

**Friday 24 May 2013 – Morning**

**AS GCE MATHEMATICS**

**4732/01** Probability & Statistics 1

**QUESTION PAPER**

Candidates answer on the Printed Answer Book.

**OCR supplied materials:**

- Printed Answer Book 4732/01
- List of Formulae (MF1)

**Other materials required:**

- Scientific or graphical calculator

**Duration:** 1 hour 30 minutes

**MODIFIED LANGUAGE**

**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**.
- The 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 lengths of 18 snakes are given below in centimetres.

24 62 20 65 27 67 69 32 40 53 55 47 33 45 55 56 49 58

(i) Draw an ordered stem-and-leaf diagram for the data. [3]

(ii) Find the mean and median of the lengths of the snakes. [2]

(iii) It was found that one of the lengths had been measured incorrectly. After this length was corrected, the median increased by 1 cm. Give two possibilities for the incorrect length and give a corrected value in each case. [2]

- 2 (i) The table shows the times, in minutes, spent by five students revising for a test, and the grades that they achieved in the test.

Student	Ann	Bill	Caz	Den	Ed
Time revising	0	60	35	100	45
Grade	C	D	E	B	A

Calculate Spearman's rank correlation coefficient. [5]

(ii) The table below shows the ranks given by two judges to four competitors.

Competitor	P	Q	R	S
Judge 1 rank	1	2	3	4
Judge 2 rank	3	2	1	4

Spearman's rank correlation coefficient for these ranks is denoted by  $r_s$ . Keeping the same set of ranks for Judge 1, write down a different set of ranks for Judge 2 which gives the same value of  $r_s$ . There is no need to find the value of  $r_s$ . [2]

- 3 The probability distribution of a random variable  $X$  is shown.

$x$	1	3	5	7
$P(X=x)$	0.4	0.3	0.2	0.1

(i) Find  $E(X)$  and  $\text{Var}(X)$ . [5]

(ii) Three independent values of  $X$ , denoted by  $X_1$ ,  $X_2$  and  $X_3$ , are chosen. Given that  $X_1 + X_2 + X_3 = 19$ , write down all the possible sets of values for  $X_1$ ,  $X_2$  and  $X_3$ . Hence find  $P(X_1 = 7)$ . [2]

(iii) 11 independent values of  $X$  are chosen. Use an appropriate formula to find the probability that exactly 4 of these values are 5s. [3]

- 4 Contestants have to estimate the mass of a cake on a stall at a fair. A group of 10 people made estimates,  $m$  kg. For each person the value of  $(m - 5)$  was recorded. The mean of  $(m - 5)$  was found to be 0.74 and the standard deviation was found to be 0.13.

(i) Write down the mean and standard deviation of  $m$ . [2]

The mean and standard deviation of the estimates made by another group of 15 people were found to be 5.6 kg (mean) and 0.19 kg (standard deviation).

(ii) Calculate the mean of all 25 estimates. [2]

(iii) Fiona claims that if a group's estimates are more consistent, they are likely to be more accurate. Comment on this claim given that the true mass of the cake is 5.65 kg. [2]

- 5 The table shows some of the values of the seasonally adjusted Unemployment Rate (UR),  $x\%$ , and the Consumer Price Index (CPI),  $y\%$ , in the United Kingdom from April 2008 to July 2010.

Date	April 2008	July 2008	October 2008	January 2009	April 2009	July 2009	October 2009	January 2010	April 2010	July 2010
UR, $x\%$	5.2	5.7	6.1	6.8	7.5	7.8	7.8	7.9	7.8	7.7
CPI, $y\%$	3.0	4.4	4.5	3.0	2.3	1.8	1.5	3.5	3.7	3.1

These data are summarised below.

$$n = 10 \quad \Sigma x = 70.3 \quad \Sigma x^2 = 503.45 \quad \Sigma y = 30.8 \quad \Sigma y^2 = 103.94 \quad \Sigma xy = 211.9$$

- (i) Calculate the product moment correlation coefficient,  $r$ , for the data, showing that  $-0.6 < r < -0.5$ . [3]
- (ii) Karen says "The negative value of  $r$  shows that when the Unemployment Rate increases, it causes the Consumer Price Index to decrease." Give a criticism of this statement. [1]
- (iii) (a) Calculate the equation of the regression line of  $x$  on  $y$ . [3]
- (b) Use your equation to estimate the value of the Unemployment Rate in a month when the Consumer Price Index is 4.0%. [2]

- 6 The diagram shows five cards, each with a letter on it.



The letters A and E are vowels; the letters B, C and D are consonants.

- (i) Two of the five cards are chosen at random, without replacement. Find the probability that they both have vowels on them. [2]
  - (ii) The two cards are replaced. Now three of the five cards are chosen at random, without replacement. Find the probability that they include exactly one card with a vowel on it. [3]
  - (iii) The three cards are replaced. Now four of the five cards are chosen at random without replacement. Find the probability that they include the card with the letter B on it. [2]
- 7 In a factory, an inspector checks a random sample of 30 mugs from a large batch. He notes the number,  $X$ , which are damaged. He then deals with the batch as follows.
- If  $X < 2$ , the batch is accepted.
  - If  $X > 2$ , the batch is rejected.
  - If  $X = 2$ , the inspector selects another random sample of only 15 mugs from the batch. If this second sample contains 1 or more damaged mugs, the batch is rejected. Otherwise the batch is accepted.

It is given that 5% of mugs are damaged.

- (i) (a) Find the probability that the batch is rejected after just the first sample is checked. [3]
  - (b) Show that the probability that the batch is rejected is 0.327, correct to 3 significant figures. [5]
  - (ii) Batches are checked one after another. Find the probability that the first batch to be rejected is either the 4th or the 5th batch that is checked. [3]
- 8 (i) A bag contains 12 black discs, 10 white discs and 5 green discs. Three discs are drawn at random from the bag, without replacement. Find the probability that all three discs are of different colours. [3]
- (ii) A bag contains 30 red discs and 20 blue discs. A second bag contains 50 discs, each of which is either red or blue. A disc is drawn at random from each bag. The probability that these two discs are of different colours is 0.54. Find the number of red discs that were in the second bag at the start. [4]

- 9 A game is played with a token on a board with a grid printed on it. The token starts at the point  $(0, 0)$  and moves in steps. Each step is either 1 unit in the positive  $x$ -direction with probability 0.8, or 1 unit in the positive  $y$ -direction with probability 0.2. The token stops when it reaches a point with a  $y$ -coordinate of 1. It is given that the token stops at  $(X, 1)$ .
- (i) (a) Find the probability that  $X = 10$ . [2]
- (b) Find the probability that  $X < 10$ . [3]
- (ii) Find the expected number of steps taken by the token. [2]
- (iii) Hence, write down the value of  $E(X)$ . [1]

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