (ii)** Previously collected data suggest that the 75th percentile of the resting heart rates of all 4-year-old children is 111. Calculate an estimate of the percentage of children in the sample whose resting heart rate is 111 or below. **[3]**

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The table opposite shows the resting heart rates, y BPM, of a sample of 18-year-olds.

- (iii)** Calculate estimates of the mean and standard deviation of these data. **[4]**
- (iv)** Use your answers to part **(iii)** to investigate whether there may be any outliers. **[4]**
- (v)** Add a histogram for these data on the copy of the diagram in the answer book or on the insert provided. **[4]**
- (vi)** Use the two histograms to compare the central tendency and variation of the resting heart rates of 4-year-old children and 18-year-olds. **[3]**

Resting heart rate	Frequency
$35 \leq y < 50$	4
$50 \leq y < 60$	12
$60 \leq y < 70$	30
$70 \leq y < 75$	16
$75 \leq y < 85$	22
$85 \leq y < 105$	16

END OF QUESTION PAPER

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