The Poisson distribution
Question Paper 7

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	The Poisson distribution
Sub Topic	
Booklet	Question Paper 7

Time Allowed: **60 minutes**

Score: **/50**

Percentage: **/100**

Grade Boundaries:

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

1. When the council published a plan for a new road, only 15% of local residents approved the plan. The council then published a revised plan and, out of a random sample of 300 local residents, 60 approved the revised plan. Is there evidence, at the 2.5% significanc level, that the proportion of local residents who approve the revised plan is greater than for the original plan? [5]

2. A random variable X has the distribution Po(3.2).

   (i) A random value of X is found.

   (a) Find $P(X \geqslant 3)$. [2]

   (b) Find the probability that $X = 3$ given that $X \geqslant 3$. [3]

   (ii) Random samples of 120 values of X are taken.

   (a) Describe fully the distribution of the sample mean. [2]

   (b) Find the probability that the mean of a random sample of size 120 is less than 3.3. [3]

3. Bacteria of a certain type are randomly distributed in the water in two ponds, A and B. The average numbers of bacteria per cm^3 in A and B are 0.32 and 0.45 respectively.

   (i) Samples of $8 \, cm^3$ of water from A and $12 \, cm^3$ of water from B are taken at random. Find the probability that the total number of bacteria in these samples is at least 3. [3]

   (ii) Find the probability that in a random sample of $155 \, cm^3$ of water from A, the number of bacteria is less than 35. [5]

4. The number of lions seen per day during a standard safari has the distribution Po(0.8). The number of lions seen per day during an off-road safari has the distribution Po(2.7). The two distributions are independent.

   (i) Susan goes on a standard safari for one day. Find the probability that she sees at least 2 lions. [2]

   (ii) Deena goes on a standard safari for 3 days and then on an off-road safari for 2 days. Find the probability that she sees a total of fewer than 5 lions. [3]

   (iii) Khaled goes on a standard safari for n days, where n is an integer. He wants to ensure that his chance of not seeing any lions is less than 10%. Find the smallest possible value of n. [3]

5   On average, 2 people in every 10 000 in the UK have a particular gene. A random sample of

6000 people in the UK is chosen. The random variable X denotes the number of people in the sample who have the gene. Use an approximating distribution to calculate the probability that there will be more than 2 people in the sample who have the gene.   [4]

6   Cans of drink are packed in boxes, each containing 4 cans. The weights of these cans are normally

distributed with mean 510 g and standard deviation 14 g. The weights of the boxes, when empty, are independently normally distributed with mean 200 g and standard deviation 8 g.

   (i) Find the probability that the total weight of a full box of cans is between 2200 g and 2300 g.   [6]

   (ii) Two cans of drink are chosen at random. Find the probability that they differ in weight by more
      than 20 g.   [5]

7   The weights of bags of fuel have mean 3.2 kg and standard deviation 0.04 kg. The total weight of a
    random sample of three bags is denoted by T kg. Find the mean and standard deviation of T.   [4]