

**ADVANCED SUBSIDIARY GCE UNIT
MATHEMATICS (MEI)**

4766/01

Statistics 1

FRIDAY 12 JANUARY 2007

Morning

Time: 1 hour 30 minutes

Additional Materials:

Answer booklet (8 pages)

Graph paper

MEI Examination Formulae and Tables (MF2)

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Answer **all** the questions.
- 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.
- The total number of marks for this paper is 72.

ADVICE TO CANDIDATES

- Read each question carefully and make sure you know what you have to do before starting your answer.
- 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.

This document consists of **6** printed pages and **2** blank pages.

Section A (36 marks)

- 1 The total annual emissions of carbon dioxide, x tonnes per person, for 13 European countries are given below.

6.2 6.7 6.8 8.1 8.1 8.5 8.6 9.0 9.9 10.1 11.0 11.8 22.8

- (i) Find the mean, median and midrange of these data. [4]
- (ii) Comment on how useful each of these is as a measure of central tendency for these data, giving a brief reason for each of your answers. [3]

- 2 The numbers of absentees per day from Mrs Smith's reception class over a period of 50 days are summarised below.

Number of absentees	0	1	2	3	4	5	6	>6
Frequency	8	15	11	8	3	4	1	0

- (i) Illustrate these data by means of a vertical line chart. [2]
- (ii) Calculate the mean and root mean square deviation of these data. [3]
- (iii) There are 30 children in Mrs Smith's class altogether. Find the mean and root mean square deviation of the number of children who are present during the 50 days. [2]

- 3 The times taken for 480 university students to travel from their accommodation to lectures are summarised below.

Time (t minutes)	$0 \leq t < 5$	$5 \leq t < 10$	$10 \leq t < 20$	$20 \leq t < 30$	$30 \leq t < 40$	$40 \leq t < 60$
Frequency	34	153	188	73	27	5

- (i) Illustrate these data by means of a histogram. [5]
- (ii) Identify the type of skewness of the distribution. [1]

- 4 A fair six-sided die is rolled twice. The random variable X represents the higher of the two scores. The probability distribution of X is given by the formula

$$P(X = r) = k(2r - 1) \text{ for } r = 1, 2, 3, 4, 5, 6.$$

- (i) Copy and complete the following probability table and hence find the exact value of k , giving your answer as a fraction in its simplest form. [3]

r	1	2	3	4	5	6
$P(X = r)$	k					$11k$

- (ii) Find the mean of X . [2]

A fair six-sided die is rolled three times.

- (iii) Find the probability that the total score is 16. [3]

- 5 Each day the probability that Ashwin wears a tie is 0.2. The probability that he wears a jacket is 0.4. If he wears a jacket, the probability that he wears a tie is 0.3.

- (i) Find the probability that, on a randomly selected day, Ashwin wears a jacket and a tie. [2]

- (ii) Draw a Venn diagram, using one circle for the event 'wears a jacket' and one circle for the event 'wears a tie'. Your diagram should include the probability for each region. [3]

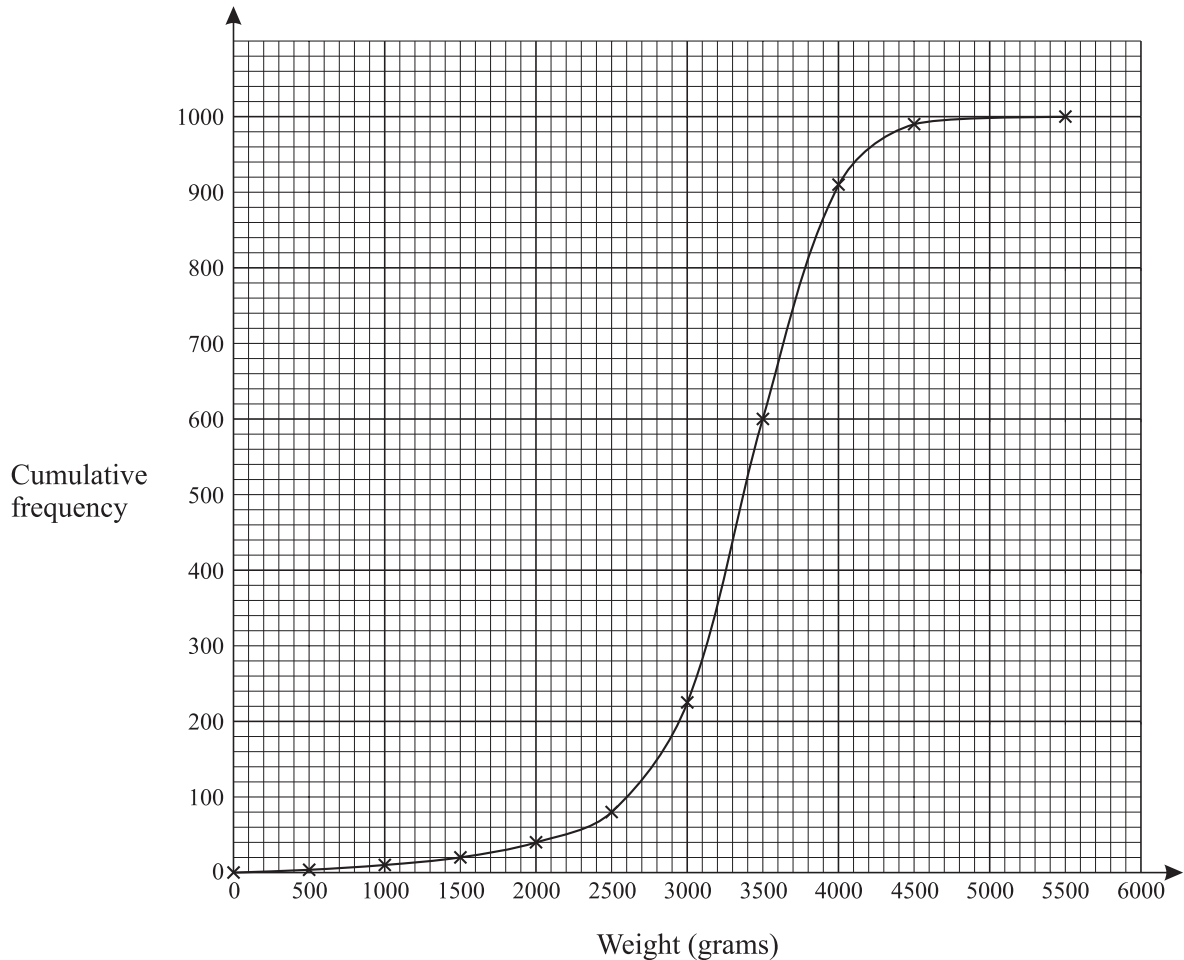
- (iii) Using your Venn diagram, or otherwise, find the probability that, on a randomly selected day, Ashwin

(A) wears either a jacket or a tie (or both),

(B) wears no tie or no jacket (or wears neither). [3]

Section B (36 marks)

- 6 The birth weights in grams of a random sample of 1000 babies are displayed in the cumulative frequency diagram below.



- (i) Use the diagram to estimate the median and interquartile range of the data. [3]
- (ii) Use your answers to part (i) to estimate the number of outliers in the sample. [4]
- (iii) Should these outliers be excluded from any further analysis? Briefly explain your answer. [2]
- (iv) Any baby whose weight is below the 10th percentile is selected for careful monitoring. Use the diagram to determine the range of weights of the babies who are selected. [2]
- 12% of new-born babies require some form of special care. A maternity unit has 17 new-born babies. You may assume that these 17 babies form an independent random sample.
- (v) Find the probability that
- (A) exactly 2 of these 17 babies require special care, [3]
- (B) more than 2 of the 17 babies require special care. [3]
- (vi) On 100 independent occasions the unit has 17 babies. Find the expected number of occasions on which there would be more than 2 babies who require special care. [1]

7 When onion seeds are sown outdoors, on average two-thirds of them germinate. A gardener sows seeds in pairs, in the hope that at least one will germinate.

(i) Assuming that germination of one of the seeds in a pair is independent of germination of the other seed, find the probability that, if a pair of seeds is selected at random,

(A) both seeds germinate,

(B) just one seed germinates,

(C) neither seed germinates. [3]

(ii) Explain why the assumption of independence is necessary in order to calculate the above probabilities. Comment on whether the assumption is likely to be valid. [2]

(iii) A pair of seeds is sown. Find the expectation and variance of the number of seeds in the pair which germinate. [3]

(iv) The gardener plants 200 pairs of seeds. If both seeds in a pair germinate, the gardener destroys one of the two plants so that only one is left to grow. Of the plants that remain after this, only 85% successfully grow to form an onion. Find the expected number of onions grown from the 200 pairs of seeds. [3]

If the seeds are sown in a greenhouse, the germination rate is higher. The seed manufacturing company claims that the germination rate is 90%. The gardener suspects that the rate will not be as high as this, and carries out a trial to investigate. 18 randomly selected seeds are sown in the greenhouse and it is found that 14 germinate.

(v) Write down suitable hypotheses and carry out a test at the 5% level to determine whether there is any evidence to support the gardener's suspicions. [7]