

**ADVANCED SUBSIDIARY GCE  
MATHEMATICS (MEI)**  
Statistics 1

**4766**

Candidates answer on the Answer Booklet

**OCR Supplied Materials:**

- 8 page Answer Booklet
- Graph paper
- MEI Examination Formulae and Tables (MF2)

**Other Materials Required:**

None

**Monday 25 January 2010  
Morning**

**Duration:** 1 hour 30 minutes



**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that 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 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.
- 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**.
- This document consists of **8** pages. Any blank pages are indicated.

## Section A (36 marks)

- 1 A camera records the speeds in miles per hour of 15 vehicles on a motorway. The speeds are given below.

73 67 75 64 52 63 75 81 77 72 68 74 79 72 71

- (i) Construct a sorted stem and leaf diagram to represent these data, taking stem values of 50, 60, ... [4]
- (ii) Write down the median and midrange of the data. [2]
- (iii) Which of the median and midrange would you recommend to measure the central tendency of the data? Briefly explain your answer. [2]
- 2 In her purse, Katharine has two £5 notes, two £10 notes and one £20 note. She decides to select two of these notes at random to donate to a charity. The total value of these two notes is denoted by the random variable £ $X$ .
- (i) (A) Show that  $P(X = 10) = 0.1$ . [1]
- (B) Show that  $P(X = 30) = 0.2$ . [2]

The table shows the probability distribution of  $X$ .

$r$	10	15	20	25	30
$P(X = r)$	0.1	0.4	0.1	0.2	0.2

- (ii) Find  $E(X)$  and  $\text{Var}(X)$ . [5]
- 3 In a survey, a large number of young people are asked about their exercise habits. One of these people is selected at random.
- $G$  is the event that this person goes to the gym.
  - $R$  is the event that this person goes running.
- You are given that  $P(G) = 0.24$ ,  $P(R) = 0.13$  and  $P(G \cap R) = 0.06$ .
- (i) Draw a Venn diagram, showing the events  $G$  and  $R$ , and fill in the probability corresponding to each of the four regions of your diagram. [3]
- (ii) Determine whether the events  $G$  and  $R$  are independent. [2]
- (iii) Find  $P(R | G)$ . [3]

4 In a multiple-choice test there are 30 questions. For each question, there is a 60% chance that a randomly selected student answers correctly, independently of all other questions.

(i) Find the probability that a randomly selected student gets a total of exactly 20 questions correct. [3]

(ii) If 100 randomly selected students take the test, find the expected number of students who get exactly 20 questions correct. [2]

5 My credit card has a 4-digit code called a PIN. You should assume that any 4-digit number from 0000 to 9999 can be a PIN.

(i) If I cannot remember any digits and guess my number, find the probability that I guess it correctly. [1]

In fact my PIN consists of four different digits. I can remember all four digits, but cannot remember the correct order.

(ii) If I now guess my number, find the probability that I guess it correctly. [2]

6 Three prizes, one for English, one for French and one for Spanish, are to be awarded in a class of 20 students.

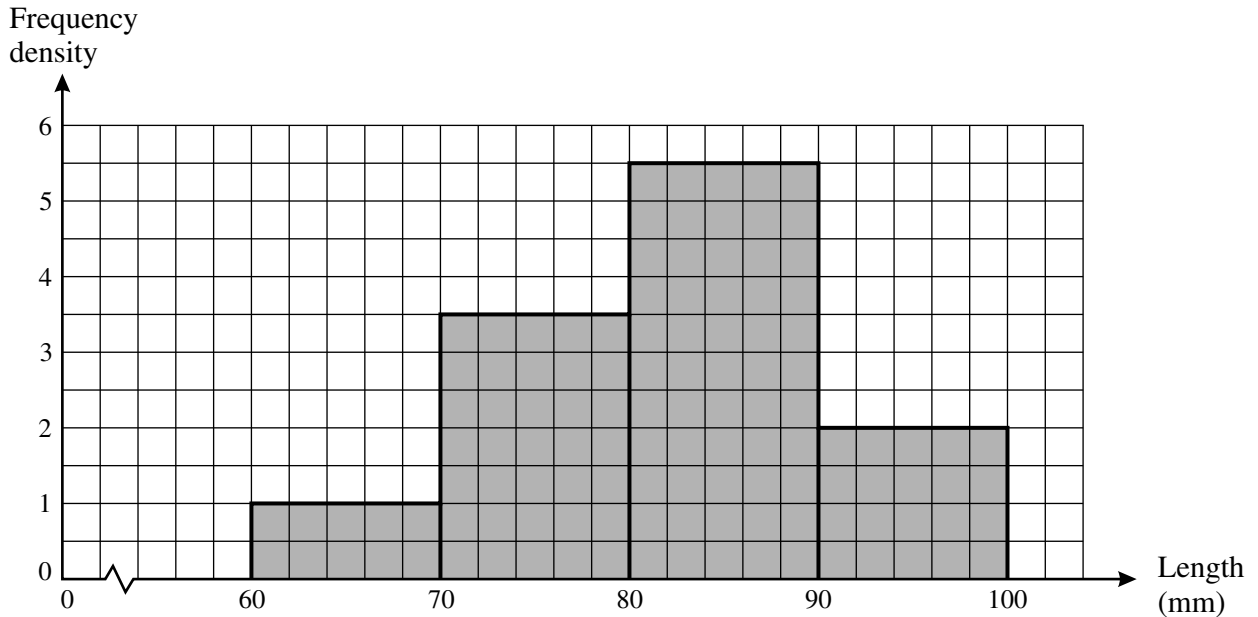
Find the number of different ways in which the three prizes can be awarded if

(i) no student may win more than 1 prize, [2]

(ii) no student may win all 3 prizes. [2]

## Section B (36 marks)

- 7 A pear grower collects a random sample of 120 pears from his orchard. The histogram below shows the lengths, in mm, of these pears.



- (i) Calculate the number of pears which are between 90 and 100 mm long. [2]
- (ii) Calculate an estimate of the mean length of the pears. Explain why your answer is only an estimate. [4]
- (iii) Calculate an estimate of the standard deviation. [3]
- (iv) Use your answers to parts (ii) and (iii) to investigate whether there are any outliers. [4]
- (v) Name the type of skewness of the distribution. [1]
- (vi) Illustrate the data using a cumulative frequency diagram. [5]

- 8 An environmental health officer monitors the air pollution level in a city street. Each day the level of pollution is classified as low, medium or high. The probabilities of each level of pollution on a randomly chosen day are as given in the table.

Pollution level	Low	Medium	High
Probability	0.5	0.35	0.15

- (i) Three days are chosen at random. Find the probability that the pollution level is
- (A) low on all 3 days, [2]
- (B) low on at least one day, [2]
- (C) low on one day, medium on another day, and high on the other day. [3]
- (ii) Ten days are chosen at random. Find the probability that
- (A) there are no days when the pollution level is high, [2]
- (B) there is exactly one day when the pollution level is high. [3]

The environmental health officer believes that pollution levels will be low more frequently in a different street. On 20 randomly selected days she monitors the pollution level in this street and finds that it is low on 15 occasions.

- (iii) Carry out a test at the 5% level to determine if there is evidence to suggest that she is correct. Use hypotheses  $H_0: p = 0.5$ ,  $H_1: p > 0.5$ , where  $p$  represents the probability that the pollution level in this street is low. Explain why  $H_1$  has this form. [5]

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