Professor Assignment PDF (Mixed Questions)

Professor: Dr. Gomez
Course: Data & Algorithms
Session: Winter 2025
Assignment No: 3

Q1:

Question: Explain the difference between supervised and unsupervised learning. Provide one example of each.
Ideal Answer: Supervised learning uses labeled data (input-output pairs) to learn a mapping from inputs to targets, often via classification or regression; unsupervised learning uses unlabeled data to discover structure (e.g., clustering, dimensionality reduction). Example supervised: spam email classifier; example unsupervised: k-means clustering on customer segments.

Rubric:

- Correct definition of supervised learning (2 points)
- Correct definition of unsupervised learning (2 points)
- One example for supervised and one for unsupervised (2 points)
- States key difference (labels vs. no labels) (2 points)

Q2:

Question: Compute the definite integral: ∫0^1 2x dx. Provide a simplified numeric value.
Ideal Answer: 1

Rubric:

- Sets up or recognizes antiderivative correctly (2 points)
- Correct evaluation and simplification (4 points)

Q3:

Question: Write a Python program that reads a single integer n from standard input and prints 'prime' if n is prime, otherwise 'composite'. Treat n < 2 as composite.
Ideal Answer: A program that correctly checks primality and prints exactly 'prime' or 'composite'.

Rubric:

- Correct primality logic (loops/divisibility checks) (4 points)
- Prints exactly 'prime' or 'composite' (2 points)
- Handles n < 2 as composite (2 points)

Q4:

Question: (MCQ) Which sorting algorithm has average-case time complexity O(n log n)?
A) Bubble sort B) Insertion sort C) Merge sort D) Selection sort
Ideal Answer: C

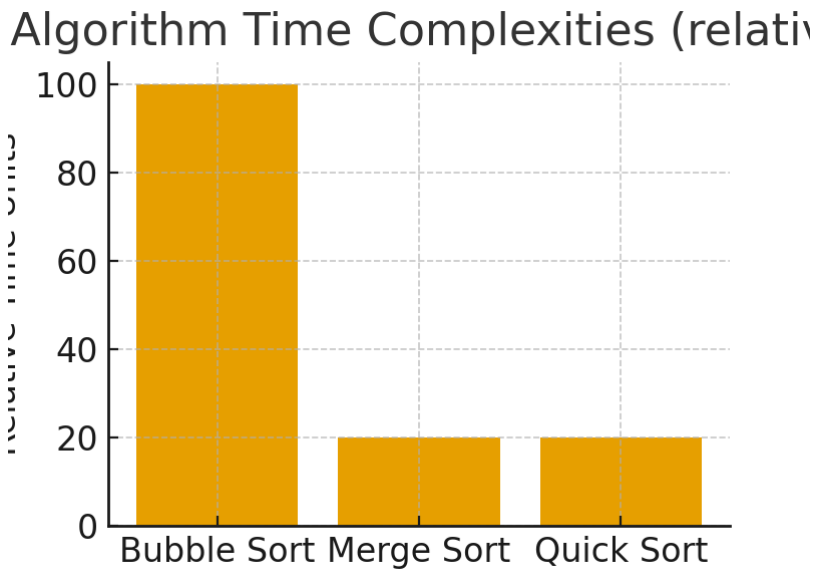
Rubric:

- Selects the correct option (C) (4 points)
- Brief justification mentioning divide-and-conquer / merging (2 points)

Q5:

Question: Interpret the following data table and chart.

Algorithm	Time Complexity
Bubble Sort	O(n^2)
Merge Sort	O(n log n)
Quick Sort	O(n log n)



Ideal Answer: Students should explain that Bubble Sort is O(n^2), while Merge Sort and Quick Sort are O(n log n), and discuss why O(n log n) is better for large inputs.

Rubric:

- Correctly identifies algorithms with O(n log n). (3 points)
- Explains significance of O(n log n) vs. O(n^2). (3 points)
- References both table and chart in explanation. (2 points)