

**Wednesday 25 January 2012 – Afternoon**

**AS GCE MATHEMATICS**

**4732** Probability and Statistics 1

**QUESTION PAPER**

Candidates answer on the Printed Answer Book.

**OCR supplied materials:**

- Printed Answer Book 4732
- List of Formulae (MF1)

**Other materials required:**

- Scientific or graphical calculator

**Duration:** 1 hour 30 minutes



**INSTRUCTIONS TO CANDIDATES**

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found in the centre of the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book.** 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.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Do **not** write in the bar codes.
- 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**

This information is the same on the Printed Answer Book and the Question Paper.

- 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**.
- This Printed Answer Book consists of **12** pages. The Question Paper consists of **8** pages. Any blank pages are indicated.

**INSTRUCTION TO EXAMS OFFICER/INVIGILATOR**

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- 1 The probability distribution of a random variable  $X$  is shown in the table.

$x$	1	2	3	4
$P(X=x)$	0.1	0.3	$2p$	$p$

(i) Find  $p$ . [2]

(ii) Find  $E(X)$ . [2]

- 2 In an experiment, the percentage sand content,  $y$ , of soil in a given region was measured at nine different depths,  $x$  cm, taken at intervals of 6 cm from 0 cm to 48 cm. The results are summarised below.

$$n = 9 \quad \Sigma x = 216 \quad \Sigma x^2 = 7344 \quad \Sigma y = 512.4 \quad \Sigma y^2 = 30\,595 \quad \Sigma xy = 10\,674$$

(i) State, with a reason, which variable is the independent variable. [1]

(ii) Calculate the product moment correlation coefficient between  $x$  and  $y$ . [3]

(iii) (a) Calculate the equation of the appropriate regression line. [3]

(b) This regression line is used to estimate the percentage sand content at depths of 25 cm and 100 cm. Comment on the reliability of each of these estimates. You are not asked to find the estimates. [3]

- 3 A random variable  $X$  has the distribution  $B(13, 0.12)$ .

(i) Find  $P(X < 2)$ . [3]

Two independent values of  $X$  are found.

(ii) Find the probability that exactly one of these values is equal to 2. [3]

- 4 (a) The table gives the heights and masses of 5 people.

Person	$A$	$B$	$C$	$D$	$E$
Height (m)	1.72	1.63	1.77	1.68	1.74
Mass (kg)	75	62	64	60	70

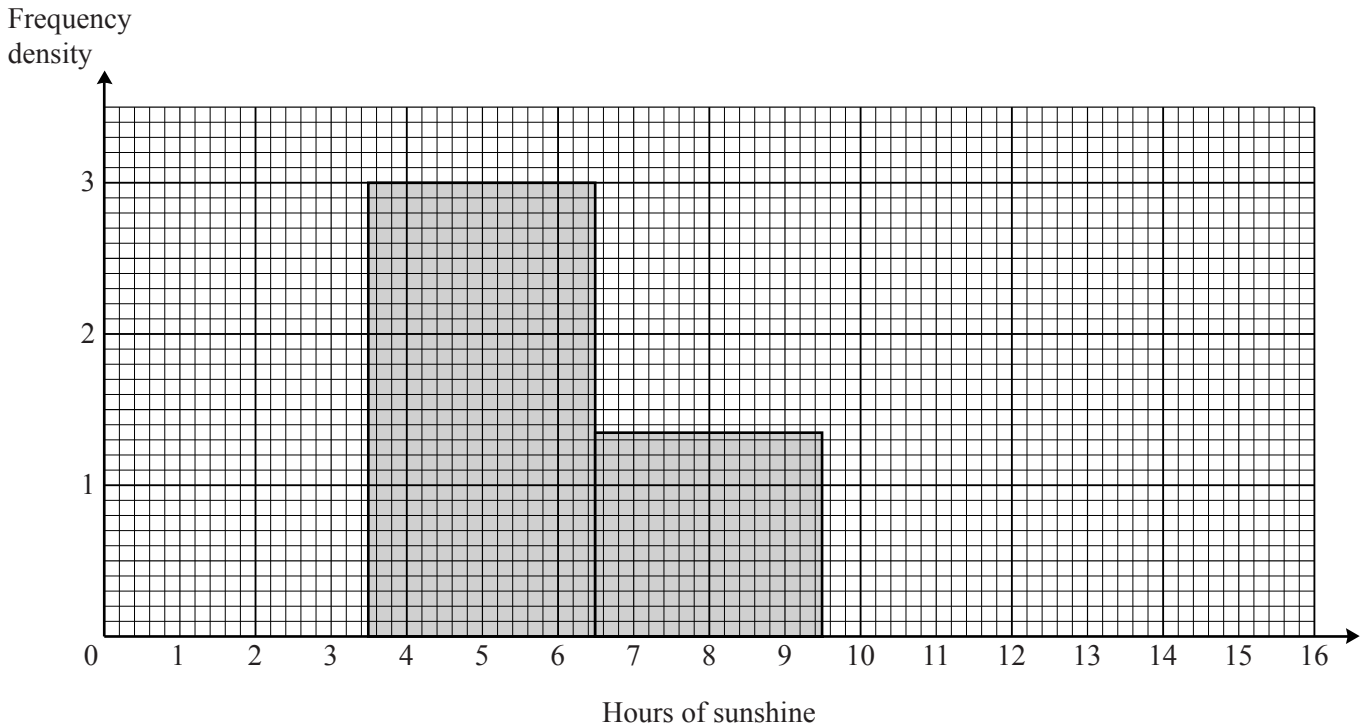
Calculate Spearman's rank correlation coefficient. [5]

(b) In an art competition the value of Spearman's rank correlation coefficient,  $r_s$ , calculated from two judges' rankings was 0.75. A late entry for the competition was received and both judges ranked this entry lower than all the others. By considering the formula for  $r_s$ , explain whether the new value of  $r_s$  will be less than 0.75, equal to 0.75, or greater than 0.75. [3]

- 5 At a certain resort the number of hours of sunshine, measured to the nearest hour, was recorded on each of 21 days. The results are summarised in the table.

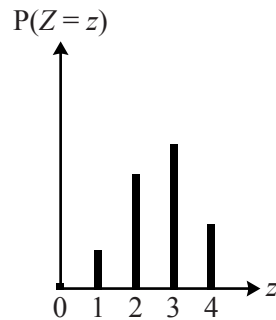
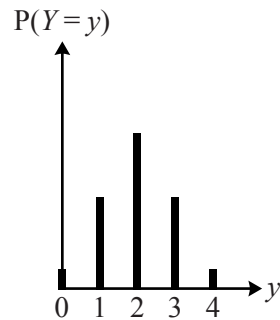
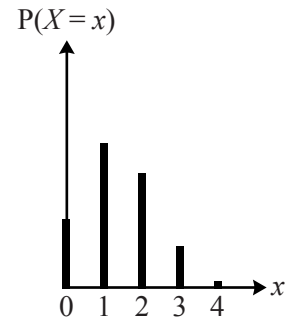
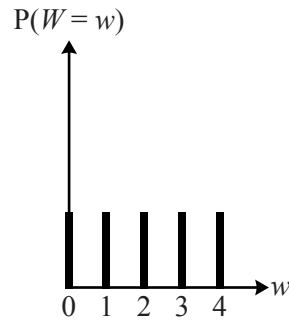
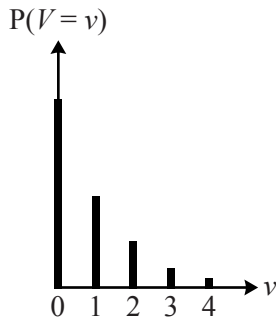
Hours of sunshine	0	1 – 3	4 – 6	7 – 9	10 – 15
Number of days	0	6	9	4	2

The diagram shows part of a histogram to illustrate the data. The scale on the frequency density axis is 2 cm to 1 unit.



- (i) (a) Calculate the frequency density of the 1 – 3 class. [1]
- (b) Fred wishes to draw the block for the 10 – 15 class on the same diagram. Calculate the height, in centimetres, of this block. [2]
- (ii) A cumulative frequency graph is to be drawn. Write down the coordinates of the first two points that should be plotted. You are not asked to draw the graph. [2]
- (iii) (a) Calculate estimates of the mean and standard deviation of the number of hours of sunshine. [5]
- (b) Explain why your answers are only estimates. [1]

- 6 The diagrams illustrate all or part of the probability distributions of the discrete random variables  $V$ ,  $W$ ,  $X$ ,  $Y$  and  $Z$ .



- (i) One of these variables has the distribution  $\text{Geo}(\frac{1}{2})$ . State, with a reason, which variable this is. [2]
- (ii) One of these variables has the distribution  $\text{B}(4, \frac{1}{2})$ . State, with reasons, which variable this is. [3]
- 7 60% of the voters at a certain polling station are women. Voters enter the polling station one at a time. The number of voters who enter, up to and including the first woman, is denoted by  $X$ .

- (i) State a suitable distribution that can be used as a model for  $X$ , giving the value(s) of any parameter(s). State also any necessary condition(s) for this distribution to be a good model. [4]

Use the distribution stated in part (i) to find

- (ii)  $P(X=4)$ , [2]
- (iii)  $P(X \geq 4)$ . [2]

- 8 On average, half the plants of a particular variety produce red flowers and the rest produce blue flowers.
- (i) Ann chooses 8 plants of this variety at random. Find the probability that more than 6 plants produce red flowers. [3]
  - (ii) Karim chooses 22 plants of this variety at random.
    - (a) Find the probability that the number of these plants that produce blue flowers is equal to the number that produce red flowers. [2]
    - (b) Hence find the probability that the number of these plants that produce blue flowers is greater than the number that produce red flowers. [3]
- 9 A bag contains 9 discs numbered 1, 2, 3, 4, 5, 6, 7, 8, 9.
- (i) Andrea chooses 4 discs at random, without replacement, and places them in a row.
    - (a) How many different 4-digit numbers can be made? [2]
    - (b) How many different **odd** 4-digit numbers can be made? [3]
  - (ii) Andrea's 4 discs are put back in the bag. Martin then chooses 4 discs at random, without replacement. Find the probability that
    - (a) the 4 digits include at least 3 odd digits, [4]
    - (b) the 4 digits add up to 28. [3]

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