

College of Computer Science & Engineering at Yanbu	 جامعة طيبة TAIBAH UNIVERSITY	كلية علوم وهندسة الحاسبات ببنبع
Department of Computer Science.		قسم علوم الحاسبات

Midterm. Exam

Academic Year 1446 - First Semester

Exam Information معلومات الامتحان		
Course name	الإحتمالات والإحصاء للمهندسين - الاحتمالات والإحصاء الهندسي	اسم المقرر
Course Code	STAT 301 – STAT 305	رمز المقرر
Exam Date	28 / 10 / 2024	تاريخ الامتحان
Exam Time		وقت الامتحان
Exam Duration	30 Mins	مدة الامتحان
Classroom No.		رقم قاعة الاختبار
Instructor Name	Prof. Mostafa Elhosseini	اسم استاذ المقرر
Student Information معلومات الطالب		
Student's Name		اسم الطالب
ID number		الرقم الجامعي
Section No.		رقم الشعبة
Serial Number		الرقم التسلسلي

General Instructions:

تعليمات عامة:

- Your Exam consists of **3 PAGES** (except this paper) (إستثناء هذه الورقة) عدد صفحات الامتحان **3 صفحة**.
- Phones and smart devices are forbidden inside the hall. يمنع استخدام الهواتف والأجهزة الذكية داخل القاعة.

هذا الجزء خاص بأستاذ المادة

This section is ONLY for instructor

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
1	Present data in charts and tables	Q1 – Part A	2	
2	Compute measures of location and measures of variability	Q1 – Part B	2	
3				
4	Distinguish between discrete, continuous random variables and probability distributions	Q1 – Part C	2	
5				
6	Analyze measures of location and measures of variability	Q1 – Part D	1	
7				
8	Compute probability models for a given problem.	Q2 – Part A	1.5	
9	Implement probability methods to solve real-world problems.	Q2 – Part B	1.5	

Question 1: Points: 7**CLO #1,2,4,6**

A traffic analyst is studying the number of **traffic accidents** occurring at a particular intersection **per month** over a period of **50 months**. The data collected is summarized below:

Number of Accidents per Month (X)	Frequency
0	8
1	12
2	15
3	10
4	4
5	1

(A) Points: 2**CLO #1**

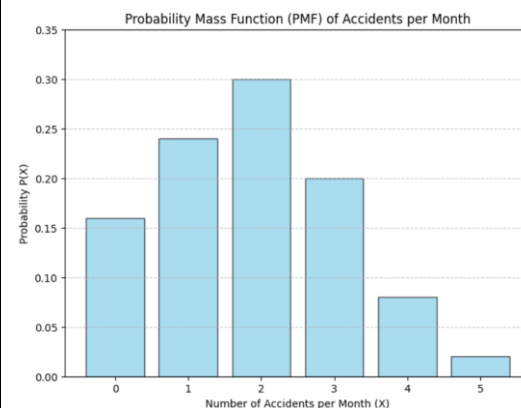
Present the above data as a **Probability Distribution Table**.

$$\text{Total Months} = 8 + 12 + 15 + 10 + 4 + 1 = 50$$

$$P(X = x) = \frac{\text{Frequency of } x}{\text{Total Months}}$$

Number of Accidents per Month (X)	Frequency	Probability $P(X)$
0	8	$8/50 = 0.16$
1	12	$12/50 = 0.24$
2	15	$15/50 = 0.3$
3	10	$10/50 = 0.2$
4	4	$4/50 = 0.08$
5	1	$1/50 = 0.02$

Create an appropriate chart to represent the **PMF**.

**(B) Points: 2****CLO #2**

Calculate the **expected number** of accidents per month.

$$E[x] = \sum_{i=0}^5 x_i P(X = x_i)$$

$$E[x] = (0)(0.16) + (1)(0.24) + (2)(0.3) + (3)(0.2) + (4)(0.08) + (5)(0.02) = 1.86$$

Calculate the **variance of the number** of accidents per month.

$$E[x^2] = \sum_{i=0}^5 x_i^2 P(X = x_i)$$

$$E[x^2] = (0^2)(0.16) + (1^2)(0.24) + (2^2)(0.3) + (3^2)(0.2) + (4^2)(0.08) + (5^2)(0.02) = 5.02$$

$$\text{Var}(x) = E[x^2] - E[x]^2 = 5.02 - (1.86)^2 = 1.5604$$

(C) Points: 2	CLO #4
Define discrete random variable and probability distribution. A random variable that can take on a countable number of distinct values. Each possible value has an associated probability A table, formula, or graph that provides the probabilities $P(X=x)$ for all possible values of a discrete random variable X.	Explain how the data provided represents a discrete random variable and its probability distribution. The data represents a discrete random variable because the number of accidents per month X can only take integer values from 0 to 5. Each possible number of accidents has a specific frequency and associated probability based on observed data. The Probability Distribution is constructed by calculating the probability of each possible value of X occurring, forming a probability distribution table. This table shows the likelihood of each number of accidents happening in any given month.

(D) Points: 1	CLO #6
Analyze what the computed expected value and variance in Part B indicate about traffic safety at the intersection The expected value of 1.86 accidents per month indicates that, on average, there are approximately 2 accidents at the intersection each month. The variance of approximately 1.56 suggests there is some variability in the monthly number of accidents. The standard deviation is $\sqrt{1.56} \approx 1.25$, indicating that the number of accidents typically varies by about 1.25 from the mean.	

Question 2: Points: 3

CLO #8,9

(A) Points: 1.5	CLO #8	(B) Points: 1.5	CLO #9
From the Probability Distribution Table in Question 1, determine the probability that in any given month, there are exactly two accidents at the intersection. From the table in Question 1: $P(X = 2) = 0.30$		Using the same Probability Distribution Table, calculate the probability that in any given month, there are at most three accidents at the intersection. The probability of at most three accidents per month: $P(X \leq 3) = P(X = 0) + P(X = 1) + P(X = 2) + P(X = 3)$ $= 0.16 + 0.24 + 0.30 + 0.20$ $= 0.9$	