BRAC UNIVERSITY
Department of Computer Science and Engineering
B.Sc. in CS or CSE Program
Final Exam, Fall 2023

Inspiring Excellence

Course:	**CSE437 (Data Science: Coding With Real-World Data), Section-1**

Full Marks: 25
Time: 90 minutes

Note: There are three questions, answer ALL of them. Course Outcome (CO), Cognitive Level and Mark of each question are mentioned at the right margin.

1. The average mid-term marks obtained by the students of Data Science is 38 marks. This semester due to the campus shifting issue the mid-term exam was held online. Does the online exam has any effect on mid-term marks? A sample of 12 students online mid-term scores are given below. Define the null and alternate hypothesis. Test the null hypothesis considering $\alpha=0.05$. [Use t-Test; the t-statistical table is given in our course repository]   [CO3,C5, Mark: 5]

Student	Score
1	28
2	29
3	35
4	37
5	32
6	26
7	37
8	39
9	22
10	29
11	36
12	38

2. Consider the following dataset of 3 features namely X, Y, and Z. **Apply** principal components analysis (PCA) to determine the first principal component. [CO2,C3, Mark: 10]

Instances	X	Y	Z
Instance 1:	-1	1	-1
Instance 2:	0	0	1
Instance 3:	1	-1	0

Note that, in determining the principal components, the eigenvectors

e.g., $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ should be scaled to unit length using this equation

$$\begin{bmatrix} x_1' \\ x_2' \\ x_3' \end{bmatrix} = \begin{bmatrix} x_1/\sqrt{x_1^2 + x_2^2 + x_3^2} \\ x_2/\sqrt{x_1^2 + x_2^2 + x_3^2} \\ x_3/\sqrt{x_1^2 + x_2^2 + x_3^2} \end{bmatrix}.$$

3. **Find** the association rules using the Apriori algorithm considering the following transactions of a smartphone center. You have to show all the necessary computations to find out the association rules. You have to determine association rules of each and every frequent itemsets of length greater than or equal to 2. [Assume that, min_support=0.29 and min_confidence=0.6, min_lift=1.2] [CO3, C4, Marks:10]

1	Smartpho	Charger	Earphone		
2	Smartpho	Charger			Cover
3	Smartpho	Charger		Selfistick	Cover
4				Selfistick	Cover
5			Earphone		Cover
6	Smartphone			Selfistick	Cover