OCR
Oxford Cambridge and RSA

Friday 5 June 2015 – Morning

A2 GCE MATHEMATICS (MEI)

4767/01 Statistics 2

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4767/01
- 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**. 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.

1 A random sample of wheat seedlings is planted and their growth is measured. The table shows their average growth, y mm, at half-day intervals.

Time t days	0	0.5	1	1.5	2	2.5	3
Average growth y mm	0	7	21	33	45	56	62

(i) Draw a scatter diagram to illustrate these data. **[3]**

(ii) Calculate the equation of the regression line of y on t. **[5]**

(iii) Calculate the value of the residual for the data point at which $t = 2$. **[3]**

(iv) Use the equation of the regression line to calculate an estimate of the average growth after 5 days for wheat seedlings. Comment on the reliability of this estimate. **[2]**

It is suggested that it would be better to replace the regression line by a line which passes through the origin.

You are given that the equation of such a line is $y = at$, where $a = \dfrac{\Sigma yt}{\Sigma t^2}$.

(v) Find the equation of this line and plot the line on your scatter diagram. **[4]**

2 It was stated in 2012 that 3% of £1 coins were fakes. Throughout this question, you should assume that this is still the case.

(i) Find the probability that, in a random selection of 25 £1 coins, there is exactly one fake coin. **[2]**

A random sample of 250 £1 coins is selected.

(ii) Explain why a Poisson distribution is an appropriate approximating distribution for the number of fake coins in the sample. **[2]**

(iii) Use a Poisson distribution to find the probability that, in this sample, there are

(A) exactly 10 fake coins, **[3]**

(B) at least 10 fake coins. **[2]**

(iv) Use a suitable approximating distribution to find the probability that there are at least 50 fake coins in a sample of 2000 coins. **[5]**

It is known that 0.2% of another type of coin are fakes.

(v) A random sample of size n of these coins is taken. Using a Poisson approximating distribution, show that the probability of at most one fake coin in the sample is equal to $\mathrm{e}^{-\lambda} + \lambda \mathrm{e}^{-\lambda}$, where $\lambda = 0.002n$. **[2]**

(vi) Use the approximation $\mathrm{e}^{-\lambda} + \lambda \mathrm{e}^{-\lambda} \approx 1 - \dfrac{\lambda^2}{2}$ for small values of λ to estimate the value of n for which the probability in part **(v)** is equal to 0.995. **[3]**

3 The random variable X represents the weight in kg of a randomly selected male dog of a particular breed. X is Normally distributed with mean 30.7 and standard deviation 3.5.

(i) Find

(A) $\mathrm{P}(X < 30)$, **[3]**

(B) $P(25 < X < 35)$. **[3]**

(ii) Five of these dogs are chosen at random. Find the probability that each of them weighs at least 30 kg. **[2]**

(iii) The weights of females of the same breed of dog are Normally distributed with mean 26.8 kg. Given that 5% of female dogs of this breed weigh more than 30 kg, find the standard deviation of their weights. **[4]**

(iv) Sketch the distributions of the weights of male and female dogs of this breed on a single diagram. **[4]**

4 **(a)** As part of an investigation into smoking, a random sample of 120 students was selected. The students were asked whether they were smokers, and also whether either of their parents were smokers. The results are summarised in the table below. Test, at the 5% significance level, whether there is any association between the smoking habits of the students and their parents.

	At least one parent smokes	Neither parent smokes
Student smokes	21	27
Student does not smoke	17	55

[10]

(b) The manufacturer of a particular brand of cigarette claims that the nicotine content of these cigarettes is Normally distributed with mean 0.87 mg. A researcher suspects that the mean nicotine content of this brand is higher than the value claimed by the manufacturer. The nicotine content, x mg, is measured for a random sample of 100 cigarettes. The data are summarised as follows.

$$\Sigma x = 88.20 \qquad \Sigma x^2 = 78.68$$

Carry out a test at the 1% significance level to investigate the researcher's belief. **[10]**

END OF QUESTION PAPER