

MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (COMPUTER SCIENCE & ENGG)

END SEMESTER EXAMINATIONS, APR/MAY 2019

SUBJECT: MACHINE LEARNING [CSE 4010]

REVISED CREDIT SYSTEM (3/5/2019)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer ALL the questions.

✤ Missing data may be suitably assumed.

1A.	In probably approximately correct (PAC) learning, given a class, C, and examples drawn from some unknown but fixed probability distribution, $p(x)$, find the expression for the number of examples, N.	4			
1B.	You are required to classify a customer as high-risk (C=1) or low-risk (C=0) based on the observable variables yearly income and savings. Explain Bayes' rule and derive the expression for the posterior probability using this rule.				
1C.	With an example, explain reinforcement learning.				
2A.	What is meant by maximum likelihood estimation? Explain. Obtain the expression for maximum likelihood estimation for multinomial distribution.				
2B.	Given two normal distributions $p(x C_1) \sim N(\mu_1, \sigma_1^2)$ and $p(x C_2) \sim N(\mu_2, \sigma_2^2)$ and P(C ₁) and P(C ₂), calculate the Bayes' discriminant points analytically.				
2C.	Let us say our hypothesis class is a circle instead of a rectangle. What are its parameters? How can the parameters of a circle hypothesis be calculated in such a case? What if it is an ellipse? Why does it make more sense to use an ellipse instead of a circle?				
3A.	Derive the expression for the quadratic discriminant in the case of multivariate classification assuming the class conditional densities are normal.				
3B.	Explain the working principle of the simple perceptron.	3			
3C.	Assume a disease so rare that it is seen in only one person out of every million. Assume also that we have a test that is effective in that if a person has the disease, there is a 99 percent chance that the test result will be positive; however, the test is not perfect, and there is a one in a thousand chance that the test result will be positive on a healthy person. Assume that a new patient arrives and the test result is positive. What is the probability that the patient has the disease?	2			
4A.	Derive the expression for the reference vector used in the k-means clustering algorithm Also write the algorithm	4			
4B.	Write the logistic discrimination algorithm implementing gradient descent for the single output case with two classes and explain.	4			

4C.	Explain adaptive resonance theory.					
	Consider the data shown in Table 5A. A decision tree is to be drawn for predicting the target attribute "PlayTennis" using input attributes "Humidity" and "Wind". Using entropy, find out which attribute should be tested in the root node of the decision tree, "Humidity" or "Wind". Table 5A					
5A.	Humidity	Wind	PlayTennis			
	High	Weak	No			
	High	Strong	No			
	High	Weak	Yes			
	High	Weak	Yes		5	
	Normal	Weak	Yes			
	Normal	Strong	No			
	Normal	Strong	Yes			
	High	Weak	No			
	Normal	Weak	Yes			
	Normal	Weak	Yes			
	Normal	Strong	Yes			
	High	Strong	Yes			
	Normal	Weak	Yes			
	High	Strong	No			
5B.	What are graphical models? With a diagram, explain the graphical model for linear regression.					
5C.	Explain hidden markov models.					