

Wednesday 3 June 2015 – 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

INSTRUCTIONS TO CANDIDATES

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

- The Question Paper will be found inside 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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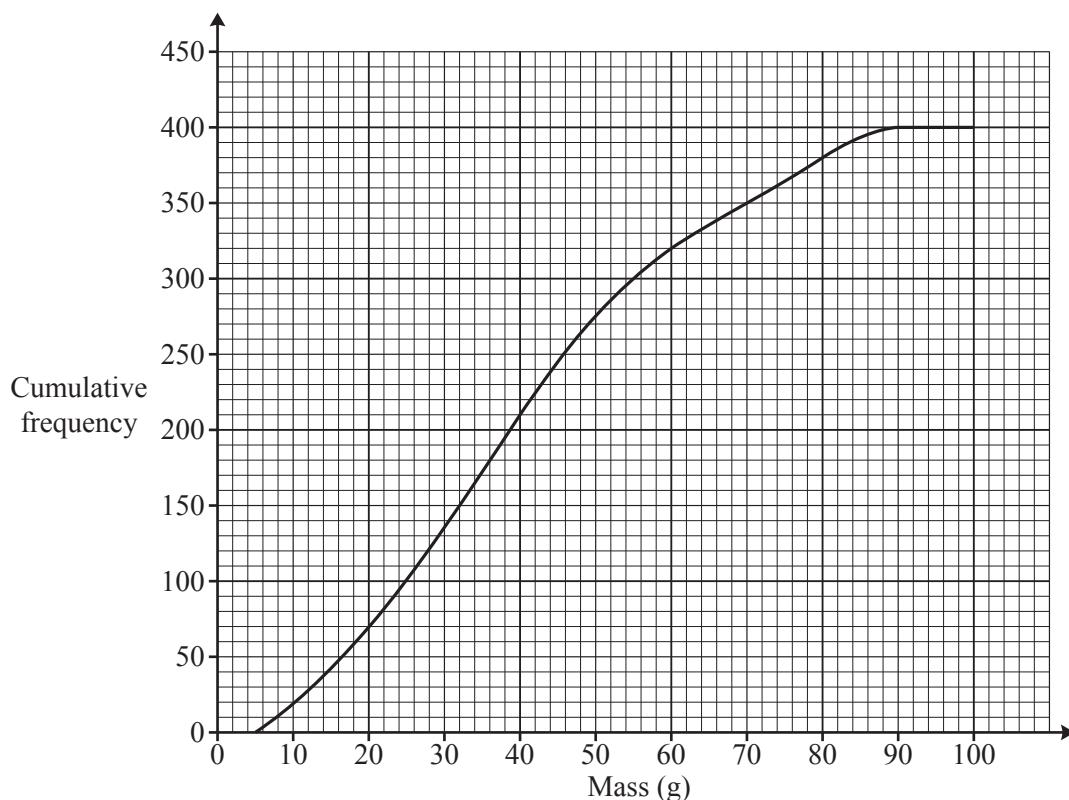
- 1 For the top 6 clubs in the 2010/11 season of the English Premier League, the table shows the annual salary, £ x million, of the highest paid player and the number of points scored, y .

Club	Manchester United	Manchester City	Chelsea	Arsenal	Tottenham	Liverpool
x	5.6	7.4	6.5	4.1	3.6	6.5
y	80	71	71	68	62	58

$$n = 6 \quad \sum x = 33.7 \quad \sum x^2 = 200.39 \quad \sum y = 410 \quad \sum y^2 = 28\,314 \quad \sum xy = 2313.9$$

- (i) Use a suitable formula to calculate the product moment correlation coefficient, r , between x and y , showing that $0 < r < 0.2$. [3]
- (ii) State what this value of r shows in this context. [1]
- (iii) A fan suggests that the data should be used to draw a regression line in order to estimate the number of points that would be scored by another Premier League club, whose highest paid player's salary is £1.7 million. Give two reasons why such an estimate would be unlikely to be reliable. [2]

- 2 The masses, in grams, of 400 plums were recorded. The masses were then collected into class intervals of width 5 g and a cumulative frequency graph was drawn, as shown below.



- (i) Find the number of plums with masses in the interval 40 g to 45 g. [1]
- (ii) Find the percentage of plums with masses greater than 70 g. [2]
- (iii) Give estimates of the highest and lowest masses in the sample, explaining why their exact values cannot be read from the graph. [2]
- (iv) On the graph paper in the answer book, draw a box-and-whisker plot to illustrate the masses of the plums in the sample. [4]
- (v) Comment briefly on the shape of the distribution of masses. [1]
- 3 An expert tested the quality of the wines produced by a vineyard in 9 particular years. He placed them in the following order, starting with the best.

1980 1983 1981 1982 1984 1985 1987 1986 1988

- (i) Calculate Spearman's rank correlation coefficient, r_s , between the year of production and the quality of these wines. The years should be ranked from the earliest (1) to the latest (9). [5]
- (ii) State what this value of r_s shows in this context. [1]

- 4 The table shows the load a lorry was carrying, x tonnes, and the fuel economy, y km per litre, for 8 different journeys. You should assume that neither variable is controlled.

Load (x tonnes)	5.1	5.8	6.5	7.1	7.6	8.4	9.5	10.5
Fuel economy (y km per litre)	6.2	6.1	5.9	5.6	5.3	5.4	5.3	5.1

$$n = 8 \quad \Sigma x = 60.5 \quad \Sigma y = 44.9 \quad \Sigma x^2 = 481.13 \quad \Sigma y^2 = 253.17 \quad \Sigma xy = 334.65$$

- (i) Calculate the equation of the regression line of y on x . [4]
- (ii) Estimate the fuel economy for a load of 9.2 tonnes. [2]
- (iii) An analyst calculated the equation of the regression line of x on y . Without calculating this equation, state the coordinates of the point where the two regression lines intersect. [1]
- (iv) Describe briefly the method required to estimate the load when the fuel economy is 5.8 km per litre. [2]
- 5 Each year Jack enters a ballot for a concert ticket. The probability that Jack will win a ticket in any particular year is 0.27.
- (i) Find the probability that the first time Jack wins a ticket is
- (a) on his 8th attempt, [2]
- (b) after his 8th attempt. [2]
- (ii) Write down an expression for the probability that Jack wins a ticket on exactly 2 of his first 8 attempts, and evaluate this expression. [3]
- (iii) Find the probability that Jack wins his 3rd ticket on his 9th attempt and his 4th ticket on his 12th attempt. [3]
- 6 (i) The seven digits 1, 1, 2, 3, 4, 5, 6 are arranged in a random order in a line. Find the probability that they form the number 1452163. [3]
- (ii) Three of the seven digits 1, 1, 2, 3, 4, 5, 6 are chosen at random, without regard to order.
- (a) How many possible groups of three digits contain two 1s? [1]
- (b) How many possible groups of three digits contain exactly one 1? [2]
- (c) How many possible groups of three digits can be formed altogether? [2]

- 7 Froox sweets are packed into tubes of 10 sweets, chosen at random. 25% of Froox sweets are yellow.
- (i) Find the probability that in a randomly selected tube of Froox sweets there are
- (a) exactly 3 yellow sweets, [3]
 (b) at least 3 yellow sweets. [2]
- (ii) Find the probability that in a box containing 6 tubes of Froox sweets, there is at least 1 tube that contains at least 3 yellow sweets. [3]
- 8 A game is played with a fair, six-sided die which has 4 red faces and 2 blue faces. One turn consists of throwing the die repeatedly until a blue face is on top or until the die has been thrown 4 times.
- (i) In the answer book, complete the probability tree diagram for one turn.
- First throw**
-
- ```

graph LR
 Root --- Red["Red
2/3"]
 Root --- Blue["Blue
1/3"]

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- [2]
- (ii) Find the probability that in one particular turn the die is thrown 4 times. [2]
- (iii) Adnan and Beryl each have one turn. Find the probability that Adnan throws the die more times than Beryl. [4]
- (iv) State one change that needs to be made to the rules so that the number of throws in one turn will have a geometric distribution. [1]

- 9 The random variable  $X$  has probability distribution given by

$$P(X = x) = a + bx \quad \text{for } x = 1, 2 \text{ and } 3,$$

where  $a$  and  $b$  are constants.

- (i) Show that  $3a + 6b = 1$ . [2]
- (ii) Given that  $E(X) = \frac{5}{3}$ , find  $a$  and  $b$ . [4]

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