# Sessional-I Exam

Date: 26, Feb 2025

**Course Instructor(s)**

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**Total Time: 1 Hour**
**Total Marks: 30**
**Total Questions: 02**

Roll No _____ Section _____ Student Signature _____

**Attempt all the questions.**

***CLO 1: Describe the fundamental concepts in probability and statistics***

**Q1:** [18 marks]

(a) The Machine Learning engineer collected 30 observations of a performance metric related to the response time (in micro seconds) of a machine learning model processing user queries. The recorded values range from 20 to 62 micro seconds, as follows: *[7+4 Marks]*

21,30,40,50,60,30,40,20,50,40,30,50,60,21,30,40,50,60,21,30,40,50,62,20,30,40,50,61,22,50

i. Sketch box-plot for these values and identify outlier(s) if any. Is the data skewed? Justify your answer

ii. Organize these values into 5 equal-width classes (bins) which starts from 20.

(b) A software engineering team is analyzing system logs from an AI-powered recommendation engine. The logs contain response times, error codes, and system status data, but some values are missing or contain outliers due to network issues and system anomalies. [3 Marks]

| Request ID | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 |
|---|---|---|---|---|---|---|---|---|---|---|
| Response Time (ms) | 120 | 132 | ? | 128 | 135 | 300 (outlier) | ? | 125 | 130 | ? |
| Error Code | 200 | 404 | 500 | 200 | ? | 200 | 404 | 200 | 500 | 200 |
| System Status | Normal | Normal | ? | Overloaded | Normal | Normal | Overloaded | Normal | ? | Normal |

*Fill missing values for Response Time, Error Code, System Status with respective appropriate measure of center (mean, median and mode)*

(c) A database administrator is tracking the number of failed queries in two different database systems over 10 days. Determine which database system has more consistent performance based on the variation in failed queries. [4 Marks]

Database A: 8, 10, 9, 11, 7, 6, 12, 9, 10, 8 Database B: 5, 15, 3, 14, 8, 18, 2, 13, 6, 16

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***CLO 2: Analyze the data and produce probabilistic models for different problems***

**Q2:** [12 marks]

(a) A software development team is analyzing the **bug reporting process** in their application. The system tracks **three categories** of bugs based on severity: **Critical**, **Major**, and **Minor**. After a bug is reported, it can be either **Acknowledged** by the development team or **Ignored**. If the bug is acknowledged, it can be either **Fixed** or **Pending Fix**. [3+1 Marks]

i. List all possible ways to analyze a bug in bug reporting process (sample space) with the help of tree diagram

ii. List the elements of event A which represents a randomly reported bug is acknowledged

(b) A company manufactures batteries and stores them in two testing labs before final approval.
Lab A contains 5 faulty and 7 functional batteries.
Lab B contains 4 faulty and 6 functional batteries.
A random battery is selected from Lab A and transferred unseen to Lab B. After the transfer, a battery is randomly selected from Lab B. What is the probability that the selected battery from Lab B is faulty?

[3 Marks]

(c) A company is evaluating the performance of a Deep Learning (DL) model on two datasets:
Dataset A: Collected from real-world scenarios
Dataset B: Generated from synthetic data
The model classifies images into three mutually exclusive categories:
*Correctly Classified (C)*, Misclassified (M), and Uncertain (U) – The model is unsure and *requires human review*
The following table shows the number of images in each category:

| Dataset | Correctly Classified (C) | Misclassified (M) | Uncertain(U) |
|---|---|---|---|
| Dataset A | 50 | 30 | 20 |
| Dataset B | 60 | 25 | 15 |

[2+2+1 Marks]

(i) If an image is selected randomly and is found to be misclassified, what is the probability that it came from Dataset A?

(ii) What is the probability that any randomly selected image is from Dataset B or correctly classified?

(iii) Explain why the events "Correctly Classified" (C), "Misclassified" (M), and "Uncertain" (U) are mutually exclusive.