OXFORD CAMBRIDGE AND RSA EXAMINATIONS

AS GCE

4732/01

MATHEMATICS

Probability & Statistics 1

QUESTION PAPER

WEDNESDAY 6 JUNE 2018: Morning

DURATION: 1 hour 30 minutes
plus your additional time allowance
MODIFIED ENLARGED 24pt

Candidates answer on the Printed Answer Book sent with the standard paper 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 sent with standard paper
List of Formulae (MF1) sent with standard paper

OTHER MATERIALS REQUIRED:
Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF

DC (NF) 165335/1

7861990295

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. Please write clearly and in capital letters.

IF YOU USE THE PRINTED ANSWER BOOK WRITE YOUR ANSWER TO EACH QUESTION IN THE SPACE PROVIDED. If additional space is required, you should use the lined page(s) at the end of the Printed Answer Book. The question number(s) must be clearly shown.

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

Answer ALL the questions.

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

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

Do not send this Question Paper for marking; it should be retained in the centre or recycled. Please contact OCR Copyright should you wish to re-use this document.

BLANK PAGE

Answer ALL the questions

1 Six cards are numbered 1, 1, 1, 2, 2, 3. Two cards are chosen at random, without replacement. The sum of the numbers on the two cards is denoted by X.

(i) Show that $\mathrm{P}(X = 4) = \frac{4}{15}$. [2]

Part of the probability distribution of X is given in the table.

x	2	3	4	5
$\mathrm{P}(X = x)$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{4}{15}$	

(ii) Calculate $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. [6]

2 A fair six-sided dice has sides numbered 1, 2, 3, 4, 5, 6.

(i) The dice is thrown once and the score is greater than 2. Find the probability that the score is greater than 3. [1]

(ii) The dice is thrown twice and the sum of the two scores is greater than 8. Find the probability that the sum of the two scores is greater than 10. [2]

(iii) The dice is thrown three times. Find the probability that the score on the third throw is at least twice the sum of the scores on the first two throws. [3]

3 The table shows the age, x years, and the height, y cm, of each of seven randomly selected trees of a certain species.

Age (x years)	10	12	20	29	36	45	50
Height (y cm)	244	320	528	784	792	1026	1212

$n = 7$ $\quad \Sigma x = 202$ $\quad \Sigma y = 4906$ $\quad \Sigma x^2 = 7306$ $\quad \Sigma y^2 = 4\,204\,260$

$\Sigma xy = 174\,858$

(i) Show that the value of the product moment correlation coefficient for the data is 0.99, correct to 2 significant figures. [2]

(ii) State, correct to 2 significant figures, the value of the product moment correlation coefficient for the data if the heights were measured in metres. [1]

(iii) Find the equation of the regression line of y on x. [3]

(iv) Use your equation to estimate the mean height of a tree of this species with age 25 years. [1]

(v) Comment on the reliability of your estimate in part (iv). [2]

4 Two judges each marked six contestants. Their marks are shown in the table.

Contestant	A	B	C	D	E	F
Judge 1	73	67	60	48	39	38
Judge 2	42	50	63	54	71	69

(i) Calculate Spearman's rank correlation coefficient, r_s, between the marks. [5]

(ii) Give an interpretation of your value of r_s in this context. [1]

(iii) Later, Judge 1 changed her mark for Contestant C from 60 to 61. Without calculation, state whether the value of r_s will increase, decrease or remain the same. Give a reason for your answer. [2]

5 The lengths of 27 worms were measured in centimetres, correct to the nearest 0.1 cm. The results are shown in the stem-and-leaf diagram.

Key: 4 | 2 means 4.2 cm

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

(i) Find the median and interquartile range of these lengths. [3]

(ii) State one advantage of using the median rather than the mean as a measure of the average of these lengths. [1]

A biologist wished to draw a cumulative frequency graph using the data in the stem-and-leaf diagram. He collected the data into five classes, each of width 1 cm.

(iii) List the coordinates of the points that he should plot. [2]

The biologist calculated the mean, m, of the given data. He also found the difference, d, between each data item and the mean and calculated Σd^2. His results were $m = 5$ and $\Sigma d^2 = 36.96$.

(iv) Hence calculate the standard deviation of the 27 lengths. [2]

6 It has been found that 4% of radios made at a factory are faulty. The radios are packed in boxes of 15 for delivery to stores. The number of faulty radios in a box is denoted by X.

(i) Give an appropriate distribution for modelling X, stating a necessary assumption. [2]

(ii) Find the probability that in 3 randomly chosen boxes there are no faulty radios. [2]

(iii) Find the probability that a randomly chosen box contains at least 2 faulty radios. [4]

(iv) A random sample of 10 boxes is selected. Find the probability that the number of these boxes that contain at least 2 faulty radios is fewer than 4. [4]

7 Every day William watches for whales from his bedroom window. The probability that he will see whales on any given day is $\frac{1}{4}$. It is assumed that this probability is not affected by whether he has seen whales on any other day.

(i) Calculate the probability that William first sees whales

(a) on the fourth day, [3]

(b) before the seventh day. [3]

(ii) Find the expectation of the number of days up to and including the first day on which he sees whales. [1]

William watches for whales every day for two weeks (14 days).

(iii) Calculate the probability that he sees whales on at least 1 day during one of the weeks, but does not see whales during the other week. [4]

8 A florist has 4 roses, A, B, C and D, all of different varieties, and 3 begonias, X, Y and Z, all of different varieties.

(i) She selects 2 roses and 2 begonias. Find the number of different selections she can make. [2]

Now the florist arranges all 7 plants in random order in a straight line, regardless of the type of plant.

(ii) (a) Find the probability that no 2 roses are next to each other and no 2 begonias are next to each other. [2]

(b) Find the probability that all 3 begonias are next to each other. [3]

Later, the florist decides to arrange the plants in two sections, roses on the left and begonias on the right, all in a straight line.

(iii) Given that plants A and X are separated by exactly three other plants, how many different arrangements are possible? [3]

END OF QUESTION PAPER