Reg. No. ☐☐☐☐☐☐☐☐☐☐

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

II SEMESTER M.TECH. (CSE/CSIS)
END-SEMESTER EXAMINATIONS, JUNE 2022
SUBJECT: ADVANCED MACHINE LEARNING (CSE 5256)
Time: 3 Hours **25/06/2022** **Max. Marks: 50**

Instructions to Candidates:

❖ Answer **ALL** the questions.
❖ Missing data may be suitably assumed.
❖ Individual steps to be listed clearly for numerical questions.

1A Use Candidate Elimination Algorithm to learn the concept in **Table Q1A** and find the version space.   **5**
Assume that all possible value for each attribute is available in the table itself. Show clearly all the
steps involved.

Size	Color	Shape	Class / Label
Big	Red	Circle	No
Small	Red	Triangle	No
Small	Red	Circle	Yes
Big	Blue	Circle	No
Small	Blue	Circle	Yes

Table Q1A

1B Using the concept learned in **Q1A**, classify the new instances in **Table Q1B**.   **2**

Instance	Size	Color	Shape
A	Small	Blue	Triangle
B	Big	Red	Triangle

Table Q1B

1C Describe the following three learning algorithms based on their inductive bias, ordering them from   **3**
the strongest to the weakest:
i. Rote learner ii. Candidate Elimination Algorithm iii. Find -S Algorithm

2A Label the last instance of the data given in **Table Q2A** by k-Nearest Neighbor Classifier for k=1, 3, 5. **5**
Show clearly all the steps involved.

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Height (CM)	Weight (KG)	Class
167	51	Underweight
182	62	Normal
176	69	Normal
173	64	Normal
172	65	Normal
174	56	Underweight
169	58	Normal
173	57	Normal
170	55	Normal
170	57	?

Table Q2A

2B Illustrate Cube Algorithm and Projection Algorithm to find the Nearest Neighbors **2**

2C List the drawbacks of Nearest Neighbor Classifiers. **3**

3A Using the Complete Linkage Technique, perform agglomerative clustering for the data set in **5**
Table Q3A. Show all the steps clearly.

	X	Y
P1	0.40	0.53
P2	0.22	0.38
P3	0.35	0.32
P4	0.26	0.19
P5	0.08	0.41
P6	0.45	0.30

Table Q3A

3B Draw the dendrogram corresponding to the clustering performed in **Q3A**. **2**

3C Compare and contrast k-NN and k-Means algorithms. **3**

4A   Construct a Decision Tree for the data in **Table Q4A** using ID3. Show all the computation involved   5
clearly.

Patient ID	Age	Sex	BP	Cholesterol	Drug
p1	Young	F	High	Normal	Drug A
p2	Young	F	High	High	Drug A
p3	Middle-age	F	Hiigh	Normal	Drug B
p4	Senior	F	Normal	Normal	Drug B
p5	Senior	M	Low	Normal	Drug B
p6	Senior	M	Low	High	Drug A
p7	Middle-age	M	Low	High	Drug B
p8	Young	F	Normal	Normal	Drug A
p9	Young	M	Low	Normal	Drug B
p10	Senior	M	Normal	Normal	Drug B
p11	Young	M	Normal	High	Drug B
p12	Middle-age	F	Normal	High	Drug B
p13	Middle-age	M	High	Normal	Drug B
p14	Senior	F	Normal	High	Drug A

Table Q4A

4B   Using the decision tree constructed in **Q4A**, classify the instances in **Table Q4B**   2

Patient ID	Age	Sex	BP	Cholestrol
t1	Middle-age	F	Low	Normal
t2	Young	M	High	High
t3	Senior	F	High	High

Table Q4B

4C   Train the perceptron in **Fig Q4C** to perform OR gate function as shown in **Table Q4C** with the   3
following initial values for weights, learning rate and threshold. List the final value for the weights
(w1, w2).

- Weights: w1 = 0.6, w2=0.6
- Learning rate n = 0.5
- Threshold = 1
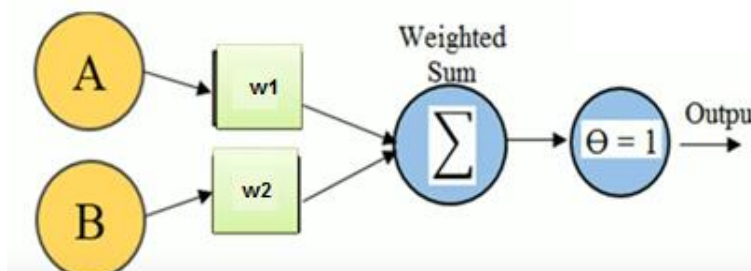
Perceptron
Fig Q4C

A	B	Y=A+B
0	0	0
0	1	1
1	0	1
1	1	1

OR Gate Truth Table
Table Q4C

5A Showing individual steps clearly, find the species of the following instance using Naïve Bayes   **5**
Classifier based on the data given in **Table Q5A**:

<Color – Green, Legs – 2, Height – Tall, Smelly – No>

No	Color	Legs	Height	Smelly	Species
1	White	3	Short	Yes	M
2	Green	2	Tall	No	M
3	Green	3	Short	Yes	M
4	White	3	Short	Yes	M
5	Green	2	Short	No	H
6	White	2	Tall	No	H
7	White	2	Tall	No	H
8	White	2	Short	Yes	H

Table Q5A

5B Write a short note on the AdaBoost algorithm used for Classification Tasks.   **2**

5C Show using diagrams the following cross-over operations in Genetic Algorithms: **3**
    i. Single-point crossover
    ii. Two-point crossover
    iii. Uniform crossover