OXFORD CAMBRIDGE AND RSA EXAMINATIONS

AS GCE

4732/01

MATHEMATICS

Probability & Statistics 1

QUESTION PAPER

FRIDAY 6 JUNE 2014: Afternoon

DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidates answer on the Printed Answer Book, or any suitable paper provided by the centre. The Printed Answer Book may be enlarged by the centre.

OCR SUPPLIED MATERIALS:

Printed Answer Book 4732/01
List of Formulae (MF1)
Insert for questions 1 and 6

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF

DC (RW) 4107714653 97005

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book or on the paper provided by the centre. Please write clearly and in capital letters.

If you use the Printed Answer Book, write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).

Use black ink. HB pencil may be used for graphs and diagrams only.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Answer **ALL** the questions.

You are permitted to use a scientific or graphical calculator in this paper.

Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.

INFORMATION FOR CANDIDATES

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

YOU ARE REMINDED OF THE NEED FOR CLEAR PRESENTATION IN YOUR ANSWERS.

The total number of marks for this paper is **72**.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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1 The stem-and-leaf diagram below shows the heights, in metres to the nearest 0.1 m, of a random sample of trees of species *A*.

Key: 6 | 4 means 6.4 m

5	
5	9
6	1 4
6	5 5 9
7	2 3 3 4
7	5 6 6 6 7 8
8	0 3 4
8	5

(i) Find the median and interquartile range of the heights. **[3]**

(ii) The heights, in metres to the nearest 0.1 m, of a random sample of trees of species *B* are given below.

7.6	5.2	8.5	5.2	6.3	6.3	6.8	7.2
6.7	7.3	5.4	7.5	7.4	6.0	6.7	

In the answer book or on the insert, complete the back-to-back stem-and-leaf diagram. **[2]**

(iii) Make two comparisons between the heights of the two species of tree. **[2]**

2 **(a)** The probability distribution of a random variable W is shown in the table below.

w	0	2	4
$\mathrm{P}(W = w)$	0.3	0.4	0.3

Calculate $\mathrm{Var}(W)$. **[3]**

(b) The random variable X has probability distribution given by

$\mathrm{P}(X = x) = k(x + 1)$ for x = 1, 2, 3, 4.

(i) Show that $k = \frac{1}{14}$. **[1]**

(ii) Calculate $\mathrm{E}(X)$. **[3]**

3 The table below shows information about the numbers of people per household in 280 900 households in the north-west of England in 2001.

Number of people	1	2	3	4	5 or more
Number of households	86 900	92 500	45 000	37 100	19 400

(i) Taking '5 or more' to mean '5 or 6', calculate estimates of the mean and standard deviation of the number of people per household. **[5]**

(ii) State the values of the median and upper quartile of the number of people per household. **[2]**

4 Each time Ben attempts to complete a crossword in his daily newspaper, the probability that he succeeds is $\frac{2}{3}$.

The random variable X denotes the number of times that Ben succeeds in 9 attempts.

(i) Find

(a) $\mathrm{P}(X = 6)$, **[3]**

(b) $\mathrm{P}(X < 6)$, **[1]**

(c) $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. **[2]**

Ben notes three values, X_1, X_2 and X_3, of X.

(ii) State the total number of attempts to complete a crossword that are needed to obtain three values of X. Hence find $\mathrm{P}(X_1 + X_2 + X_3 = 18)$. **[4]**

5 Tariq collected information about typical prices, £*y* million, of four-bedroomed houses at varying distances, *x* miles, from a large city. He chose houses at 10-mile intervals from the city. His results are shown below.

x	10	20	30	40	50	60	70	80
y	1.2	1.4	1.2	0.9	0.8	0.5	0.5	0.3

$n = 8$
$\Sigma x = 360$
$\Sigma x^2 = 20\,400$
$\Sigma y = 6.8$
$\Sigma y^2 = 6.88$
$\Sigma xy = 241$

(i) Use an appropriate formula to calculate the product moment correlation coefficient, r, showing that $-1.0 < r < -0.9$. **[3]**

(ii) State what this value of r shows in this context. **[1]**

(iii) Tariq decides to recalculate the value of r with the house prices measured in hundreds of thousands of pounds, instead of millions of pounds. State what effect, if any, this will have on the value of r. **[1]**

(iv) Calculate the equation of the regression line of y on x. **[3]**

(v) Explain why the regression line of y on x, rather than x on y, should be used for estimating a value of x from a given value of y. **[1]**

6 Fiona and James collected the results for six hockey teams at the end of the season. They then carried out various calculations using Spearman's rank correlation coefficient, r_s.

(i) Fiona calculated the value of r_s between the number of goals scored FOR each team and the number of goals scored AGAINST each team. She found that $r_s = -1$.

Complete the table in the answer book or on the insert showing the ranks. (The table is shown below for reference only.)

Team	A	B	C	D	E	F
Number of goals FOR (rank)	1	2	3	4	5	6
Number of goals AGAINST (rank)						

[1]

(ii) James calculated the value of r_s between the number of goals scored and the number of points gained by the 6 teams. He found the value of r_s to be 1.

He then decided to include the results of another two teams in the calculation of r_s. The table below shows the ranks for these two teams.

Team	G	H
Number of goals scored (rank)	7	8
Number of points gained (rank)	8	7

Calculate the value of r_s for all 8 teams. **[4]**

7 The table below shows the numbers of members of a swimming club in certain categories.

	Male	Female
Adults	78	45
Children	52	n

It is given that $\frac{5}{8}$ of the female members are children.

(i) Find the value of n. **[2]**

(ii) Find the probability that a member chosen at random is either female or a child (or both). **[2]**

The table below shows the corresponding numbers for an athletics club.

	Male	Female
Adults	6	4
Children	5	10

(iii) Two members of the athletics club are chosen at random for a photograph.

(a) Find the probability that one of these members is a female child and the other is an adult male. **[2]**

(b) Find the probability that exactly one of these members is female and exactly one is a child. **[2]**

8 A group of 8 people, including Kathy, David and Harpreet, are planning a theatre trip.

(i) Four of the group are chosen at random, without regard to order, to carry the refreshments.
Find the probability that these 4 people include Kathy and David but not Harpreet. **[3]**

(ii) The 8 people sit in a row. Kathy and David sit next to each other and Harpreet sits at the left-hand end of the row. How many different arrangements of the 8 people are possible? **[3]**

(iii) The 8 people stand in a line to queue for the exit. Kathy and David stand next to each other and Harpreet stands next to them. How many different arrangements of the 8 people are possible? **[3]**

9 Each day Harry makes repeated attempts to light his gas fire. If the fire lights he makes no more attempts. On each attempt, the probability that the fire will light is 0.3 independent of all other attempts. Find the probability that

(i) the fire lights on the 5th attempt, **[2]**

(ii) Harry needs more than 1 attempt but fewer than 5 attempts to light the fire. **[3]**

If the fire does not light on the 6th attempt, Harry stops and the fire remains unlit.

(iii) Find the probability that, on a particular day, the fire lights. **[3]**

(iv) Harry's week starts on Monday. Find the probability that, during a certain week, the first day on which the fire lights is Wednesday. **[2]**

END OF QUESTION PAPER