UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

7407747594

STATISTICS **4040/23**

Paper 2 **October/November 2010**

2 hours 15 minutes

Candidates answer on the question paper.

Additional Materials: Mathematical tables
Pair of compasses
Protractor

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions in Section A and not more than **four** questions from Section B.
If working is needed for any question it must be shown below that question.
The use of an electronic calculator is expected in this paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **20** printed pages and **4** blank pages.

DC (NF/SW) 24565/4

UNIVERSITY *of* CAMBRIDGE International Examinations

[Turn over

Section A [36 marks]

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

For Examiner's Use

1 A class of 29 pupils was given a test, which was marked out of a total of 20.

The modal mark for the test was 12.

For each of the following statements, give a reason to justify that

A the statement is definitely true,

or *B* the statement is definitely false,

or *C* it is impossible to tell from the information above whether the statement is true or false.

(i) 12 pupils all scored the same mark as each other.

....

....

.... [2]

(ii) More pupils scored 12 marks than any other single mark.

....

....

.... [2]

(iii) 15 pupils scored 10 marks.

....

....

.... [2]

For Examiner's Use

2 Two six-sided unbiased dice, one red and one blue, each with sides numbered 1, 2, 3, 4, 5 and 6, are rolled. Four possible outcomes are as follows.

A The red dice shows a 3.

B The blue dice shows an even number.

C Both dice show the same number.

D The sum of the two numbers shown is 2.

(a) State a pair of outcomes from the above list which are

(i) mutually exclusive, ... [1]

(ii) independent. .... [1]

(b) Find the probability that the number shown on the red dice is greater than the number shown on the blue dice.

.... [3]

(c) **Without further calculation** state the probability that the number shown on the blue dice is greater than the number shown on the red dice.

.... [1]

For Examiner's Use

3 In a grouped frequency table, values of the variable are given in classes labelled 35 – under 45, 45 – under 55, 55 – under 65 etc.

Insert in the table below the true lower class limit and the true upper class limit of the 45 – under 55 class, if the values are

(i) the number of **whole** laps of a racing circuit completed by cyclists in the course of one hour, [2]

(ii) the lengths of the leaves on a plant, measured to the nearest mm, [2]

(iii) the number of inhabitants in each of the streets in a town. [2]

	True lower class limit	*True upper class limit*
(i)		
(ii)		
(iii)		

4 15 males and 25 females applied for employment at a large company.

For Examiner's Use

As part of the interview process, each applicant was given the same puzzle to solve, and the times, in seconds, taken to solve it correctly were recorded.

The times taken are summarised in the following table.

	Number of applicants	*Sum of times (seconds)*	*Sum of the squares of the times*
Male	15	235	5206
Female	25	285	6317

(i) Calculate the total time taken by **all** the applicants.

.... seconds [1]

(ii) Calculate the mean time taken by **all** the applicants.

..................................seconds [1]

(iii) Calculate the sum of the squares of the times taken by **all** the applicants.

....[1]

(iv) Hence calculate the standard deviation of the times taken by **all** the applicants.

.... seconds [3]

5 A family's expenditure was summarised under the four headings Food, Housing, Transport and Leisure. The following table shows the percentage increase in the prices of items under each of these headings from the year 2004 to the year 2009, together with weights allocated to each of the headings in line with the family's expenditure.

For Examiner's Use

	Percentage price increase 2004–2009	*Weight*
Food	20	7
Housing	8	10
Transport	14	6
Leisure	12	2

(i) By expressing the percentage price increases as price relatives, or otherwise, calculate the overall percentage increase in the family's price index from 2004 to 2009.

Give your answer to 3 significant figures.

.... [4]

(ii) The family's income increased by 11% from 2004 to 2009. State, with a reason, whether they would be able to maintain the same standard of living in 2009 as they had enjoyed in 2004.

....

....

.... [2]

6 Give a brief explanation of the meaning of each of the following terms when used in the calculation of index numbers.

For Examiner's Use

(i) Base year

....

....

....[2]

(ii) Price relative

....

....

....[2]

(iii) Weighted aggregate index

....

....

....[2]

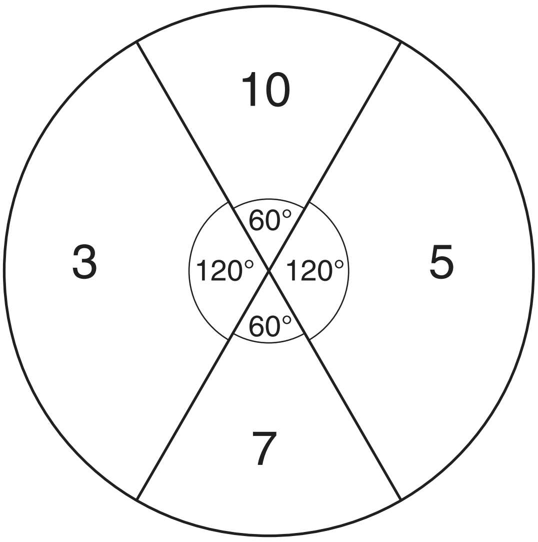
For Examiner's Use

Section B [64 marks]

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

Each question in this section carries 16 marks.

7 The diagram below shows a circular dart board divided into four regions, the size of each region being indicated by its angle at the centre of the board. The other figure in each region is the score awarded when a dart lands in that region.



In a game a player throws two darts and wins a prize determined by the total score of his two darts. The following table lists the prizes paid.

Total score	*Prize paid* ($)
20	100
15 or 17	50
Less than 8	25
Any other total	No prize paid

A novice player aims his darts at the centre of the board. Although his darts always hit the board, they are equally likely to land anywhere on its surface.

(i) Insert in the table below the nine **possible total scores** for the novice player.

Possible total scores									
Probability									

[1]

(ii) Find the probability of a total score of 20.

.... [1]

(iii) Show that the total probability of a score of 10 is 2/9.

[2]

(iv) Insert in the table in part **(i)** the probability of each of the nine possible total scores.

[4]

(v) Calculate the expected prize won by this novice player.

$ .... [2]

An expert darts player aims at the '10 region'. His darts always hit the upper half of the board, and are equally likely to land anywhere in that area.

(vi) Insert in the table below the six possible total scores for the expert player.

Possible total scores						
Probability						

[1]

(vii) Insert in the table in part **(iv)** the probability of each of the six possible total scores.

For Examiner's Use

[2]

Each player pays $15 to throw two darts.

(viii) Show that in the long run

(a) the novice player will make a loss,

[1]

(b) the expert player will make a profit.

[2]

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[Question 8 is printed on the next page]

8 The table shows the quarterly electricity bills, to the nearest $, for a household during the years 2006 to 2009, together with the four-quarter totals, eight-quarter totals, and eight-quarter moving average values.

For Examiner's Use

Year	*Quarter*	*Amount of bill ($)*	*4-quarter totals*	*8-quarter totals*	*8-quarter moving average*
2006	I	217			
	II	198			
			758		
	III	155		1502	187.75
			744		
	IV	188		1490	186.25
			746		
2007	I	203		1497	187.125
			751		
	II	200		*x* =	*y* =
			753		
	III	160		1510	188.75
			w =		
	IV	190		1515	189.375
			758		
2008	I	207		1527	190.875
			769		
	II	*v* =		1541	192.5
			772		
	III	171		1552	194
			780		
	IV	193		1565	195.625
			785		
2009	I	215		1569	196.125
			784		
	II	206			
			z		
	III	170			

For Examiner's Use

(i) Calculate the values of v, w, x and y, and insert them in the table.

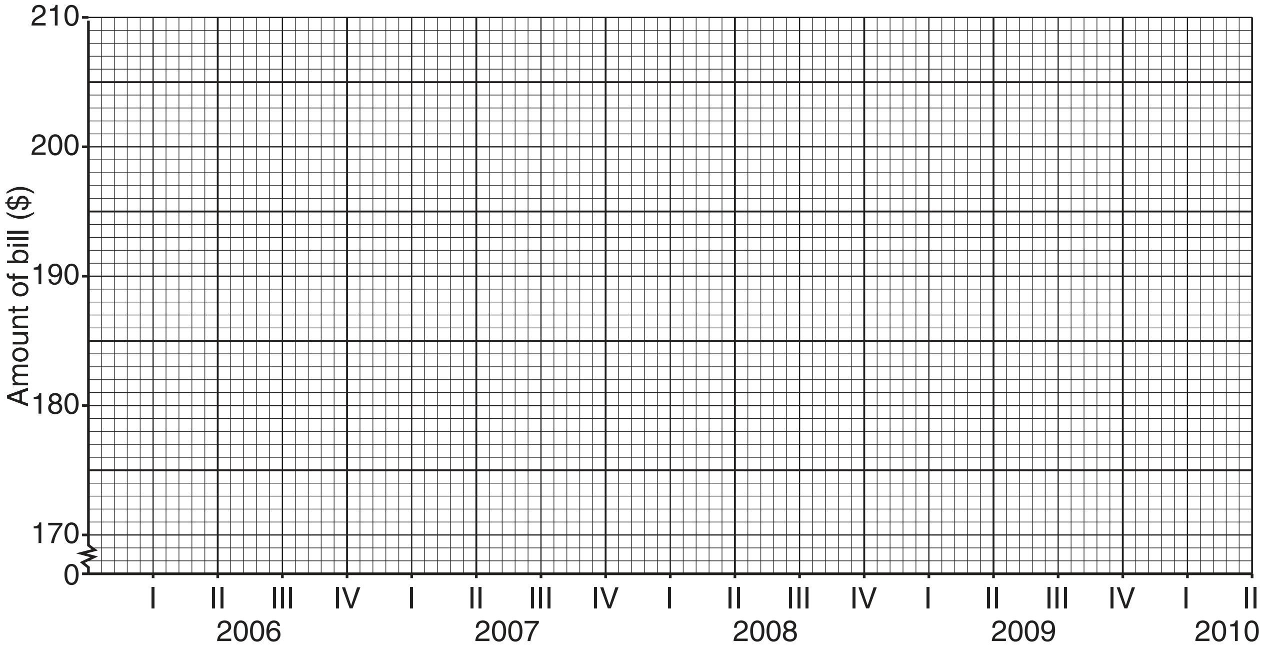
[4]

(ii) Explain why it is not possible to calculate the value of z from the information in the table.

....

....

.... [1]



(iii) Plot the 8-quarter moving average values on the above grid. [3]

(iv) Draw an appropriate trend line through the moving average values, and comment on what it shows.

....

.... [2]

The quarterly components for these data are summarised in the following table.

	I	II	III	IV
Quarterly component	17.6	q	–28.1	0.1

(v) Calculate the value of q.

q = ... [2]

(vi) Comment on the values of the quarterly components.

....

....

.... [2]

(vii) Estimate the household's electricity bill in the first quarter of 2010.

$ .... [2]

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[Question 9 is printed on the next page]

9 Four friends try to meet for lunch each day at their favourite restaurant, although it is never certain who will be able to keep the appointment on any particular day. The following table gives the probability that each will arrive on any day. All probabilities are independent.

	Probability
Caspar	3/4
Denzil	2/5
Edouard	1/6
Faroukh	2/3

(a) Showing all working, and giving results as fractions, find the probability that, on any particular day,

(i) both Caspar and Denzil arrive,

.... [2]

(ii) Caspar and Denzil do **not both** arrive,

.... [2]

(iii) Caspar and Denzil both arrive, but Edouard and Faroukh do **not both** arrive,

.... [4]

(iv) three of the four arrive.

For Examiner's Use

.... [6]

(b) On seeing the above table, a student commented that there must be an error in it, as the probabilities do not sum to 1. Explain briefly why the student's comment is incorrect.

....

....

.... [2]

10 The 100 members of a gardening club were classified by their age and gender, and the following frequency table produced.

	Age group I	*Age group II*	*Age group III*	TOTAL
Male	12	24	24	60
Female	8	16	16	40
TOTAL	20	40	40	100

The members were then each allocated a two-digit random number according to the following table.

	Age group I	*Age group II*	*Age group III*
Male	00–11	12–35	36–59
Female	60–67	68–83	84–99

Different methods are to be considered for selecting a sample **of size 5** from the club membership, using the two-digit random number table below.
No member may be selected more than once in any one sample.

TWO-DIGIT RANDOM NUMBER TABLE

82	60	12	02	60	69	99	09	67	01	12	04	36
40	99	02	66	37	59	24	79	35	04	09	15	06
21	02	08	10	91	65	05	78	09	99	15	14	00
14	45	74	15	01	63	09	07	12	18	00	13	51

(i) Starting at the beginning of the first row of the table, and moving along the row, select a **simple random sample** of the required size.

.... [2]

(ii) A **systematic sample** is to be selected.

(a) Write down the smallest possible and largest possible two-digit numbers of the first member selected.

.... [1]

The systematic sample is selected by starting at the beginning of the second row of the table, and moving along the row.

(b) Write down the number of the first member selected.

.... [1]

(c) Write down the numbers of the other four members selected for the systematic sample.

.... [1]

(iii) A **sample stratified by gender** is to be selected.

(a) State how many members of each gender would be selected for such a sample.

.... [1]

(b) Starting at the beginning of the third row of the table, and moving along the row, select a sample stratified by gender. Use every number if the gender to which it relates has not yet been fully sampled.

.... [2]

(iv) A **sample stratified by age group** is to be selected.

(a) State how many members of each age group would be selected for such a sample.

.... [1]

(b) Starting at the beginning of the fourth row of the table, and moving along the row, select a sample stratified by age group. Use every number if the age group to which it relates has not yet been fully sampled.

.... [2]

For Examiner's Use

(v) For each of the four samples you have selected, state whether it represents the population exactly in terms of gender and in terms of age group.

Simple random ....

....

Systematic ....

....

Stratified by gender ....

....

Stratified by age group ....

.... [4]

(vi) State why it would be impossible for samples of size 6 to represent the population exactly in terms of both gender and age group.

....

....

.... [1]

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[Question 11 is printed on the next page]

11 This question must be answered by calculation. Graphical solutions will not be awarded any marks.

For Examiner's Use

The following table shows the weights, in kg, of 250 boys.

Each weight was recorded **to the nearest 0.1 kg**.

Weight (kg)	*Number of boys*	*Cumulative frequency*
44.0 – 47.9	3	
48.0 – 51.9	17	
52.0 – 55.9	50	
56.0 – 57.9	45	
58.0 – 59.9	46	
60.0 – 63.9	57	
64.0 – 67.9	23	
68.0 – 71.9	9	

(i) Calculate the cumulative frequencies, and insert them in the table. [1]

(ii) Estimate the median, correct to 2 decimal places.

Median = ... kg [4]

(iii) The mean weight of the boys is 58.55 kg. Compare the mean and median with reference to the data in the table.

....

....

....[2]

(iv) Estimate the upper quartile, the lower quartile and the interquartile range of the weights, giving all your answers correct to 2 decimal places.

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Upper quartile = ... kg

Lower quartile = ... kg

Interquartile range = ... kg [6]

(v) Estimate the percentage of boys with weights greater than 59.5 kg.

.... [3]

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