Roll Number:_____	
Thapar Institute of Engineering and Technology, Patiala	
Computer Science and Engineering Department	
BE(3rd Year) Dec 9, 2022 EST	UML501: Machine Learning
Time: 3 Hours	Marks:40
Instructors: Dr. Singara Singh Kasana, Dr. Maninder Kaur, Dr. Jatin Bedi, Dr. Raman Goyal, Dr. Harpreet Singh, Dr. Swati	

Note: All questions are compulsory. All parts of a question must be answered in order. Show all intermediate steps, where applicable.

Q 1 [8]

Consider the training examples shown in table below for a binary classification problem.

(a) What are the information gains of car_type and first_owner relative to the given training examples?

(b) For rating, which is a continuous attribute, compute the information gains (considering two split point choices 2 and 3.5)

(c) In continuous of (a) and (b), what is the best split (among car_type, first_owner, and rating) according to the information gain?

(d) What is the best split (between car_type and first_owner) according to the Gini index?

Sample	car_type	first_owner	rating	buys
1	Sedan	yes	1.0	True
2	Sedan	yes	6.0	True
3	Sedan	no	5.0	False
4	SUV	no	4.0	True
5	SUV	yes	7.0	False
6	SUV	yes	3.0	False
7	SUV	no	8.0	False
8	Sedan	no	7.0	True
9	SUV	yes	5.0	False

Q 2 [5]

(a) Use single and complete link agglomerative clustering to group the data described by the following distance matrix. Show output at each step and represent the clustering results with dendrograms

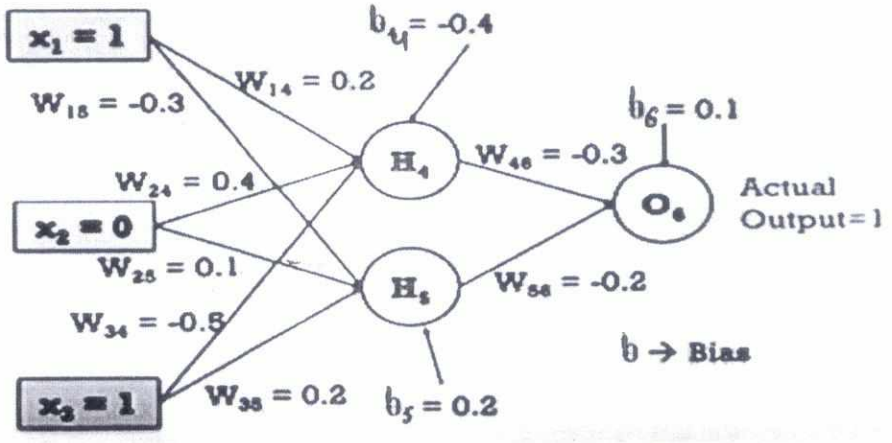
	A	B	C	D
A	0	1	4	5
B		0	2	6
C			0	3
D				0

(b) Why we need hyper parameter tuning in SVM? Explain different hyper-tuning parameters in SVM? [3]

Q 3 [4]

(a) Derive the coefficients equation of multiple linear regression using least square method.

P.T.O.

	(b) Normalize the data: 8, 10, 15, and 20 by using min-max and z-score approach.	[4]
Q 4	For the given Neural Network, find (upto one iteration). (a) error using forward propagation (b) updated weights w_{14} (Use Sigmoid function as activation function)  All intermediate results should be rounded upto two decimal places. Use learning rate=0.9; error formula $E = \frac{1}{2}(actual - predicted)^2$. In above figure, take $W_{34} = -0.5$, $W_{35} = 0.2$	[8]
Q 5	Consider the following transactions: | Transaction	Items
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T_1	I_1, I_2, I_3
T_2	I_2, I_3, I_4
T_3	I_4, I_5
T_4	I_1, I_2, I_4
T_5	I_1, I_2, I_3, I_5
T_6	I_1, I_2, I_3, I_4 | Apply the association rule mining by using Apriori algorithm to get the association rules with minimum support of 50% and confidence of 60%.	[8]