MANIPAL INSTITUTE OF TECHNOLOGY
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II SEMESTER M.TECH. (COMPUTER NETWORKING AND ENGINEERING / SOFTWARE ENGINEERING)
END SEMESTER EXAMINATION, APRIL 2018
SUBJECT: PROGRAM ELECTIVE I: MACHINE LEARNING [ICT 5239]
REVISED CREDIT SYSTEM
(23/04/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:
❖ Answer ALL the questions.
❖ Missing data if any may be suitably assumed.

1A. Explain the features of various cross validation techniques along with suitable example and the algorithm. — 5

1B. A training input vector x and output y is shown in the Table Q.1B. Assume the learning rate $\alpha = 0.01$, coefficients $\theta_0 = 0$ and $\theta_1 = 0$ and training size m =5. Find the coefficient values after one level of training in the case of gradient decent. — 3

Table Q.1B

x	1	2	4	3	5
y	1	3	3	2	5

1C. Explain the different search procedures that are used for feature selection. — 2

2A. Obtain the expression for the weight θ_j in the case of logistic regression for the hypothesis. — 5

$$h_\theta(x) = \frac{1}{1 + e^{-\theta^T x}}$$

2B. Given a two classifier problem with the input features which are continuous valued random variables (Gaussian), what is the maximum likelihood estimate for the parameters μ, ϕ and Σ? — 3

2C. Distinguish between bias and variance. — 2

3A. Explain the Markov decision process using suitable example and also derive the optimal value function. — 5

3B. 'There is some inherent ambiguities in the mixing matrix that are impossible to recover given only the dataset x ". Substantiate as to why is it so. — 3

3C. Given the kernel $K(x,z) = (x^T z + c)^2$, with x, z $\in R^3$, write the feature mapping vector $\phi(z)$ for the given kernel function. — 2

4A. There are two coins. One round of coin toss includes picking one coin randomly among the two and tossing it ten times and repeating this process five times with a random choice of coin each time. The initial estimation of obtaining head for the first and second coin is 0.6 and 0.5 respectively before the coin toss. The actual number of times head was obtained during the first round of coin toss out of ten tosses for randomly selected coin was a) five b) nine c) eight d) four e) seven. What — 5

is the estimated probability of obtaining head for each of the coins during the next round of coin toss?

4B. Explain with an example and an algorithm the k-means clustering. 3

4C. Distinguish between online and batch process with respect to predictions made during the learning process. 2

5A. Given the vector inputs x_1 and x_2 as shown in the Table Q.5A find the transformed data using one of the principal component of the eigen vector. 5

Table Q.5A

x_1	x_2
2.5	2.4
0.5	0.7
2.2	2.9
1.9	2.2
3.1	3.0
2.3	2.7
2	1.6
1	1.1
1.5	1.6
1.1	0.9

5B. Given the Frequency Tables Q.5B (a), (b) and (c) find the likelihood of playing football game today given: Today = { Season = Winter, Outlook = Not Sunny, Weather =Windy} 3

Table Q.5B

Frequency Table	Play	
	Yes	No
Sunny	3	4
	6	1

(a)

Frequency Table	Play	
	Yes	No
Windy	6	2
	3	3

(b)

Frequency Table		Play	
		Yes	No
Season	Summer	3	2
	Monsoon	4	0
	Winter	2	3

(c)

5C. Let S1, S2, S3 be the subjects for which five students have scored the marks as per the Table Q.5C. Given the latent factor loading component for the model as {{0.5, 0.5}, {0.3, 0.3}, {0.5, -0.5}}, find the covariance between the various subjects. Assume the estimated error terms are zero. 2

Table Q.5C

S1	S2	S3
3	6	5
7	3	3
10	9	8
3	9	7
10	6	5

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