JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- May, 2022

B.Tech. (CSE, IT) VI Semester

COURSE CODE: 18B1WCI634 (2)   MAX. MARKS: 35

COURSE NAME: Machine Learning

COURSE INSTRUCTORS: Dr. Ekta Gandotra, Dr. Vipul Sharma, Dr. Shubham Goel

MAX. TIME: 2 Hrs.

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. a. Give geometric intuition behind gradient descent algorithm? What will happen   [5]
         if learning rate is too high or too low?

     b. What is vanishing gradient problem? Which activation function can be used to   [2]
         solve this problem?

Q2. a. Consider the following 8 data points with (x, y) representing locations. Use k-   [5]
         means clustering algorithm to group these into three clusters.
         A1(2, 10), A2(2, 5), A3(8, 4), A4(5, 8), A5(7, 5), A6(6, 4), A7(1, 2), A8(4, 9)
         Note: Consider the initial cluster centers as A1, A4 and A7. The distance function
         between two data points a = (x1, y1) and b = (x2, y2) is defined as:
         $P(a, b) = |x2 - x1| + |y2 - y1|$

     b. What is a dendrogram in hierarchical clustering? How to get the optimal   [2]
         number of clusters using a dendrogram?

Q3. a. Discuss the working of Genetic Algorithms with the help of a diagram and give   [5]
         a short description of each step.

     b. Differentiate between Linear Regression and Logistic Regression.   [2]

Q4. a. Differentiate between hard and soft SVM using geometric interpretation.   [5]
         Derive the objective function for soft SVM and also explain how to optimize it.

     b. Consider the data distribution in the following figures. Which case provides the   [2]
         minimum entropy and why?
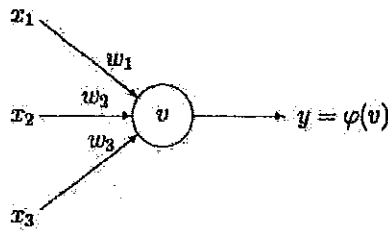

A   B   C

P.T. O
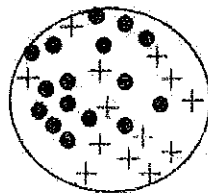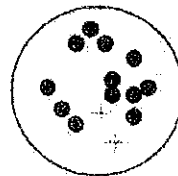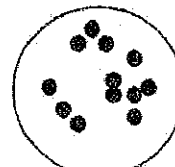
Q5. a. Consider the following diagram of a single artificial neuron. The node has three [5] inputs x = (x1, x2, x3) that receive only binary signals (either 0 or 1).

Suppose that the weights corresponding to the three inputs have the values w1 = 2, w2 = −4 and w3 = 1 and the activation of the unit is given by the following step-function:

$$\varphi(v) = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Calculate the output value y of the unit for each of the following input patterns.

Pattern	P1	P2	P3	P4
x1	1	0	1	1
x2	0	1	0	1
x2	0	1	1	1

b. Given the following training examples from the questionnaires survey (to ask [2] people opinion) with two attributes (acid durability and strength) to classify whether a special paper tissue is good or not. Find the class of the test sample using k-NN algorithm. Take k =3. Use L2 Norm for distance computations.

X1 = Acid Durability (seconds)	X2 = Strength (kg/squaremeter)	Y= Classification
7	7	Bad
7	4	Bad
3	4	Good
1	4	Good

Test Sample

X1 = Acid Durability (seconds)	X2 = Strength (kg/squaremeter)	Y= Classification
3	7	?