Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

MATHEMATICS **9709/73**

Paper 7 Probability & Statistics 2 **(S2)** **October/November 2014**

1 hour 15 minutes

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

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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 an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

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.

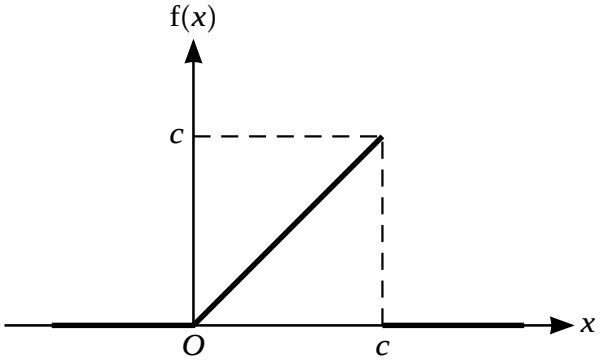
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1 A researcher wishes to investigate whether the mean height of a certain type of plant in one region is different from the mean height of this type of plant everywhere else. He takes a large random sample of plants from the region and finds the sample mean. He calculates the value of the test statistic, z, and finds that $z = 1.91$.

(i) Explain briefly why the researcher should use a two-tail test. [1]

(ii) Carry out the test at the 4% significance level. [3]

2



The diagram shows the graph of the probability density function, f, of a random variable X.

(i) Find the value of the constant c. [2]

(ii) Find the value of a such that $P(a < X < 1) = 0.1$. [4]

(iii) Find $E(X)$. [2]

3 The times, in minutes, taken by people to complete a walk are normally distributed with mean μ. The times, t minutes, for a random sample of 80 people were summarised as follows.

$$\Sigma t = 7220 \qquad \Sigma t^2 = 656\,060$$

(i) Calculate a 97% confidence interval for μ. [6]

(ii) Explain whether it was necessary to use the Central Limit theorem in part **(i)**. [2]

4 The masses, in grams, of tomatoes of type A and type B have the distributions $N(125, 30^2)$ and $N(130, 32^2)$ respectively.

(i) Find the probability that the total mass of 4 randomly chosen tomatoes of type A and 6 randomly chosen tomatoes of type B is less than 1.5 kg. [5]

(ii) Find the probability that a randomly chosen tomato of type A has a mass that is at least 90% of the mass of a randomly chosen tomato of type B. [5]

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5 It is known that when seeds of a certain type are planted, on average 10% of the resulting plants reach a height of 1 metre. A gardener wishes to investigate whether a new fertiliser will increase this proportion. He plants a random sample of 18 seeds of this type, using the fertiliser, and notes how many of the resulting plants reach a height of 1 metre.

(i) In fact 4 of the 18 plants reach a height of 1 metre. Carry out a hypothesis test at the 8% significance level. [5]

(ii) Explain which of the errors, Type I or Type II, might have been made in part **(i)**. [2]

Later, the gardener plants another random sample of 18 seeds of this type, using the fertiliser, and again carries out a hypothesis test at the 8% significance level.

(iii) Find the probability of a Type I error. [3]

6 The number of calls received at a small call centre has a Poisson distribution with mean 2.4 calls per 5-minute period. Find the probability of

(i) exactly 4 calls in an 8-minute period, [2]

(ii) at least 3 calls in a 3-minute period. [3]

The number of calls received at a large call centre has a Poisson distribution with mean 41 calls per 5-minute period.

(iii) Use an approximating distribution to find the probability that the number of calls received in a 5-minute period is between 41 and 59 inclusive. [5]

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