OCR
RECOGNISING ACHIEVEMENT

Thursday 24 May 2012 – Morning

AS GCE MATHEMATICS (MEI)

4766   Statistics 1

QUESTION PAPER

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.
*   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.
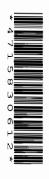*   Final answers should be given to a degree of accuracy appropriate to the context.

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.

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Turn over

Section A (36 marks)

1   At a garden centre there is a box containing 50 hyacinth bulbs. Of these, 30 will produce a blue flower and the remaining 20 will produce a red flower. Unfortunately they have become mixed together so that it is not known which of the bulbs will produce a blue flower and which will produce a red flower.

Karen buys 3 of these bulbs.

(i) Find the probability that all 3 of these bulbs will produce blue flowers. [3]

(ii) Find the probability that Karen will have at least one flower of each colour from her 3 bulbs. [3]

2   An examination paper consists of two sections. Section A has 5 questions and Section B has 9 questions. Candidates are required to answer 6 questions.

(i) In how many different ways can a candidate choose 6 questions, if 3 are from Section A and 3 are from Section B? [3]

(ii) Another candidate randomly chooses 6 questions to answer. Find the probability that this candidate chooses 3 questions from each section. [3]

3   At a call centre, 85% of callers are put on hold before being connected to an operator. A random sample of 30 callers is selected.

(i) Find the probability that exactly 29 of these callers are put on hold. [3]

(ii) Find the probability that at least 29 of these callers are put on hold. [3]

(iii) If 10 random samples, each of 30 callers, are selected, find the expected number of samples in which at least 29 callers are put on hold. [2]

4   It is known that 8% of the population of a large city use a particular web browser. A researcher wishes to interview some people from the city who use this browser. He selects people at random, one at a time.

(i)   Find the probability that the first person that he finds who uses this browser is

(A)   the third person selected, [3]

(B)   the second or third person selected. [2]

(ii) Find the probability that at least one of the first 20 people selected uses this browser. [3]

5   A manufacturer produces titanium bicycle frames. The bicycle frames are tested before use and on average 5% of them are found to be faulty. A cheaper manufacturing process is introduced and the manufacturer wishes to check whether the proportion of faulty bicycle frames has increased. A random sample of 18 bicycle frames is selected and it is found that 4 of them are faulty. Carry out a hypothesis test at the 5% significance level to investigate whether the proportion of faulty bicycle frames has increased. [8]

Section B (36 marks)

6 The engine sizes $x \, \text{cm}^3$ of a sample of 80 cars are summarised in the table below.

Engine size x	$500 < x \leqslant 1000$	$1000 < x \leqslant 1500$	$1500 < x \leqslant 2000$	$2000 < x \leqslant 3000$	$3000 < x \leqslant 5000$
Frequency	7	22	26	18	7

(i) Draw a histogram to illustrate the distribution. [5]

(ii) A student claims that the midrange is $2750 \, \text{cm}^3$. Discuss briefly whether he is likely to be correct. [1]

(iii) Calculate estimates of the mean and standard deviation of the engine sizes. Explain why your answers are only estimates. [5]

(iv) Hence investigate whether there are any outliers in the sample. [3]

(v) A vehicle duty of £1000 is proposed for all new cars with engine size greater than $2000 \, \text{cm}^3$. Assuming that this sample of cars is representative of all new cars in Britain and that there are 2.5 million new cars registered in Britain each year, calculate an estimate of the total amount of money that this vehicle duty would raise in one year. [3]

(vi) Why in practice might your estimate in part (v) turn out to be too high? [1]

7 Yasmin has 5 coins. One of these coins is biased with P(heads) = 0.6. The other 4 coins are fair. She tosses all 5 coins once and records the number of heads, X.

(i) Show that $P(X = 0) = 0.025$. [2]

(ii) Show that $P(X = 1) = 0.1375$. [4]

The table shows the probability distribution of X.

r	0	1	2	3	4	5
$P(X=r)$	0.025	0.1375	0.3	0.325	0.175	0.0375

(iii) Draw a vertical line chart to illustrate the probability distribution. [2]

(iv) Comment on the skewness of the distribution. [1]

(v) Find $E(X)$ and $Var(X)$. [5]

(vi) Yasmin tosses the 5 coins three times. Find the probability that the total number of heads is 3. [4]