



TAYLOR'S  
UNIVERSITY  
COLLEGE  
Wisdom • Integrity • Excellence

**CAMBRIDGE A LEVEL PROGRAMME**  
**SEMESTER ONE EXAMINATION JUNE 2008**  
(January 2008 Intake)

**Monday**

**9 June 2008**

**3.00 pm – 4.00 pm**

**MATHEMATICS**

**9709/6**

**PAPER 6 Probability & Statistics 1 (S1)**

**1 hour**

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

**READ THESE INSTRUCTIONS FIRST**

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 40.  
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 **3** printed pages.

1. The length of an engine part must be between 4.81 cm and 5.20 cm. In mass production it is found that 0.8% is too short and 3% are too long. If these lengths are normally distributed about the mean  $\mu$  with standard deviation  $\sigma$ , find the two equations of the form  $\mu + A\sigma = B$ . Solve these equations to find the mean and standard deviation. [3]
2. A machine manufactures glass bottles of which, on average, 1 in every 20 is found to be defective. If a random sample of 1000 bottles is taken from the production line, calculate using a suitable approximation, the probability that there are at least 35 but no more than 55 defective bottles. [4]
3. In a game, a player rolls two balls down an inclined plane so that each ball finally settles in one of five slots and scores the number of points allotted to that slots as shown in the diagram below.

|   |   |   |   |   |
|---|---|---|---|---|
| 2 | 4 | 7 | 4 | 2 |
|---|---|---|---|---|

It is possible for both balls to settle in one slot and it may be assumed that each slot is equally likely to accept either ball. The player's score is the sum of the points scored by each ball.

- (a) Draw a table showing all the possible scores and the probability of each score [3]
  - (b) If the player pays 10pence for each game and receives back a number of pence equal to his score, calculate the player's expected gain or loss per 50 games. [2]
4. A company has ten telephone lines. At any instant the probability that any particular line is engaged is  $\frac{1}{5}$ .
    - (a) State the expected number of free telephone lines [1]
    - (b) Calculate for any instant, the probability that
      - (i) all the lines are engaged, [2]
      - (ii) at least one line is free, [2]

5. A committee of 6 members is to be chosen from 7 engineers, 3 chemists and 1 doctor. In how many ways can this be done so as to include:

- (a) 1 doctor [2]  
 (b) 4 engineers [2]  
 (c) not more than 3 engineers [3]

6. (a) A and B play a game as follows: an ordinary die is rolled and if a six is obtained then A wins and if a one is obtained then B wins. If neither a six nor a one is obtained then the die is rolled again until a decision can be made. What is the probability that A wins on

- (i) the first roll,  
 (ii) the second roll [3]

- (b) A bag contains 4 red and 3 yellow balls and another bag contains 3 red and 4 yellow. A ball is taken from the first bag and placed in the second, the second bag shaken and a ball taken from it and placed in the first bag. What is the probability that the ball is red in the second bag?

(You are advised to draw a tree diagram.) [5]

7. 30 specimens of sheet steel are tested for tensile strength, measured in  $\text{kN m}^{-2}$ . The table gives the distribution of the measurements.

| Tensile strength | Number of specimens |
|------------------|---------------------|
| 405 – 415        | 4                   |
| 415 – 425        | 3                   |
| 425 – 435        | 6                   |
| 435 – 445        | 10                  |
| 445 – 455        | 5                   |
| 455 – 465        | 2                   |

- (a) Draw a cumulative diagram of this distribution. Estimate the median and the quartiles. [6]

- (b) Draw a box plot to illustrate the information. [2]