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Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Final Examination, Summer 2025

Course Code: CSE325, Course Title: Data Mining and Machine Learning

Level: 3 Term: 3 Batch: 63

Time: 02:00 Hrs **Marks: 40**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

In a quiet neighborhood, there's a small family-owned shop called **The Corner Mart**. It's known for its essentials: fresh **milk**, warm **bread**, farm-fresh **eggs**, and creamy **butter**. Each morning, regular customers stop by:

- **Mrs. Green** always buys **milk**, **bread**, **apples**, and **eggs** for breakfast.
- **Mr. Patel**, a bachelor, usually grabs **milk**, **eggs**, **meat**, and **bread** for his sandwiches.
- **Sophie**, a college student, prefers a protein-heavy combo of **milk** and **eggs**.
- **The Thompson family** likes **milk**, **bread**, **eggs**, and sometimes **butter and meat** on weekends.
- **Elderly Mr. Clark** comes by often just for **coffee**, **milk**, and **butter**.
- **Young Jake**, who lives nearby, likes to help his mom by buying **milk**, **bread**, **coffee**, and **butter**.

The shop records the transactions of 6 regular customers. The owner, curious about what products are frequently bought together, wants to analyze these transactions to make smarter inventory decisions and offer some discounts.

Now, based on the story above, answer the following questions 1 and 2.

1	**Organize the** table based on the given data. Which algorithm is suitable for analyzing this dataset, and why? **Explain** your reasoning with Examples.	5	**CO1**
2	**Find all possible 3-itemset association rules** (meeting the same minimum thresholds of support and confidence) that can be generated from these transactions. Additionally, **Analyze and interpret** the rule **{Bread, Eggs} ⇒ {Milk}** in comparison with the other strong rules to provide meaningful business insights for inventory planning and promotional offers. Min Support = 20% and Min confidence = 60%	10	**CO3**

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Dr. Karim, a public health researcher, is developing a patient monitoring system for early detection of cardiovascular risks. She gathers basic health metrics from patients during routine checkups, specifically:

- Body Mass Index (BMI) (min 18.5, max 35.0)
- Systolic Blood Pressure (mmHg) (min 60, max 160)

ID	BMI	BP
p1	22	118
p2	28.5	145
p3	31.2	160
p4	25.5	200
p5	20.0	110

During her data collection, she found irrelevant data.

3.	**Analyze** the suitability of K-Means clustering for the given patient dataset. Based on its limitations, identify and justify one alternative unsupervised learning method that could better group patients by health risk.	5	**CO3**
4.	**Apply** the K-Means clustering technique to cluster the patients based on BMI and blood pressure. Use the results to assign each patient to a group. (K=2)	10	**CO2**

You are given a simple Artificial Neural Network (ANN) with the following data. The last inputs in the hidden units are "**Bias**" and **Sigmoid** is the activation function in the hidden layer.

X = [[0.5, 0.9], [0.8,0.1]] Y = [[0.60], [0.15]]

W1	0.1	0.4
	0.2	0.6
	0.3	0.3

W2	0.3	0.8
	0.5	0.1
	-0.2	0.2

W3	0.7
	0.9
	-0.4

5.	Draw the Neural Network, and **Apply** forward propagation on the given data using the provided weights. Calculate the final outputs and find the **Mean Squared Error.** Show each step of the calculations clearly.	10	**CO2**