AI 2002 Artificial Intelligence		
Course Instructor		
Ms. Mahzaib Younas		
Time allowed = 40 min	**Quiz 7**	**Total Marks = 30**
BCS Section E		

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Roll No	**Name**	**Signature**

Question No 01: Choose the correct one. **[6]**

1. What type of network is the Multi Layer Perceptron (MLP)?	2. What advantage does the sigmoid function have over the perceptron unit?
a) Convolutional neural network b) Hopfield network c) Recurrent neural network ✓d) Feedforward neural network	a) It uses binary output b) It is faster to train ✓c) It's continuous and differentiable d) It's more accurate
3. What does the elbow method help determine in clustering?	4. The sigmoid function maps any real number input into what output range?
a) Cluster density b) Optimal number of features c) Type of distance function to use ✓d) Ideal number of clusters (K)	a) $(-\infty, \infty)$ b) $[-1, 1]$ ✓c) $[0, 1]$ d) Depends on the weights
5. Which of the following scenarios is K-means **least suitable** for?	6. Which of the following measures is **not** typically used to compute similarity or distance in K-means?
a) Data without outliers b) Large datasets that have well-separated clusters ✓c) Clusters with different densities and shapes d) Spherical-shaped clusters	a) Cosine similarity b) Manhattan distance c) Euclidean distance ✓d) Jaccard index

Question No 02: **[10 Marks]**

    (a) Draw a **multilayer perceptron** with **two input neurons**, **three hidden layers** where each hidden layer has **2 neurons**, and an **output layer with 1 neuron**. Also compute the **total number of trainable parameters** in the network (weights + biases).

Input neurons = 2
Hidden layer 1 = (2 x 2) + 2 = 6
Hidden layer 2 = (2 x 2) + 2 = 6
Hidden layer 3 = (2 x 2) + 2 = 6
Output layer = (2 x 1) + 1 = 3
Total Parameters = 6 + 6 + 6 + 3 = 21

Question No 02:
You are given a dataset containing the following six points in a two-dimensional space:
{(1,2), (3,4), (6,1), (7,5), (9,3), (10,6), (12,4)}
Your task is to perform k-medoid clustering on this dataset with k-2 using the first and the fourth data points as initial medoids and Manhattan distance. Perform two iterations.   [14 Marks]

Manhattan distance: $|x_2 - x_1| + |y_2 - y_1|$

Data point	Manhattan distance (1,2) C1	Manhattan distance (7,5) C2	Cluster
(1,2)	0	9	C1
(3,4)	4	5	C1
(6,1)	6	5	C2
(7,5)	9	0	C2
(9,3)	9	4	C2
(10,6)	13	4	C2
(12,4)	13	6	C2

Compute the error:

C1 = (0 + 4) = 4
C2 = (5 + 0 + 4 + 4 + 6) = 19

Cluster 2 : (9,3)

Data point	Manhattan distance (1,2) C1	Manhattan distance (9,3) C2	Cluster
(1,2)	0	9	C1
(3,4)	4	7	C1
(6,1)	6	5	C2
(7,5)	9	4	C2
(9,3)	9	0	C2
(10,6)	13	4	C2
(12,4)	13	4	C2

Compute the error:

C1 = (0 + 4) = 4
C2 = (5 + 4 + 0+ 4 + 4) = 17