OCR

Thursday 22 May 2014 – Morning

AS GCE MATHEMATICS (MEI)

4766/01 Statistics 1

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4766/01
- MEI Examination Formulae and Tables (MF2)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

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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.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are permitted to use a scientific or graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

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 advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **4** pages. Any blank pages are indicated.

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.

Section A (36 marks)

1 The ages, x years, of the senior members of a running club are summarised in the table below.

Age (x)	$20 \leqslant x < 30$	$30 \leqslant x < 40$	$40 \leqslant x < 50$	$50 \leqslant x < 60$	$60 \leqslant x < 70$	$70 \leqslant x < 80$	$80 \leqslant x < 90$
Frequency	10	30	42	23	9	5	1

(i) Draw a cumulative frequency diagram to illustrate the data. **[5]**

(ii) Use your diagram to estimate the median and interquartile range of the data. **[3]**

2 Candidates applying for jobs in a large company take an aptitude test, as a result of which they are either accepted, rejected or retested, with probabilities 0.2, 0.5 and 0.3 respectively. When a candidate is retested for the first time, the three possible outcomes and their probabilities remain the same as for the original test. When a candidate is retested for the second time there are just two possible outcomes, accepted or rejected, with probabilities 0.4 and 0.6 respectively.

(i) Draw a probability tree diagram to illustrate the outcomes. **[3]**

(ii) Find the probability that a randomly selected candidate is accepted. **[2]**

(iii) Find the probability that a randomly selected candidate is retested at least once, given that this candidate is accepted. **[3]**

3 Each weekday, Marta travels to school by bus. Sometimes she arrives late.

- L is the event that Marta arrives late.
- R is the event that it is raining.

You are given that $\mathrm{P}(L) = 0.15$, $\mathrm{P}(R) = 0.22$ and $\mathrm{P}(L \mid R) = 0.45$.

(i) Use this information to show that the events L and R are not independent. **[1]**

(ii) Find $\mathrm{P}(L \cap R)$. **[2]**

(iii) Draw a Venn diagram showing the events L and R, and fill in the probability corresponding to each of the four regions of your diagram. **[3]**

4 There are 16 girls and 14 boys in a class. Four of them are to be selected to form a quiz team. The team is to be selected at random.

(i) Find the probability that all 4 members of the team will be girls. **[3]**

(ii) Find the probability that the team will contain at least one girl and at least one boy. **[3]**

5 The probability distribution of the random variable X is given by the formula

$$P(X = r) = k + 0.01r^2 \text{ for } r = 1, 2, 3, 4, 5.$$

(i) Show that $k = 0.09$. Using this value of k, display the probability distribution of X in a table. **[3]**

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

Section B (36 marks)

6 The weights, w grams, of a random sample of 60 carrots of variety A are summarised in the table below.

Weight	$30 \leqslant w < 50$	$50 \leqslant w < 60$	$60 \leqslant w < 70$	$70 \leqslant w < 80$	$80 \leqslant w < 90$
Frequency	11	10	18	14	7

(i) Draw a histogram to illustrate these data. **[5]**

(ii) Calculate estimates of the mean and standard deviation of w. **[4]**

(iii) Use your answers to part **(ii)** to investigate whether there are any outliers. **[3]**

The weights, x grams, of a random sample of 50 carrots of variety B are summarised as follows.

$$n = 50 \qquad \Sigma x = 3624.5 \qquad \Sigma x^2 = 265\,416$$

(iv) Calculate the mean and standard deviation of x. **[3]**

(v) Compare the central tendency and variation of the weights of varieties A and B. **[2]**

7 It is known that on average 85% of seeds of a particular variety of tomato will germinate. Ramesh selects 15 of these seeds at random and sows them.

(i) (A) Find the probability that exactly 12 germinate. **[3]**

(B) Find the probability that fewer than 12 germinate. **[2]**

The following year Ramesh finds that he still has many seeds left. Because the seeds are now one year old, he suspects that the germination rate will be lower. He conducts a trial by randomly selecting n of these seeds and sowing them. He then carries out a hypothesis test at the 1% significance level to investigate whether he is correct.

(ii) Write down suitable null and alternative hypotheses for the test. Give a reason for your choice of alternative hypothesis. **[4]**

(iii) In a trial with $n = 20$, Ramesh finds that 13 seeds germinate. Carry out the test. **[4]**

(iv) Suppose instead that Ramesh conducts the trial with $n = 50$, and finds that 33 seeds germinate. Given that the critical value for the test in this case is 35, complete the test. **[3]**

(v) If n is small, there is no point in carrying out the test at the 1% significance level, as the null hypothesis cannot be rejected however many seeds germinate. Find the least value of n for which the null hypothesis can be rejected, quoting appropriate probabilities to justify your answer. **[3]**

THERE ARE NO QUESTIONS PRINTED ON THIS PAGE.