STATISTICS

4040/1

PAPER 1

OCTOBER/NOVEMBER SESSION 2002

2 hours 15 minutes

Additional materials:
Answer paper
Graph paper (4 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 10 printed pages and 2 blank pages.

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

[Turn over

Section A [36 marks]

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

1   A shop sells ice-cream in cones and in blocks. The owner of the shop kept a tally chart to record the number of ice-creams sold during a 5-day period. The tally chart is shown below.

	Number of cones	Number of blocks
Monday	ɯ̄ʇ ɪɪɪɪ	ɯ̄ʇ ɪ
Tuesday	ɯ̄ʇ ɯ̄ʇ ɪ ɯ̄ʇ ɯ̄ʇ	ɯ̄ʇ ɯ̄ʇ ɪɪɪɪ
Wednesday	ɯ̄ʇ ɯ̄ʇ ɯ̄ʇ ɪɪɪ	ɯ̄ʇ ɯ̄ʇ ɪɪ
Thursday	ɯ̄ʇ ɯ̄ʇ ɯ̄ʇ ɯ̄ʇ ɯ̄ʇ ɪɪ	ɯ̄ʇ ɪɪɪɪ
Friday	ɯ̄ʇ ɯ̄ʇ ɪɪɪɪ	ɯ̄ʇ ɪ

   (i)   State how many cones were sold on Wednesday.   [1]

   (ii) State how many ice-creams altogether were sold on Friday.   [1]

   (iii) State how many more cones than blocks were sold, in total, on Monday and Thursday.   [1]

   (iv) Find the probability, as a fraction in its lowest terms, that a person who bought an ice-cream on Tuesday bought a block.   [2]

2 There are four grades of workers in a certain factory. The table below shows the number of workers in each grade in 1978 and in 1988.

	1978	1988
Grade	Number of workers	Number of workers
1	170	425
2	160	330
3	150	285
4	120	192

The data for 1978 is to be illustrated by a pie chart.

(i) Calculate, in degrees, the sector angles of the pie chart. [2]

(ii) Draw the pie chart, using a circle of radius 5 cm, labelling each sector with the item it represents. [2]

(iii) Calculate, to 2 significant figures, the radius of a comparable pie chart which could be used to represent the data for 1988. [2]

3 The table below shows the distribution of the number of breakdowns of vehicles on a particular section of a motorway for the month of December 1999.

Number of breakdowns	0	1	2	3	4	5	10	13
Number of days	1	8	6	7	3	4	1	1

(i) State the median number of breakdowns per day. [1]

Calculate, giving your answers correct to 1 decimal place,

(ii) the mean number of breakdowns per day, [2]

(iii) the standard deviation of the number of breakdowns per day. [3]

[Turn over

4 The table below gives the results of a survey carried out in a small village and shows the number of families in each category.

For example, 7 families have 2 television sets and 3 or more radios.

		Number of television sets				
		0	1	2	3 or more	Total
Number of radios	0	3	45	39	5	92
	1	2	x	42	12	117
	2	4	8	10	6	28
	3 or more	0	4	7	2	13
	Total	9	118	98	25	

(i) Find the number represented by the letter x. [1]

(ii) Find the number of families which

   (a) have exactly 2 television sets, [1]

   (b) took part in the survey, [1]

   (c) have exactly 1 television set and 2 or more radios. [2]

5 **In this question all probabilities should be expressed as fractions in their lowest terms.**

An electrician has 12 coloured plugs in a container, of which 3 are white, 5 are red and 4 are green.

When plugs are needed the electrician makes a random selection from the container.

(i) State the probability that the first plug selected will be white. [1]

Two plugs are selected at random. Calculate the probability that

(ii) neither will be white, [2]

(iii) at least one will be white. [2]

Three plugs are selected at random.

(iv) Calculate the probability that one of each colour is chosen. [3]

6 A jigsaw puzzle was completed by 100 children and the time taken by each child was recorded. The frequency diagram below shows the distribution of the times taken by the children.
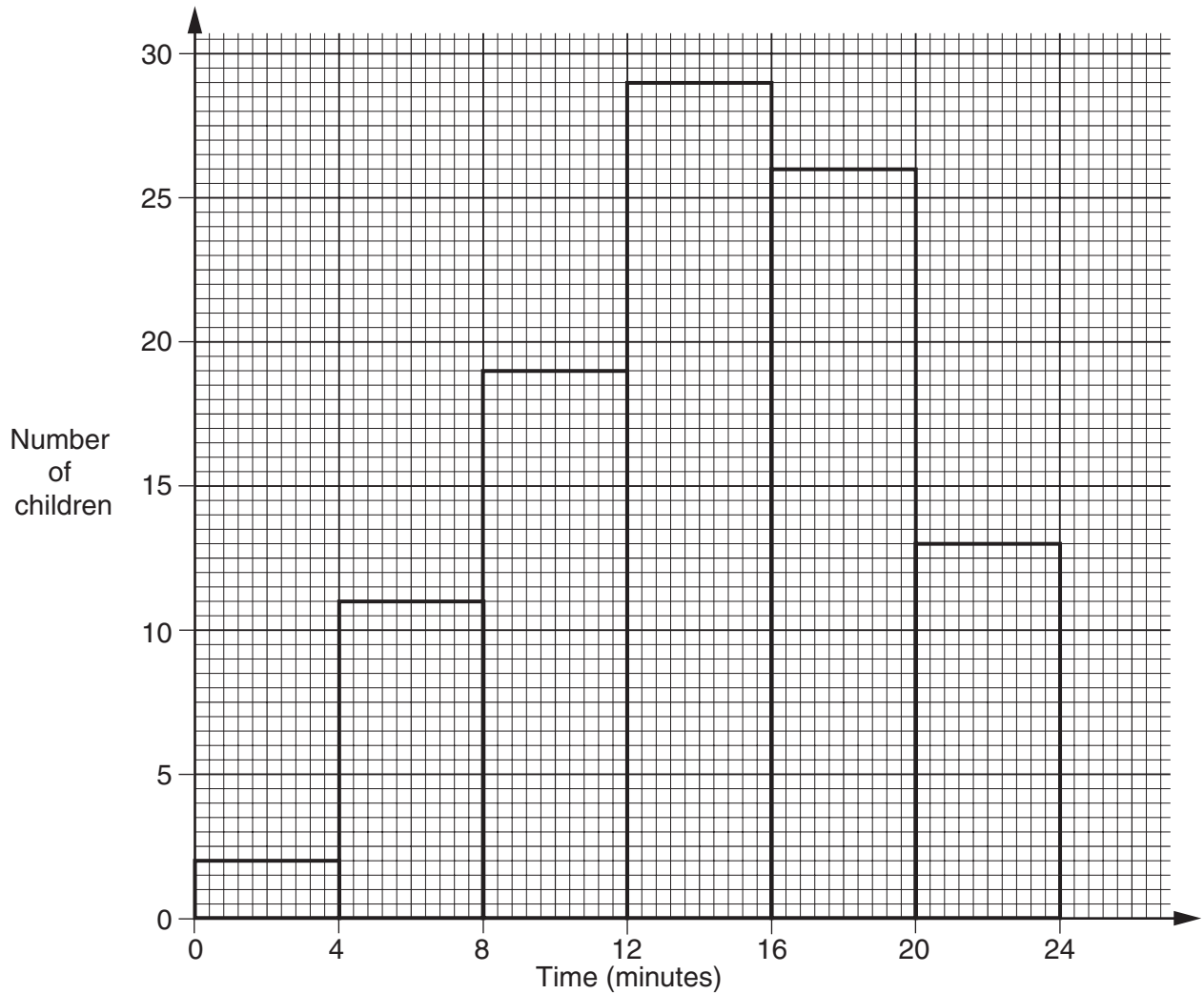
(i) Find the modal class of the distribution. [1]

(ii) Estimate the number of children who completed the jigsaw puzzle in

   (a) less than 8 minutes, [1]

   (b) more than 18 minutes. [1]

(iii) Calculate an estimate of the mean time taken by the children to complete the jigsaw puzzle. [3]

[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 **(a)** The data below relate to two seaside towns.

	SANDBOROUGH		SEABOURNE		
Age	Population	Number of deaths	Percentage of population	Death rate per 1000	Standard population
0−16	10 000	95	18%	8	20%
17−60	32 000	256	62%	12	45%
61 and over	12 000	540	20%	64	35%

- **(i)** Calculate the crude death rate for Sandborough. [2]

- **(ii)** Calculate the death rate for each of the 3 age groups in Sandborough. [3]

- **(iii)** Calculate the standardised death rate for Sandborough. [2]

- **(iv)** Calculate the crude death rate for Seabourne. [2]

- **(v)** Calculate the standardised death rate for Seabourne. [2]

- **(vi)** State, with a reason, which of the two towns offers the better chance of a longer life. [1]

(b) A group of pupils carried out a survey to find out how long pupils waited in the lunch queue on a particular day. They recorded the waiting time, to the nearest minute, for each of 45 pupils. The results are shown in the table below.

Time in minutes	1−2	3−4	5−6	7−8
Number of pupils	7	9	15	14

Using 2 cm to represent 1 minute on the horizontal axis and 2 cm to represent 2 pupils on the vertical axis, draw on graph paper a histogram illustrating the results of this survey. [4]

8 The lengths of 200 rods were measured to the nearest centimetre. The following table shows the grouped frequency distribution of the measured lengths.

Length (L cm)	Number of rods
$0 \leqslant L < 65$	2
$65 \leqslant L < 70$	6
$70 \leqslant L < 75$	18
$75 \leqslant L < 80$	48
$80 \leqslant L < 85$	64
$85 \leqslant L < 90$	46
$90 \leqslant L < 95$	14
$95 \leqslant L < 100$	2

(i) State the modal class for the length of the rods. [1]

(ii) Copy and complete the following table.

Upper class boundary								
Cumulative frequency	2							200

[2]

(iii) Using 2 cm to represent 5 cm on the horizontal axis, starting at 60 cm, and 2 cm to represent 20 rods on the vertical axis, draw on graph paper a cumulative frequency **polygon** to illustrate the distribution of the lengths of the rods. [5]

(iv) Using your cumulative frequency polygon, find the probability that a rod, chosen at random, measured between 72 cm and 88 cm. [3]

(v) Use your cumulative frequency polygon to obtain an estimate, to the nearest 0.5 cm, of

    (a) the median, [1]

    (b) the lower and upper quartiles, [2]

    (c) the interquartile range. [1]

(vi) State briefly a reason for finding the interquartile range. [1]

[Turn over

9 The table below shows the marks, x and y, of 10 students in Paper 1 and in Paper 2 of a statistics examination.

	Student									
	A	B	C	D	E	F	G	H	I	J
Paper 1 (x)	14	21	26	35	44	53	66	76	80	85
Paper 2 (y)	35	40	45	50	60	68	75	80	87	90

(i) Using 2 cm to represent 10 marks on both the horizontal axis and the vertical axis, plot on graph paper a scatter diagram of y against x. [4]

(ii) Calculate $(\bar{x}, \bar{y})$ and the two semi-averages and plot them on your scatter diagram. [6]

(iii) Hence draw the line of best fit on your scatter diagram. [1]

(iv) Given that the line of best fit is taken to be the trend for the performance of the students in the two examinations, state two candidates who did not do as well in Paper 2 as in Paper 1. [1]

(v) Estimate a mark for Paper 2 for a student who missed the Paper 2 examination, but who scored 48 in the Paper 1 examination. [1]

(vi) Find the equation of the line of best fit in the form $ax + by + c = 0$, where a, b and c are integers. [3]

10 (a) A box contains some red counters and some green counters. The probability that a counter taken at random out of the box is red is $\frac{1}{5}$.

   (i) State the smallest number of green counters that could be in the box. [1]

   Alex took two counters out of the box. Both of the counters were red.

   (ii) State the smallest number of green counters that could be in the box to make this possible. [1]

(b) A different box contains blue counters, yellow counters and white counters. The probability that a counter taken at random out of this box is yellow is $\frac{2}{5}$.

   Given that there are 20 counters in the box and that there is at least one counter of each of the three colours, calculate the greatest number of white counters that could be in the box. [3]

(c) Jasmin walks to school. Two shops A and B are located on the route from Jasmin's home to her school. The probability that Jasmin goes into shop A to buy a magazine is 0.2 and the probability that she goes into shop B to buy some fruit is 0.6.

   Jasmin sets off for school on Monday morning. Assuming that her decision to visit shop B is independent of her decision to visit shop A, calculate

   (i) the probability that she goes into both shops, [2]

   (ii) the probability that she goes into only one shop. [4]

   Sometimes Jasmin is late for school.

   The probability of this happening depends on whether she goes into either or both of shops A and B.

   If Jasmin goes into only one of the shops then the probability of her being late for school is 0.06.

   If Jasmin goes into both shops then the probability of her being late for school is 0.15.

   (iii) Calculate the probability that she is late for school on that Monday morning. [3]

   Jasmin walks to school for a total of 200 days each year.

   (iv) Assuming that she is not absent for any of the 200 days, calculate the number of days that she is likely to be late for school. [2]

[Turn over

11 A salesman recorded the distances, D km, that he travelled each day for 60 working days. The distances were grouped as shown in the table below.

Distance travelled (D km)	Number of days
$0 \leqslant D < 30$	18
$30 \leqslant D < 40$	14
$40 \leqslant D < 60$	16
$60 \leqslant D < 100$	8
$100 \leqslant D < 150$	4

(i) Using 2 cm to represent a distance of 20 km on the horizontal axis and a column of height 8 cm to represent the $40 \leqslant D < 60$ group of distances, draw on graph paper a histogram to illustrate the distribution of distances travelled each day by the salesman. [6]

(ii) From your histogram, find the modal class of the distribution. [1]

(iii) Write down the mid-values of each of the five groups of distances. [2]

(iv) Hence, showing all your working, calculate

(a) an estimate of the mean distance travelled each day by the salesman,

(b) an estimate, correct to 3 significant figures, of the standard deviation of the distances travelled each day by the salesman. [7]

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