The Poisson distribution
Question Paper 1

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	The Poisson distribution
Sub Topic	
Booklet	Question Paper 1

Time Allowed: **57 minutes**

Score: **/47**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 The probability that a randomly chosen plant of a certain kind has a particular defect is 0.01. A random sample of 150 plants is taken.

   (i) Use an appropriate approximating distribution to fin the probability that at least 1 plant has the

   defect. Justify your approximating distribution. [4]

The probability that a randomly chosen plant of another kind has the defect is 0.02. A random sample of 100 of these plants is taken.

   (ii) Use an appropriate approximating distribution to f nd the probability that the total number of plants with the defect in the two samples together is more than 3 and less than 7. [3]

2 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 f nd the probability that the number of calls received in a 5-minute period is between 41 and 59 inclusive. [5]

3 Each computer made in a factory contains 1000 components. On average, 1 in 30 000 of these components is defective. Use a suitable approximate distribution to fin the probability that a randomly chosen computer contains at least 1 faulty component. [4]

4   Goals scored by Femchester United occur at random with a constant average of 1.2 goals per match. Goals scored against Femchester United occur independently and at random with a constant average of 0.9 goals per match.

    (i) Find the probability that in a randomly chosen match involving Femchester,

        (a) a total of 3 goals are scored,   **[2]**

        (b) a total of 3 goals are scored and Femchester wins.   **[3]**

The manager promises the Femchester players a bonus if they score at least 35 goals in the next 25 matches.

    (ii) Find the probability that the players receive the bonus.   **[4]**

5   The cost of hiring a bicycle consists of a fixe charge of 500 cents together with a charge of 3 cents per minute. The number of minutes for which people hire a bicycle has mean 142 and standard deviation 35.

    (i) Find the mean and standard deviation of the amount people pay when hiring a bicycle.   **[3]**

    (ii) 6 people hire bicycles independently. Find the mean and standard deviation of the total amount paid by all 6 people.   **[3]**

6   A random variable X has the distribution Po(1.6).

    (i) The random variable R is the sum of three independent values of X. Find $P(R < 4)$.   **[3]**

    (ii) The random variable S is the sum of n independent values of X. It is given that

$$P(S = 4) = \tfrac{16}{3} \times P(S = 2).$$

    Find n.   **[4]**

    (iii) The random variable T is the sum of 40 independent values of X. Find $P(T > 75)$.   **[4]**