MEI STRUCTURED MATHEMATICS   **2613**

Statistics 1

Thursday	**12 JANUARY 2006**	Afternoon	1 hour 20 minutes

Additional materials:
    8 page answer booklet
    Graph paper
    MEI Examination Formulae and Tables (MF12)

TIME   1 hour 20 minutes

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.
- You are advised that an answer may receive **no marks** unless sufficient detail of the working is shown to indicate that a correct method is being used.
- The total number of marks for this paper is 60.

This question paper consists of 4 printed pages.

1 Mrs Richards has parental-control software which monitors the time that her daughter Claire spends each day in internet chat rooms. During the first three weeks of March, Claire spends a total of 495 minutes in chat rooms. Her daily times, recorded to the nearest minute, are as follows.

32	14	0	19	52	0	16
23	29	53	0	35	16	2
18	63	0	41	19	35	28

  (i) Construct a stem and leaf diagram with seven stems to illustrate the data. Comment briefly on the shape of the distribution. [4]

 (ii) Find the mean, median and mode of the data. Briefly comment on how useful each of these is as a measure of central tendency for the data. [5]

(iii) Calculate the interquartile range, and hence determine whether there are any outliers. Show your method clearly. [5]

(iv) Each month, Mrs Richards only allows Claire to spend an average (i.e. mean) of 20 minutes per day in chat rooms. How many minutes on average can Claire spend in chat rooms in each of the remaining 10 days of March, if her daily average for the month is not to exceed 20 minutes? [2]

[Total 16]

2 Pedro is playing squash against his friend.

- If Pedro wins a point, the probability that he wins the next point is 0.7.
- If Pedro loses a point, the probability that he wins the next point is 0.4.

In a particular game, Pedro has won the first point.

  (i) Draw a probability tree diagram for Pedro winning and losing the second, third and fourth points. [3]

 (ii) Find the probability that Pedro either wins all three of these points or loses all three of them. [3]

(iii) Find the probability that Pedro wins the fourth point. [4]

(iv) Given that Pedro wins the fourth point, find the conditional probability that he won the second point. [4]

[Total 14]

3 A shift system is in operation at a large factory. During each 24-hour period there are three shifts: morning, afternoon and night. The numbers of workers in each shift on a particular day are as follows.

Morning	Afternoon	Night
487	623	314

A stratified random sample of size 50 is to be selected from these workers to investigate job satisfaction in the workforce.

(i) (*A*) Calculate the number of workers from each shift who should be selected for the sample, if each shift is represented proportionally. [2]

   (*B*) Describe briefly how the workers could be selected within each shift. [2]

(ii) Suggest one advantage and one disadvantage of stratified sampling as compared to simple random sampling. [2]

On the same day there are a total of 20 supervisors on duty altogether on the three shifts. As part of the investigation, three supervisors are selected to be interviewed. The numbers of supervisors on each shift are as follows.

Morning	Afternoon	Night
6	10	4

(iii) (*A*) In how many ways can three supervisors be selected if one is chosen from each shift? [2]

   (*B*) In how many ways can three supervisors be selected irrespective of their shift? [2]

(iv) If the three supervisors are selected at random from the 20, find the probability that

   (*A*) each one is from a different shift, [2]

   (*B*) all three are from the same shift. [3]

[Total 15]

[Turn over

4   The probability that a medicinal drug, in tablet form, will cause nausea as a side effect in patients is 0.35. A medical researcher selects a random sample of 20 patients who have been given the drug in tablet form.

  (i)   Find the expected number of people in the sample who have experienced nausea.   [2]

  (ii) Find the probability that exactly 4 of the 20 patients have experienced nausea.   [3]

  (iii) Find the probability that at least 8 of the 20 patients have experienced nausea.   [2]

A doctor believes that taking the drug in liquid form can reduce the probability of nausea as a side effect. A trial is carried out in which 16 patients are given the drug in liquid form. The doctor plans to carry out a hypothesis test, at the 5% level, to examine the claim.

  (iv) State suitable null and alternative hypotheses for the test.   [2]

  (v)   Find the critical region for the test. State a condition required for the test to be valid.   [4]

  (vi) Originally the doctor had planned to carry out the trial using n patients. Find the greatest and least values of n for which the critical region for the test at the 5% level is just {0}.   [2]

[Total 15]