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CAMBRIDGE A LEVEL PROGRAMME

AS TRIAL EXAMINATION AUGUST 2011

(January and March 2011 Intakes)

Friday **19 August 2011** **8.30 am – 9.45 am**

MATHEMATICS 9709/63

PAPER 6 Probability & Statistics 1 (S1) 1 hour 15 minutes

Additional materials: Answer Booklet/Paper
Graph Paper
List of formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your name and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
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.
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 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.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

This document consists of **4** printed pages.

[Turn over

1 A fair coin is tossed 80 times. Use a suitable approximation to estimate the probability that the number of heads obtained lies between 35 and 45 inclusive. [4]

2 The random variables X has a normal distribution with mean μ and standard deviation σ. Given that $P(X < 30) = 0.14$ and that $P(X < 60) = 0.79$. Calculate the values of μ and σ giving your answers correct to three significant figures. [5]

3 **(a)** Eight people go to the theatre and sit in a particular group of eight adjacent reserved seats in the front row. Three of the eight belong to one family and sit together.

(i) If the other five people do not mind where they sit, find the number of possible seating arrangements for all eight people. [2]

(ii) If the other five people do not mind where they sit, but two of them refuse to sit together, find the number of possible seating arrangements for all eight people. [2]

(b) The salad bar at a restaurant has 6 separate bowls containing lettuce, tomatoes, cucumber, radishes, spring onions and beetroot respectively. John decides to visit the salad bar and make a selection. At each bowl, he can choose to take some of the contents or not. John decides he is going to have 4 salad items, and one of them will be tomatoes. How many different selections can he make? [2]

4 A certain race genetic condition affects 0.01% of population. A test has been developed which can detect the condition, if it is present, with a probability of 95%. Unfortunately, when the condition is not present, there is a probability of 0.05% that the test will still give a positive result. Calculate the probability that

(i) a person has the condition and the test gives a positive result. [2]

(ii) the test gives a positive result, [2]

(iii) a person has the condition given that the test gave a positive result. [2]

5 A variable X is distributed normally with mean 10 and standard deviation 2.

(i) Find $P(X > 12)$. [2]

(ii) Hence, or otherwise, find the possible values of k if the probability that X is between k and 12 is 0.14. [5]

(iii) If three values of X are taken at random, calculate the probability that two of them are less than 12 and the other is greater than 12. [2]

6 A cubical die has three faces marked with a '1', two faces marked with a '2' and one face marked with a '3'. A second cubical die has one face marked with a '1', two faces marked with a '2' and three faces marked with a '3'. The two dice are thrown together and W denotes the score on the first minus the score on the second die.

(i) Use a diagram and tabulate the probability distribution of W. [4]

If the mean and variance of W are μ and σ^2 respectively, show that

(ii) $\sigma^2 = \frac{10}{9}$ [3]

(iii) $P(-\sigma < W - \mu < \sigma) = \frac{11}{18}$ [3]

7 Two thousand amateur runners took part in a mini-marathon 'fun run' to raise money for charity. The first runner to finish took 54 minutes, and the table below shows the cumulative numbers of runners who had finished by various times.

Time after start(hours)	≤ 1	≤ 1.5	≤ 2	≤ 2.5	≤ 3	≤ 4
No. finished by this time	23	457	1212	1684	1896	2000

(i) Illustrate the data by drawing a cumulative frequency graph on graph paper. Use your graph to estimate the median time taken by the runners to finish and the interquartile range of the times. [4]

(ii) Calculate an estimate of the mean time taken by the runners to finish. [4]

(iii) What is the difference between the mean found in part **(ii)** and new mean, given the additional information that the last runner to finish took exactly 3.5 hours? [2]