OCR
RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE UNIT **G241/01**

MEI STATISTICS

Statistics 1 (Z1)

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)	$0 \leqslant t < 5$	$5 \leqslant t < 10$	$10 \leqslant t < 20$	$20 \leqslant t < 30$	$30 \leqslant t < 40$	$40 \leqslant t < 60$
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]

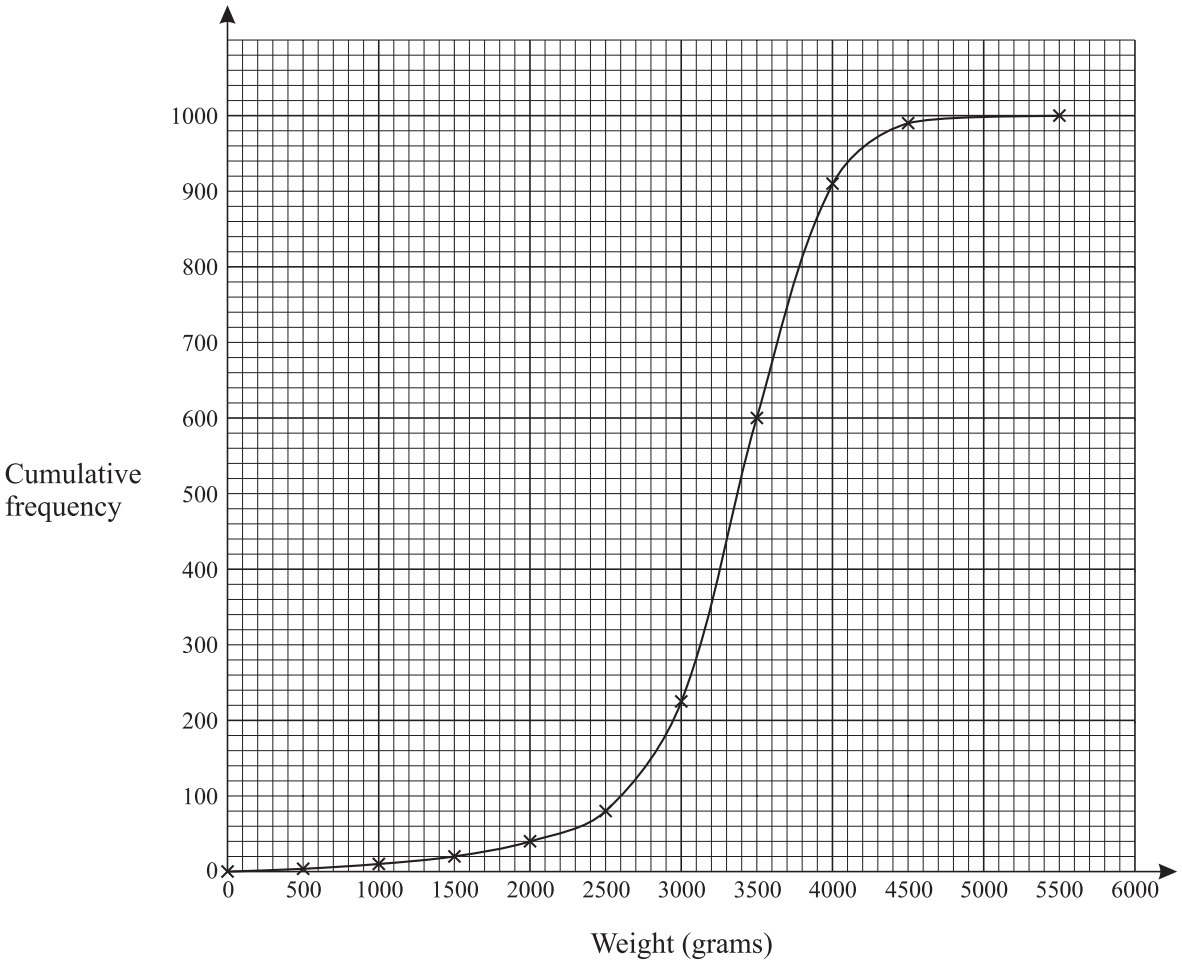
(iii) Using your Venn diagram, or otherwise, find the probability that, on a randomly selected day, Ashwin

(*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]

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