OCR
Oxford Cambridge and RSA

Friday 16 June 2017 – Afternoon

A2 GCE MATHEMATICS (MEI)

4768/01 Statistics 3

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4768/01
- MEI Examination Formulae and Tables (MF2)

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**. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- 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 barcodes.
- 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 **16** 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.

1 A food manufacturer produces baby food, which should not contain more than 30 mg of salt per jar on average. For quality control purposes the food manufacturer tests a random sample of jars every week.

In a particular week, the amounts of salt, x mg, in a random sample of 16 jars are measured. The results are summarised as follows:

$$\Sigma x = 492, \qquad \Sigma x^2 = 15\,186.$$

(i) (*A*) Why is a test based on the Normal distribution not appropriate in this case? **[2]**

(*B*) Carry out a t test, at the 5% significance level, to test whether the mean amount of salt per jar exceeds 30 mg. You may assume that all the conditions required for the t test are fulfilled. **[10]**

(ii) Construct a 95% confidence interval for the true mean amount of salt per jar. **[4]**

(iii) The marketing director says that there is a 95% chance that the true mean amount of salt lies in this interval. Explain what is wrong with the marketing director's statement, and write an improved statement interpreting the meaning of a 95% confidence interval. **[2]**

2 **(i)** In a dance contest, judges award each competitor a mark between 1.0 and 10.0, inclusive. Marks are given to one decimal place. There is some concern that Judge 1 awards higher marks on the whole than Judge 2. The marks given by those two judges, for a random sample of 8 competitors, are as follows.

Competitor	A	B	C	D	E	F	G	H
Judge 1	9.9	3.4	8.1	4.0	7.2	4.7	4.2	3.8
Judge 2	7.4	5.7	6.5	8.1	4.2	1.6	3.4	6.0

(*A*) Explain why a t test might not be appropriate in this case. **[1]**

(*B*) Carry out an appropriate test, at the 5% significance level, to test whether Judge 1 awards higher marks on the whole than Judge 2. **[10]**

(ii) In a different round of the contest, the judges were instructed to award only integer marks between 3 and 10 inclusive. One of the organisers believes that the eight possible marks are equally likely to be awarded. To check this he obtains the following random sample of 80 marks awarded.

Mark	3	4	5	6	7	8	9	10
Frequency	5	6	10	9	14	16	14	6

Carry out a goodness of fit test, with a significance level of 10%, to investigate the organiser's belief. **[8]**

3 The random variable X has the following probability density function, $f(x)$.

$$f(x) = \begin{cases} \frac{1}{108}x^2(6-x) & \text{for } 0 \leqslant x \leqslant 6, \\ 0 & \text{otherwise.} \end{cases}$$

(i) Sketch the probability density function. **[2]**

(ii) Find the mode of X. **[2]**

(iii) Find the mean of X and show that the standard deviation of X is $\frac{6}{5}$. **[8]**

(iv) Let $\overline{X}$ be the mean of a random sample of 50 observations of X. Find $P(\overline{X} > 4)$.

Why did you need to use the Central Limit Theorem to find this probability? **[6]**

4 A fishmonger sells two types of fish, mackerel and trout. The weights of fish are Normally distributed, with means and standard deviations shown in the table below.

Fish	Mean weight (kg)	Standard deviation (kg)
Mackerel	0.468	0.067
Trout	0.395	0.093

(i) Find the probability that a randomly chosen mackerel weighs more than 0.5 kg. **[3]**

(ii) Find the probability that a randomly chosen mackerel weighs less than a randomly chosen trout. **[4]**

(iii) Mackerel costs £3.50 per kg and trout £4.00 per kg. Tim buys one mackerel and two trout, chosen randomly. Find the probability that he pays more than £5. **[4]**

(iv) The fishmonger offers a discount for buying 10 or more mackerel. The discounted price is £w per kg.

(*A*) Let £D be the discounted price of 10 mackerel. Find, in terms of w, the mean and standard deviation of D. **[2]**

(*B*) The probability that, with the discount, 10 mackerel cost less than £14 should not be greater than 0.1. Find the smallest possible value of w. **[4]**

END OF QUESTION PAPER