Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

End Semester Examination, May 2024

Course: Artificial Intelligence and Machine Learning **Semester: VIII**

Program: B.Tech Mechatronics **Time : 03 hrs.**

Course Code: CSAI4001P **Max. Marks: 100**

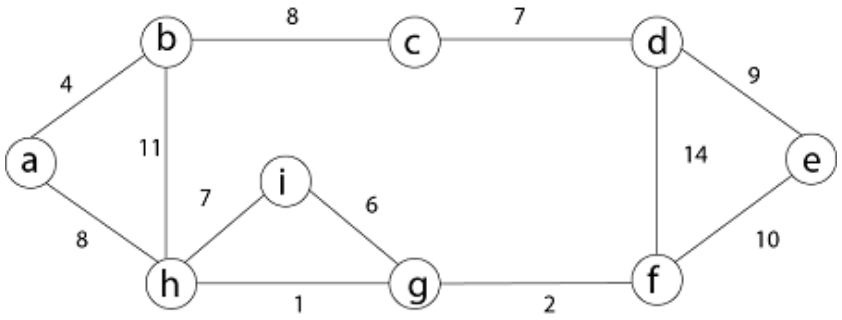
Instructions: ***Instructions: All questions are compulsory. The question paper consists of 11 questions divided into 3 sections A, B and C. Section A comprises 5 questions of 4 marks each, Section B comprises 4 questions of 10 marks each and Section C comprises 2 questions of 20 marks each.***

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Discuss the similarity & differences between two types of Supervised Machine Learning – namely Regression & Classification	**4**	**CO1**
Q 2	Explain feature engineering? Give example.	**4**	**CO1**
Q 3	Explain overfitting (High Variance) & underfitting (High bias)? How to avoid overfitting?	**4**	**CO1**
Q 4	Describe a neuron in a Neural Network along with the two mathematical operations that are done in a neuron.	**4**	**CO1**
Q 5	Discuss the major differences between Prim's and Kruskal's Algorithm for MST (Minimum Spanning Tree)	**4**	**CO2**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Describe the mathematical formulation of gradient descent for Linear Regression.	**10**	**CO2**
Q 7	Consider a hypothetical Neural Network with just one neuron with linear activation.  The operation in the neuron is just Activation a=wx+b The cost function is defined be mean square error as	**10**	**CO3**

	$J = \frac{1}{2}(a-y)^2$ Assuming w=2,b=8, and a single data point of x= -2,y=2 show the forward propagation as well as back propagation steps through a computational graph.		
Q 8	Determine the Minimum Spanning Tree of the following graph using Kruskal's algorithm.  	**10**	**CO2**
Q 9	Consider the following data and decide upon the feature for splitting at the root node for decision tree by calculating information gain associated with each feature. All features (x1 to x3) are binary categorical. There are 2 classes. **X1** | **X2** | **X3** | **Y (class)** 1 | 0 | 1 | 0 0 | 1 | 1 | 1 1 | 0 | 0 | 0 1 | 1 | 1 | 1 0 | 0 | 0 | 1 1 | 1 | 0 | 1 0 | 0 | 1 | 0	**10**	**CO3**
SECTION-C (2Qx20M=40 Marks)			
Q 10	Describe the Gradient Descent Method and associated mathematical formulation for minimization of a function. Discuss the effect of (a) learning rate being small/large and (b) the cost function being convex or non-convex on Gradient Descent. How to choose a good learning rate?	**20**	**CO2**

Q 11	Implement K-Means algorithms for a given set of data using K = 2.	**20**	**CO3**

Individual	**Variable 1**	**Variable 2**
1	1	1
2	1.5	2
3	3	4
4	5	7
5	3.5	5
6	4.5	5
7	3.5	4.5

OR

Calculate (a) Precision (b) recall (c) f1-Score for the given confusion Matrix.