Reg. No.										

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

III SEMESTER M.C.A

END SEMESTER EXAMINATIONS, JANUARY 2021

SUBJECT: MACHINE LEARNING
[MCA 5152]

REVISED CREDIT SYSTEM
(02/01/2021)

Time: 3 Hours MAX. MARKS: 50

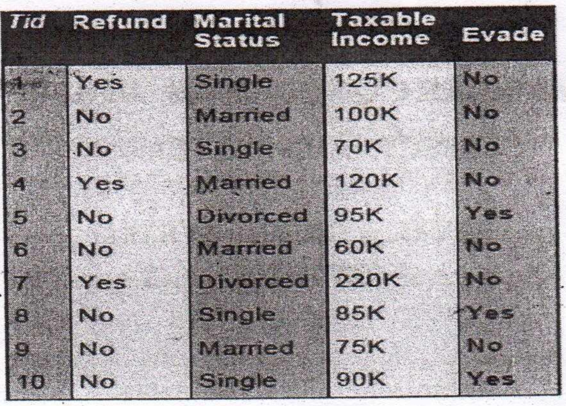
Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A	With suitable diagrams and examples , Compare and contrast between i. Supervised Learning vs. Reinforcement Learning ii. Neural Networks vs. Convolutional Neural Networks. iii. Parametric vs. Non Parametric Models iv. Bias vs. Variance v. Pre-pruning vs. Post pruning in Decision Trees.	**5**
1B	With respect to Regression models , explain the concepts of i. Auto correlation ii. Collinearity iii. Heteroscedasticity	**3**
1C	What is Inductive Bias? List any two biases that can be imposed on a machine learning model	**2**

2A Use the Naïve Bayesian method to predict the class label 'EVADE' based on the predictor variables of Refund, Marital Status and Taxable Income. The test instance is Refund='No', Marital Status='Divorced' and Taxable income is 140K. Consider the following data set:

5



Tid	Refund	Marital Status	Taxable Income	Evade
1	Yes	Single	125K	No
2	No	Married	100K	No
3	No	Single	70K	No
4	Yes	Married	120K	No
5	No	Divorced	95K	Yes
6	No	Married	60K	No
7	Yes	Divorced	220K	No
8	No	Single	85K	Yes
9	No	Married	75K	No
10	No	Single	90K	Yes

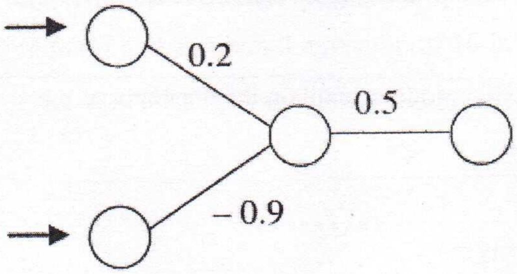
For taxable income:

For EVADE = No: the sample mean=110, sample variance=2975.

For EVADE = Yes: the sample mean=90, sample variance=25.

2B Consider the simple neural network shown below. An observation with two variables (0.5,0.3) is input to the neural network. What is the predicted output from the neural network using a sigmoid activation function?

3



2C What is over fitting? What are the strategies to avoid over fitting in a decision tree induction model?

2

3A 5

Item	A	B	C	D	E
A	0				
B	8	0			
C	2	6	0		
D	5	4	8	0	
E	10	9	1	7	0

I. Perform single-link, Agglomerative clustering on the following distance matrix.

II. Represent the clustering using a Dendrogram.

3B What is model selection and generalization? Explain with suitable examples. 3

3C We have 3 data points: 3, 3.5 and 4. Assume that these values are from a Normal Distribution. Estimate the model parameters from Maximum Likelihood Estimation. Assume there are 2 data instances. For instance 1, the mean and variance values are 3, 2; and for instance 2, the mean and variance values are 5, 7. 2

4A 5

I. Describe the equation for Maximal Margin Hyperplane (MMH) in a Support Vector Machine. Also describe the MMH equations for a 2 class classification problem.

II. What are the two essential elements involved in the design of systems that integrate multiple classifiers? Give a real time example for each.

4B 3

I. Calculate the residual values for each values of X from the mean using Linear Regression:

X	1	2	4	3	5
Y	1	3	3	2	5

II. Draw the scatter plot for the given data set.

4C Suppose the amount of gasoline sold daily at a service station is uniformly distributed with a minimum of 2,000 gallons and a maximum of 5,000 gallons. What is the probability that daily sales will fall between 2,500 gallons and 3,000 gallons? Also represent the problem statement using a 2-dimensional representation. 2

5A I. Write a Linear Cost Function for each of the following statements. Use Y for estimated costs and X for activity of the cost driver. **5**

(i) Direct manufacturing labor is $25 per hour.

(ii) Direct materials cost $9.80 per square yard.

(iii) Utilities will have a minimum charge of $900, plus a charge of $0.08 per kilowatt hour.

(iv) Machine operating costs include $220,000 of machine depreciation per year, plus $75 of utility costs for each day of the machinery is in operation.

II. Write the pseudocode for cost function in Gradient Descent algorithm.

5B We have 2 classes: C1 and C2. Each of these classes have the sample sizes of m, n respectively. The following data is given for each of the samples: **3**

	μ_x	μ_y	σ_x	σ_y
Class C1	-0.12	+0.67	4.23	0.78
Class C2	+0.57	-0.32	3.54	1.23

Assuming the samples of each class follow a Normal Distribution, Determine the class to which the tuple (2.5, 3.5) belongs to using the method of Maximum Likelihood Estimation.

5C Suppose the time required to build a computer is normally distributed with a mean of 50 minutes and a standard deviation of 10 minutes. What is the probability for the assembly time of a computer to be between 45 and 60 minutes? **2**

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