Location Entry Codes

As part of CIE's continual commitment to maintaining best practice in assessment, CIE uses different variants of some question papers for our most popular assessments with large and widespread candidature. The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions is unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiners' Reports that are available.

Question Paper	**Mark Scheme**	**Principal Examiner's Report**
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
Please direct any questions about this to CIE's Customer Services team at:
international@cie.org.uk

The titles for the variant items should correspond with the table above, so that at the top of the first page of the relevant part of the document and on the header, it has the words:

- First variant Question Paper / Mark Scheme / Principal Examiner's Report

or

- Second variant Question Paper / Mark Scheme / Principal Examiner's Report

as appropriate.

First Variant Question Paper

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

MATHEMATICS **9709/71**

Paper 7 Probability & Statistics 2 **(S2)** **May/June 2009**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

2925413684

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.

This document consists of **3** printed pages and **1** blank page.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

1 In Europe the diameters of women's rings have mean 18.5 mm. Researchers claim that women in Jakarta have smaller fingers than women in Europe. The researchers took a random sample of 20 women in Jakarta and measured the diameters of their rings. The mean diameter was found to be 18.1 mm. Assuming that the diameters of women's rings in Jakarta have a normal distribution with standard deviation 1.1 mm, carry out a hypothesis test at the $2\frac{1}{2}\%$ level to determine whether the researchers' claim is justified. [5]

2 The weights in grams of oranges grown in a certain area are normally distributed with mean μ and standard deviation σ. A random sample of 50 of these oranges was taken, and a 97% confidence interval for μ based on this sample was (222.1, 232.1).

(i) Calculate unbiased estimates of μ and σ^2. [4]

(ii) Estimate the sample size that would be required in order for a 97% confidence interval for μ to have width 8. [3]

3 Major avalanches can be regarded as randomly occurring events. They occur at a uniform average rate of 8 per year.

(i) Find the probability that more than 3 major avalanches occur in a 3-month period. [3]

(ii) Find the probability that any two separate 4-month periods have a total of 7 major avalanches. [3]

(iii) Find the probability that a total of fewer than 137 major avalanches occur in a 20-year period. [4]

4 In a certain city it is necessary to pass a driving test in order to be allowed to drive a car. The probability of passing the driving test at the first attempt is 0.36 on average. A particular driving instructor claims that the probability of his pupils passing at the first attempt is higher than 0.36. A random sample of 8 of his pupils showed that 7 passed at the first attempt.

(i) Carry out an appropriate hypothesis test to test the driving instructor's claim, using a significance level of 5%. [5]

(ii) In fact, most of this random sample happened to be careful and sensible drivers. State which type of error in the hypothesis test (Type I or Type II) could have been made in these circumstances and find the probability of this type of error when a sample of size 8 is used for the test. [4]

5 The time in minutes taken by candidates to answer a question in an examination has probability density function given by

$$f(t) = \begin{cases} k(6t - t^2) & 3 \leqslant t \leqslant 6, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

(i) Show that $k = \frac{1}{18}$. [3]

(ii) Find the mean time. [3]

(iii) Find the probability that a candidate, chosen at random, takes longer than 5 minutes to answer the question. [2]

(iv) Is the upper quartile of the times greater than 5 minutes, equal to 5 minutes or less than 5 minutes? Give a reason for your answer. [2]

6 When Sunil travels from his home in England to visit his relatives in India, his journey is in four stages. The times, in hours, for the stages have independent normal distributions as follows.

Bus from home to the airport:	N(3.75, 1.45)
Waiting in the airport:	N(3.1, 0.785)
Flight from England to India:	N(11, 1.3)
Car in India to relatives:	N(3.2, 0.81)

(i) Find the probability that the flight time is shorter than the total time for the other three stages. [6]

(ii) Find the probability that, for 6 journeys to India, the mean time waiting in the airport is less than 4 hours. [3]

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Second Variant Question Paper

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

MATHEMATICS **9709/72**

Paper 7 Probability & Statistics 2 **(S2)** **May/June 2009**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

5621478603

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
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Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.
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UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

1 The mean car engine size in Europe is known to be 1.746 litres. In Mauritius, a random sample of 230 cars was found to have a mean engine size of 1.765 litres. Assuming that the standard deviation of car engine sizes in Mauritius is 0.149 litres, test at the 10% significance level whether there is a difference between the mean engine sizes of cars in Europe and those in Mauritius. [5]

2 The weights in grams of oranges grown in a certain area are normally distributed with mean μ and standard deviation σ. A random sample of 50 of these oranges was taken, and a 97% confidence interval for μ based on this sample was (222.1, 232.1).

(i) Calculate unbiased estimates of μ and σ^2. [4]

(ii) Estimate the sample size that would be required in order for a 97% confidence interval for μ to have width 8. [3]

3 At a certain point on a road, cars pass by at random times at a constant average rate of 3 cars every 2 minutes.

(i) Find the probability that at most 2 cars pass by in a period of 3 minutes. [3]

(ii) Find the probability that the total number of cars that pass by in two separate periods of 1 minute and 4 minutes is 6. [3]

(iii) Find the probability that more than 100 cars pass by in a period of 1 hour. [4]

4 In a certain city it is necessary to pass a driving test in order to be allowed to drive a car. The probability of passing the driving test at the first attempt is 0.36 on average. A particular driving instructor claims that the probability of his pupils passing at the first attempt is higher than 0.36. A random sample of 8 of his pupils showed that 7 passed at the first attempt.

(i) Carry out an appropriate hypothesis test to test the driving instructor's claim, using a significance level of 5%. [5]

(ii) In fact, most of this random sample happened to be careful and sensible drivers. State which type of error in the hypothesis test (Type I or Type II) could have been made in these circumstances and find the probability of this type of error when a sample of size 8 is used for the test. [4]

5 The height in metres reached by a sunflower can be modelled by the probability density function given by

$$f(x) = \begin{cases} kx^2(2-x) & 0 \leqslant x \leqslant 2, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

(i) Show that $k = \frac{3}{4}$. [3]

(ii) Find the mean height reached by a sunflower. [3]

(iii) Find the probability that a randomly chosen sunflower reaches a height of more than 1.3 metres. [2]

(iv) Is the median height greater than 1.3 metres, less than 1.3 metres or equal to 1.3 metres? Justify your answer. [2]

6 When Sunil travels from his home in England to visit his relatives in India, his journey is in four stages. The times, in hours, for the stages have independent normal distributions as follows.

Bus from home to the airport:	N(3.75, 1.45)
Waiting in the airport:	N(3.1, 0.785)
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Car in India to relatives:	N(3.2, 0.81)

(i) Find the probability that the flight time is shorter than the total time for the other three stages. [6]

(ii) Find the probability that, for 6 journeys to India, the mean time waiting in the airport is less than 4 hours. [3]

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