CAMBRIDGE INTERNATIONAL EXAMINATIONS
Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level

STATISTICS   **4040/2**

PAPER 2
                                          OCTOBER/NOVEMBER SESSION 2002

                                                       2 hours 15 minutes

Additional materials:
    Answer paper
    Graph paper (2 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 9 printed pages and 3 blank pages.

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate   **[Turn over**

Section A [36 marks]

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

1   A student carried out an investigation to determine the quantity of fuel, x litres, purchased by 120 motorists on visits to a petrol station.

The table below shows the data recorded by the student.

Quantity of fuel (x litres)	Number of motorists
$2 \leqslant x < 5$	3
$5 \leqslant x < 10$	5
$10 \leqslant x < 15$	8
$15 \leqslant x < 20$	12
$20 \leqslant x < 24$	17
$24 \leqslant x < 28$	19
$28 \leqslant x < 32$	24
$32 \leqslant x < 40$	20
$40 \leqslant x < 60$	12

   (i) Calculate the median quantity of fuel purchased by the motorists, giving your answer in litres, correct to 1 decimal place. [3]

   (ii) Calculate the interquartile range for the quantity of fuel purchased by the motorists, giving your answer in litres, correct to 1 decimal place. [5]

2   **(i)** Give an example of two events A and B which are such that

$$P(A \text{ and } B) = P(A) \times P(B).$$ [2]

   (ii) State the name given to events of the kind defined in **(i)**. [1]

3   A school has the opportunity of taking 100 pupils to a special event. The school has four year-groups, *A*, *B*, *C* and *D* with 88, 96, 104 and 112 pupils respectively.

  (i) Find the probability that, if 100 pupils are chosen at random from the school, a particular pupil in year *D* will be chosen. [1]

The head teacher decided to take 25 pupils, chosen at random, from each year-group.

  (ii) Find the probability that a particular pupil in year *D* will be chosen. [1]

 (iii) State why this system is unfair to pupils in years *C* and *D*. [1]

 (iv) Calculate the number of pupils which should be chosen from each year-group if the head teacher makes allowance for the different sized year-groups. [2]

4   When candidates in an examination were asked to give an example of a discrete variable, the following five examples were offered by some candidates.

  A   The colour of new cars made by the Ford motor company in the year 2000.

  B   The distance, measured to the nearest centimetre, jumped by competitors in a long jump competition.

  C   The number of red cars parked in a town car park at different times of the week.

  D   The length of different leaves on a tree.

  E   The number of rooms in my house.

  (i) State which two of these examples are **not** discrete variables and in each case give a reason. [4]

  (ii) For each of the other three examples, state whether it is a *qualitative* or a *quantitative* variable. [3]

[Turn over

5 In order to award a languages prize among students who study different combinations of two languages, a teacher scales the original marks in each language examination to a mean of 70 with a standard deviation of 8. She then adds the scaled marks for each student.

The table below shows the original marks for three students, Alan, Beryl and Charles in each of their two languages, together with the mean and standard deviation for all students in each language.

	Language		
	French	German	Spanish
Alan	75	—	74
Beryl	—	59	80
Charles	80	59	—
Mean	70	62	74
Standard deviation	10	12	8

(i) Copy the following table of scaled marks and, after performing the necessary calculations, fill in the four blank spaces.

	French	German	Spanish
Alan	74	—	
Beryl	—	68	
Charles			—

[5]

(ii) Hence show that the student with the highest total of original marks does not win the prize. [2]

6 When illustrating the use of moving averages, three students *F*, *G* and *H*, carry out the following calculations.

F Four-quarter moving averages on the quarterly electricity consumption of a particular household.

G Seven-year moving averages on annual sales figures for a clothing manufacturer.

H Twelve-month moving averages on the monthly rainfall at a particular location.

(i) For each of the three students, state whether or not it is necessary to centre these moving averages. In each case give a brief reason. [3]

(ii) For each of the three students, state what kind of variation the student is attempting to eliminate by calculating the moving averages. [3]

Section B [64 marks]

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

Each question in this section carries 16 marks.

7 A student, carrying out an investigation to calculate a weighted aggregate cost of living index, obtained data on four food items, Bread, Vegetables, Meat and Dairy products, purchased by a family. The price relatives obtained by the student for these four food items for each of the years 1995, 2000 and 2002 are shown in the table below.

	1995	2000	2002
Bread	100	110	114
Vegetables	100	106	100
Meat	100	120	130
Dairy products	100	130	126

  (i) Explain the significance of the 100's in the column of price relatives for 1995. [2]

 (ii) State what the 100 for Vegetables in 2002 implies. [1]

(iii) Calculate, correct to 2 decimal places, the price relatives for each of the four food items for 2002, taking 2000 as the base year. [4]

The student, using total expenditure in 1995 for each of the four food items, also determined weights for Bread, Vegetables, Meat and Dairy products as 15, 8, 22 and 30 respectively.

(iv) Using your price relatives from **(iii)** and the weights determined by the student calculate, to 1 decimal place, a weighted aggregate cost of living index for 2002, taking 2000 as the base year. [4]

A friend of the student was checking through the calculations and realised that the weights were in fact based on **quantities** purchased rather than expenditure.

 (v) Using the **quantity** weights with the price relatives from the original table calculate, correct to 1 decimal place, a weighted aggregate cost of living index for 2002, taking 2000 as the base year. [4]

(vi) Comment briefly on your answers to **(iv)** and **(v)**. [1]

[Turn over

**8** **In this question answers which are probabilities should be given correct to 3 decimal places.**

The table below shows the number of boys and girls attending some extra activities offered to pupils in two year-groups, year 4 and year 5, at a junior school.

	Year 4		Year 5	
	Boys	Girls	Boys	Girls
Swimming club	9	12	15	18
Football coaching	24	3	28	2
Dancing classes	4	20	0	10
Chess club	10	2	5	3
Musical instrument lessons	26	32	24	35

There are, in total, 64 boys and 52 girls in year 4, and 53 boys and 60 girls in year 5.

(i) State what you can deduce from the fact that the total number of boys in the table is greater than 117. [1]

(ii) A pupil is chosen at random from all the pupils in years 4 and 5. Find the probability that this pupil attends the swimming club. [2]

(iii) A boy is chosen at random from the two year-groups. Find the probability that he attends the swimming club. [2]

(iv) Two boys are chosen at random from year 4. Find the probability that both of these boys attend football coaching. [3]

(v) Two girls are chosen at random, one from each of the two year-groups. Find the probability that both of these girls attend dancing classes. [3]

(vi) One boy and one girl are chosen at random from year 5. Find the probability that one of them, but not both, attends the chess club. [3]

(vii) A girl is chosen at random from those girls who attend musical instrument lessons. Find the probability that she is in year 4. [2]

9 In a language school each student chooses to study two of the languages French(F), Spanish(S) and German(G). The sectional bar chart below shows the percentages, to the nearest integer, of boys and girls studying each combination of languages.
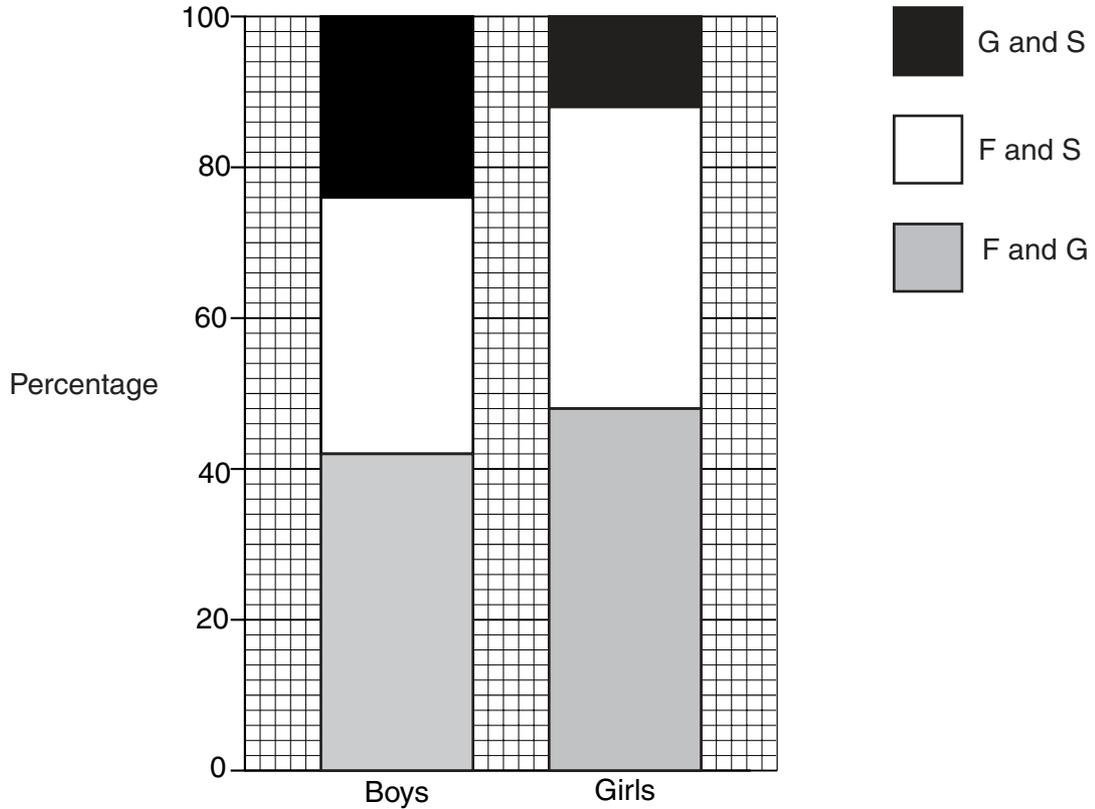
   (i) Write down the percentage of boys studying each of the combinations. [1]

  (ii) Write down the percentage of girls studying each of the combinations. [1]

There are 230 boys and 170 girls in the school.

 (iii) Find the percentage, to the nearest integer, of students who study French. [3]

 (iv) Calculate separately the number of boys and the number of girls who study each of the three languages, French, Spanish and German. [4]

  (v) Draw, on graph paper, a dual bar chart to compare the numbers of boys and girls studying each of the three languages. [5]

 (vi) State two advantages of the dual bar chart drawn in **(v)** over the sectional bar chart given in the question, for displaying data about the students' choice of languages. [2]

[Turn over

10 The owner of a general store, which is open seven days a week, recorded the total amount of money, to the nearest $10, spent in his store each day over a period of twenty-four days.These data, together with the owner's calculations of seven-day moving averages, are shown in the table with two missing numbers indicated as *p* and *q*.

	Day	Total money spent	7-day moving average
Week 1	Sunday	950	
	Monday	1200	
	Tuesday	1160	
	Wednesday	970	1058.6
	Thursday	710	1061.4
	Friday	1020	1065.7
	Saturday	1400	1067.1
Week 2	Sunday	970	1072.9
	Monday	1230	1074.3
	Tuesday	1170	1078.6
	Wednesday	1010	1081.4
	Thursday	720	1088.6
	Friday	1050	*p*
	Saturday	1420	1092.9
Week 3	Sunday	1020	1098.6
	Monday	1240	1102.9
	Tuesday	*q*	1110.0
	Wednesday	1050	1112.9
	Thursday	750	1117.1
	Friday	1100	1121.4
	Saturday	1440	1124.3
Week 4	Sunday	1050	
	Monday	1270	
	Tuesday	1210	

(i) State why there is no need to centre the moving averages. [1]

(ii) Calculate the value of *p*. [2]

(iii) Calculate the value of *q*. [2]

(iv) Draw, on graph paper, a graph showing the total amount spent each day. Use a scale on the *x*-axis, which should be on the long side of the graph paper, of 1 cm to represent one day. Use a scale on the *y*-axis, which must extend from $700 to $1500, of 2 cm to represent $100. Plots for consecutive days should be joined with straight lines. [4]

(v) Plot the moving averages on your graph and draw a straight line to show the trend. [3]

(vi) By reading the point on your trend line for Sunday of week 4 and doing the necessary calculations, estimate the total spent in the store on Wednesday of week 4. [2]

(vii) State two conclusions about the variation in total amount spent each day which you can make from your graph. [2]

11 In a gambling game a player's 'turn' consists of first drawing a card from a standard pack of 52 playing cards and then throwing a fair six-sided die. The player's score is then calculated as follows:

If the card is a club, the score is zero.

If the card is a diamond, the score is the number on the die.

If the card is a heart, the score is twice the number on the die.

If the card is a spade, the score is three times the number on the die.

(i) List the possible scores that the player can obtain in a single turn. [2]

(ii) List the number of ways in which each score can be obtained. [2]

(iii) Tabulate the possible scores and their associated probabilities, leaving your probabilities as fractions. [2]

The owner of the cards and the die offers the following prizes for each turn.

Score 0 or 6	no prize
Score 2, 3, 4 or 12	$10 prize
Any other possible score	$20 prize

(iv) Calculate, correct to 1 decimal place, the player's expected prize in one turn. [3]

(v) State what charge the owner should make for each turn to make this a fair game. [1]

(vi) Show that the owner could also have made it a fair game by changing the $20 prize to $40 and charging $15 for a turn. [2]

(vii) Calculate the owner's expected loss if he charges $15 for a turn and changes the prizes to those in **(vi)** but removes all the club cards from the pack, thus removing the possibility of the score being zero. [4]

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