ELECTIVE - II
MACHINE LEARNING
MAY 2019
Computer Engineering (Semester 6)

Total marks: 80
Total time: 3 Hours

INSTRUCTIONS
(1) Question 1 is compulsory.
*(2) Attempt any **three** from the remaining questions.*
(3) Draw neat diagrams wherever necessary.

1.a. What is Machine Learning? How is it different than Data Mining? (5 marks)
1.b. Why Dimensionality Reduction is very Important step in Machine Learning? (5 marks)
**1.c.** Determine weights and threshold for the given data using McCulloch-Pitts neuron model. Plot all data points and show separating hyper-plane. (5 marks)

X1	X2	D
0	0	0
0	1	0
1	0	1
1	1	0

1.d. Describe Down Hill Simplex method. Why is it called Derivative Free method? (5 marks)

2.a. Explain the steps of developing Machine Learning applications. (10 marks)
2.b. Consider Markov chain model for 'Rain' and 'Dry' is shown in following figure.
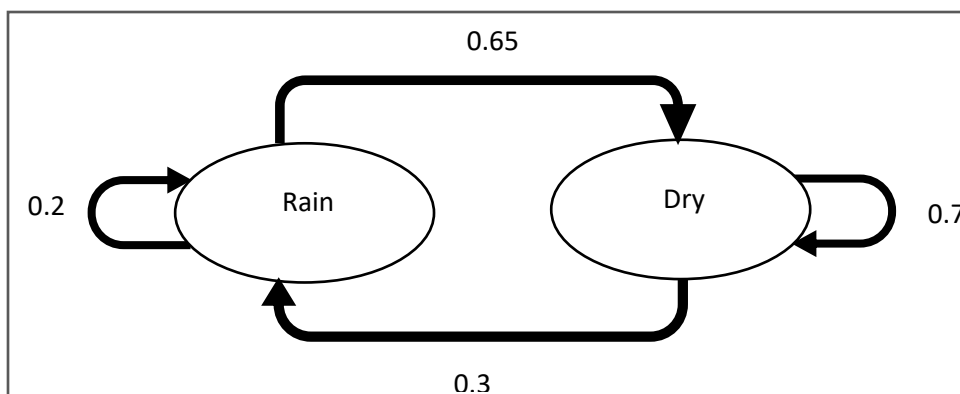
Two states: 'Rain' and 'Dry'. Transition probabilities: P('Rain'|'Rain') = 0.2, P('Dry'|'Rain') = 0.65, P('Rain'|'Dry') = 0.3, P('Dry'|'Dry') = 0.7, Initial probabilities: say P('Rain') = 0.4, P('Dry') = 0.6. (10 marks)

3.a. Minimize $f(x1, x2) = 4x_1 - 2x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$
With starting point $X1 = \{0, 0\}$ using the steepest descent method. (Perform two iterations). (10 marks)

3.b. Explain following terms Initial hypothesis, Expectation step and Maximization step w.r.t E-M algorithm. Explain How Initial hypothesis converges to optimal solution?
(You may explain it with an example) (10 marks)

4.a. Why Dimensionality reduction is an important issue? Describe the steps to reduce dimensionality using Principal Component Analysis method by clearly stating mathematical formulas used. (10 marks)

4.b. For the following data, Calculate Gini indexes and determines which attribute is root attribute and generate two level deep decision tree. (10 marks)

Sr. No.	Income	Defaulting	Credit Score	Location	Give Lone?
1	low	high	high	bad	no
2	low	high	high	good	no
3	high	high	high	bad	yes
4	medium	medium	high	bad	yes
5	medium	low	low	bad	no
6	medium	low	low	good	yes
7	high	low	low	good	yes
8	low	medium	high	bad	no
9	low	low	low	bad	no
10	medium	medium	low	bad	no
11	low	medium	low	good	yes
12	high	medium	high	good	yes
13	high	high	low	bad	no
14	medium	medium	high	good	yes

5.a. Explain following terms w.r.t Bayes' theorem with proper examples.
(a) Independent probabilities
(b) Dependent probabilities
(c) Conditional Probability
(d) Prior & Posterior probabilities
Define Bays theorem based on these probabilities. (10 marks)

5.b. Draw and discuss the structure of Radial Basis Function Network. How RBFN can be used to solve non linearly separable pattern? (10 marks)

6. Attempt any **four** (20 marks)
    a. Illustrate Support Vector machine with neat labeled sketch and also show how to derive optimal hyper-plane?
    b. Differentiate: Derivative Based and Derivative free optimization techniques.
    c. Explain how regression problem can be solved using Steepest descent method. Write down the steps.
    d. Write Short note on ISA and compare it with PCA
    e. DownHill simplex method.