STATISTICS	**4040/2**
PAPER 2	
OCTOBER/NOVEMBER SESSION 2001	2 hours 15 minutes

Additional materials:
   Answer paper
   Graph paper (3 sheets)
   Mathematical tables
   Pair of compasses
   Protractor

TIME   2 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all** questions in Section A and not more than **four** questions from Section B.

Write your answers on the separate answer paper provided.

If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The use of an electronic calculator is expected in this paper.

This question paper consists of 7 printed pages and 1 blank page.

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Section A [36 marks]

Answer **all** of the questions 1 to 6.

1 An examination syllabus required that candidates should carry out an extended investigation which was expected to take up to 30 hours of work. A number of students recorded the total time, t hours, spent on their investigations. The table summarises their recorded total times.

Total time (hours)	Number of students
$10 \leqslant t < 15$	2
$15 \leqslant t < 20$	9
$20 \leqslant t < 25$	15
$25 \leqslant t < 30$	18
$30 \leqslant t < 40$	9
$t \geqslant 40$	3

  (i) Calculate the median time spent on the investigation by the 56 students, giving your answer in hours, correct to 1 decimal place.   [3]

  (ii) Calculate the interquartile range for the time spent by the students, giving your answer in hours, correct to 1 decimal place.   [5]

2 **(i)** State two reasons for calculating **moving averages.**   [2]

  (ii) Explain what is meant by **centering** moving averages.   [1]

  (iii) State when it is necessary to **centre** moving averages.   [1]

3 **(a)** Two events A and B are known to be *mutually exclusive*.

         P(A) = 0.50, and P(B) = 0.25.

    (i) Write down the value of P(A and B).   [1]

    (ii) Write down the value of P(A or B).   [1]

  (b) A fair die is thrown twice. Find the probability that the result of the two throws will be an even number followed by either a 5 or a 6.   [3]

4 A teacher wished to add the marks gained by each student in two subjects, History and Geography, in order to award a school prize. She decided to scale the marks in each subject to a mean of 60 and a standard deviation of 12 before adding the results. The original marks for two students, Amos and Barbara, are shown in the table below, together with the mean and standard deviation of the marks gained by all the students in each subject. Barbara's mark for Geography has been omitted, but it is known that, after scaling, Amos and Barbara obtained the same total marks for the two subjects.

	History	*Geography*
Amos	71	50
Barbara	79	
Mean	59	50
Standard deviation	8	18

(i) Calculate the scaled marks in History for both Amos and Barbara. [3]

(ii) Determine Amos' scaled mark for Geography. [1]

(iii) Hence calculate Barbara's original mark for Geography. [3]

5 (i) Explain the difference between a *discrete variable* and a *continuous variable.* [2]

The following examples of variables were given as answers by students:
A The number of aces served by individual players during a tennis tournament.
B The colour of medals awarded at the Olympic Games.
C The exact distance jumped by long jumpers at an athletics championship.

(ii) For each of the three variables, state whether it is *continuous* or *discrete*. [3]

(iii) For each of the three variables, state whether it is *quantitative* or *qualitative*. [3]

6 (i) State briefly one advantage and one disadvantage of using the *median* as a measure of central tendency. [2]

(ii) State briefly one advantage and one disadvantage of using the *mean* as a measure of central tendency. [2]

[Turn over

Section B [64 marks]

Answer not more than **four** of the questions 7 to 11.

Each question in this section carries 16 marks.

7   In a game a player throws two dice. One of them has six faces numbered 2, 3, 4, 4, 6 and 6. The other die has eight faces numbered 1, 2, 3, 4, 5, 6, 7 and 8. Each die is fair. Both dice are thrown.

   (i)   Calculate the probability that the same number will be scored on each of them (i.e. a double will be scored). [3]

   (ii)   Show that there are six ways of scoring a total of 10 on the two dice. [2]

   (iii)   List all the possible total scores. [1]

   (iv)   Tabulate the possible total scores and their associated probabilities. [4]

   The owner of the dice charges players 50p to throw the two dice once and pays out prizes for certain total scores as follows:

A double	20p
Total of 11	50p
Total of 13 or 14	£1(i.e. 100p)
Total of 3	£2

   (v)   Calculate a player's expected prize if he throws the two dice once. Give your answer in pence, correct to 1 decimal place. [3]

   (vi)   Calculate the expected profit the owner will make if 50 players each throw the two dice once. Give your answer correct to the nearest penny. [2]

   (vii)   State how much the owner should charge each player to make this a **fair** game. Give your answer correct to the nearest penny. [1]

8 A campsite owner in France recorded the countries of origin of visiting families in 1998 and in 1999. The results are summarised in the table below showing the number of families who visited the campsite.

	1998	1999
France	240	275
Germany	226	240
United Kingdom	192	245
Spain	120	105
Rest of Europe	105	80

   (i) On graph paper, using a scale of 2 cm to represent 50 families, draw a dual bar chart to display these data, comparing the two years for each of the countries. [4]

   (ii) Showing your working clearly, calculate, correct to 1 decimal place, the percentage of visiting families from each country for each of the two years. Tabulate your results. [5]

   (iii) On graph paper, using a scale of 2 cm to represent 10%, draw a percentage sectional bar chart using the results from your table in **(ii)**. [5]

   (iv) Comment briefly on the advantages and disadvantages of the two bar charts in displaying information about visitors to this campsite. [2]

9 In order to calculate a weighted aggregate cost of motoring index, a man divided his expenditure into three categories: Insurance and Road Tax; Maintenance; Fuel.

To estimate weights, he looked at data for 1998 and recorded the following items.

   Insurance and Road Tax cost £490.
   Maintenance cost £30 per 1000 km travelled.
   Fuel cost 70p per litre.   (100p = £1)
   Total distance travelled was 18 000 km.
   Fuel consumption was 7.4 litres per 100 km.

   (i) By considering the costs, to the nearest £50, for each of the three categories in 1998, estimate suitable weights to use in calculating the cost of motoring index. [6]

The price relative, taking 1998 as base year, for the year 2001 for Insurance and Road Tax is 112. The price relative for maintenance is 109. Fuel prices have increased to 80.5p per litre.

   (ii) Using the weights calculated in **(i)**, calculate a weighted aggregate cost of motoring index for the year 2001. Give your answer correct to 1 decimal place. [5]

   (iii) Given that the man's total expenditure on motoring in 1998, to the nearest £10, was £1940, estimate, to the nearest £10, his total expenditure for the year 2001. [2]

   (iv) Give two possible reasons why the estimate in **(iii)** could be very unrealistic. [3]

[Turn over

10 The numbers of units of electricity used each quarter by a household in England over the period from 1st October 1996 to 31st March 1999 are shown in the table below.

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1996				658
1997	536	552	547	681
1998	665	654	439	756
1999	609			

(i) Using a scale of 2 cm to represent one quarter on the horizontal axis, which needs to be on the long side of the paper, and a scale of 4 cm to represent 100 units of electricity, starting at 400, draw, on graph paper, a graph to display these data. Join plots for consecutive quarters with straight lines. [4]

(ii) Calculate **centred** moving averages to eliminate the seasonal variation. [5]

(iii) Plot these **centred** moving averages on your graph. [3]

(iv) Draw a straight trend line through these **centred** moving averages. [1]

(v) Write down the number of units which your trend line would give you for the second quarter of 1999. [1]

(vi) Give two reasons why this answer to **(v)** is unlikely to be a good estimate of the number of units of electricity used in the second quarter of 1999. [2]

11 Of 130 students beginning an A-level course at Ayton College in 1998, 72 were boys. These 72 boys included 42 who had attended Ayton College in the previous year. Of the other boys 16 had attended Beaton School, 9 had attended Corston School and 5 had attended Deeham School which was for boys only. Of the girls 28 had attended Ayton College, 10 had attended Beaton School, 12 had attended Corston School and the remainder had attended Eastburgh School which was for girls only.

(i) Copy and complete the table below, using the given data.

	Ayton	Beaton	Corston	Deeham	Eastburgh	Total
Boys						72
Girls						
Total						130

[4]

Giving your answers as exact fractions or decimals, correct to 3 decimal places, find the probability that, for students starting an A-level course at Ayton College in 1998

(ii) a student, chosen at random, attended Beaton School in the previous year, [1]

(iii) a student, chosen at random, attended a single sex school in the previous year, [1]

(iv) two students, chosen at random, had both attended Corston School in the previous year, [3]

(v) two boys, chosen at random, had both attended Beaton School in the previous year, [3]

(vi) a student, chosen at random, was either a girl or was a student who had attended Deeham School in the previous year, [2]

(vii) a student, chosen at random, was either a boy or was a student who had attended Ayton College in the previous year. [2]

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