SAMPLE LESSON: MATHEMATICS

Class: Upper 6

Module: Probability Distribution	**TOPIC:** Discrete Probability Distribution

Title of Lesson: **Introduction to the Poisson Distribution**

Duration of Lesson: 50mins

Name of Authors: Group of teachers during training

School: TTP COP **Class:** USS/USA Duration of lesson: 50 mins **Number on Roll :**

Module: Probability Distribution

Topic: Discrete Probability Distribution

Lesson: Introduction to the Poisson Distribution

Objectives: At the end of the lesson, the learners should be able to

- Identify the Poisson distribution.
- State the properties of the Poisson distribution.
- Calculate probabilities using the Poisson distribution.

Key Question:

How can we calculate the probability of events that follow a Poisson distribution in life

Pre-requisite Knowledge:

- Knowledge of the concept of discrete random variables.
- Knowledge of the parameters of a distribution.
- Evaluation exponential values using a calculator.

Motivation:

- How many of you were involve in an accident on the way home after school last week?
- How many of you were involve in an accident yesterday?
- How many of you will like to be involve in an accident today or even tomorrow?

Didactic Materials: Calculator, students notebooks, statistical tables.

References:

(i) 2011, A complete course in A level Statistics by Nche Cheo et al., (first edition), PressPrint Cameroon.

(ii) A concise course in A level Statistics by Bostock &Chandler. Stanley Thornes Publishers.

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<tr><th>Stages/ Duration</th><th>Teaching/Learning Activities</th><th>Teacher's activities</th><th>Learners' activities</th><th>Learning Points</th></tr>
<tr>
<td>Introduction

10 mins</td>
<td>Verification of Pre-requisite Knowledge
• What are the possible number of HEADS (H) that can be obtained when one fair coin is tossed 3 times?
• Can someone come to the board and write down the pmf of the binomial distribution?
• Evaluate e^0, $e^{1.5}$, e^{-3}.
PROBLEM SITUATION
How can the government of Cameroon interpret problems involving the Poisson distribution and take decisions that can improve the lives of Cameroonians?
Consider the two events given below:
1. The number of car accidents that occur on
a particular stretch of a road per week.
2. The number of parents who come,
uninvited to see the principal within each hour of a working day.</td>
<td>Engage learners' attention.</td>
<td>Listens and responds to questions.</td>
<td>If a random variable, say X is such that the average of mean number of occurrences of the events per given interval is λ, then its pmf is given by
$$P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}, \quad x = 0, 1, 2, 3, \ldots$$
where λ is the parameter of the distribution.
If the random variable X is distributed as such, then we say that X follows a Poisson distribution with parameter λ, and is written as $\boldsymbol{X \sim P(\lambda)}$.
NOTE:
• λ is the average or mean number of occurrences of the event per given interval. x is the number of occurrences demanded from the question.</td>
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	What are the similarities between the two events? **Such events were first investigated by the renown French Mathematician, Denis Simeon Poisson, which he published in 1838 in a book titled. *Research on the probability of judgements in criminal and civil matters.***	Provokes the discussion between learners	Discuss with mates and making suggestions to the teacher.	
Lesson Development 20mins	If a random variable, say X is such that the average of mean number of occurrences of the events per given interval is λ, then its pmf is given by $$P(X = x) = \frac{e^{-\lambda}\lambda^{x}}{x!}, \quad x = 0, 1, 2, 3, \ldots$$ where λ is the parameter of the distribution. If the random variable X is distributed as such, then we say that X follows a Poisson distribution with parameter λ, and is written as $\boldsymbol{X \sim \mathrm{P}(\lambda)}$. ***NOTE*:**	Explains the concepts and presents them on the chalk board	Listen to the teacher and copy notes.	If a random variable, say X is such that the average of mean number of occurrences of the events per given interval is λ, then its pmf is given by $$P(X = x) = \frac{e^{-\lambda}\lambda^{x}}{x!}, \quad x = 0, 1, 2, 3, \ldots$$ where λ is the parameter of the distribution. If the random variable X is distributed as such, then we say that X follows a Poisson distribution with parameter λ, and is written as $\boldsymbol{X \sim \mathrm{P}(\lambda)}$. ***NOTE*:**

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	• λ is the average or mean number of occurrences of the event per given interval. • x is the number of occurrences demanded from the question. **Properties of the Poisson Distribution** ➢ Events occur randomly. ➢ Events occur independently. ➢ Intervals are equal. The probability of occurrence of an event per interval is very small.			• λ is the average or mean number of occurrences of the event per given interval. • x is the number of occurrences demanded from the question. **Properties of the Poisson Distribution** ➢ Events occur randomly. ➢ Events occur independently. ➢ Intervals are equal. The probability of occurrence of an event per interval is very small.
Application **Exercises**	***Example 1*** Cars arrive at a petrol station at an average of 3 per hour. Assuming that number of cars arriving at the petrol station follows a Poisson distribution, Find, to four decimal places, the probability that (a) no car arrives at the station within an hour,			***Example 1*** **Solution:** (a) $\lambda = 3$, $x = 0$, so then X ~ P(3). $P(X = x) = \dfrac{e^{-\lambda}\lambda^{x}}{x!}$

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10mins	(b) exactly 2 cars will arrive at the station within an hour. ***Remark:*** The interval may be changed as required by some questions, In such a case, the value of λ will change. From the example above the average number of cars that arrive per hour is 3. What will be the average number of cars that will arrive the station within (a) 2 hours, (b) 15 minutes? ***Example 2*** Lum, a bank auditor finds out that a particular bookkeeping department makes averagely two errors per week. Find, to three significant figures, the probability that (a) exactly four errors will be made in one week, (b) exactly two errors will be			$P(X=0)=\frac{e^{-3}(3^0)}{0!}=0.0498$ (b) $P(X=2)=\frac{e^{-3}(3^2)}{2!}=0.2240$ ***Remark:*** The interval may be changed as required by some questions, In such a case, the value of λ will change. From the example above the average number of cars that arrive per hour is 3. What will be the average number of cars that will arrive the station within (a) 2 hours, (b) 15 minutes? ***Example*** **SOLUTION:** (a) $\lambda = 2$, $x = 4$, so then X ~ P(2). $P(X=x)=\frac{e^{-\lambda}\lambda^x}{x!}$

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	made in three weeks. **Exercises** 1. The number of calls received by an office during each minute of a working day follows a Poisson distribution with mean 4. Find, to four decimal places, the probability that the office will receive (a) three calls during any particular minute, (b) no call in a two minutes period, (c) four calls in a period of fifteen			$P(X=4)=\frac{e^{-2}(2^4)}{4!}=0.0902$ (b) 3 weeks $\Rightarrow$ $\lambda = 6$, so that X ~ P(6). $P(X=2)=\frac{e^{-6}(6^2)}{2!}=0.0446$ **Exercises** 1. The number of calls received by an office during each minute of a working day follows a Poisson distribution with mean 4. Find, to four decimal places, the probability that the office will receive (a) three calls during any particular minute, (b) no call in a two minutes period, (c) four calls in a period of fifteen

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Conclusion and **Homework** **5mins**	If the average number of accidents that occur in the country yearly can be calculated, then probabilities can be calculated and that may push the government to look for the cause,	Dictates home work and gives instructions against the next lesson	Copy home work in their notebooks and listen to the instructions given.	**Home work.** A certain textbook has on average two misprints on each page. Assuming that misprints occur at random, find, to three significant figures, the probability that (a) there will be no misprint on a particular chosen page, (b) exactly four misprints on three chosen pages, (c) exactly two misprints on half a page.