2020(A)

Time : 3 hours

Full Marks : 70

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

*Answer any **five** questions.*

1. (a) What is machine learning ? Write down the difference between Machine Learning and Data Mining. 7

   (b) Explain Learning System. Design the learning system for Checkers problem. 7

2. (a) What is lazy learner in machine learning, explain in brief ? 7

   (b) Consider following data set suppose you are given the following set of data with three input

Boolean variable a, b, c and a single variable K. 7

a	b	c	K
1	0	1	1
1	1	1	1
0	1	1	0
1	1	0	0
1	0	1	0
0	0	0	1
0	0	0	1
0	0	1	0

According to naive base classifier find the following :

(i) $P(K=1 \mid a = 1 \wedge b\ 1 \wedge c = 0)$

(ii) $P(K=0 \mid a = 1 \wedge b\ 1)$

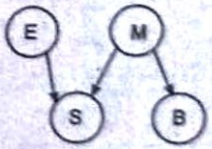
3. A smell of sulphur (S) can be caused either by rotten eggs (E) or as a sign of the doom brought by the Mayan Apocalypse (M). The Mayan Apocalyse also causes the oceans to boil (B).

The Bayesian network and corresponding conditional probability tables for this situation are shown below. For each part, you should give either a numerical answer (e. g. 0.81) or an arithmetic expression in terms of numbers form the tables below (e. g. 0. 9. 0.9). 14

P(E)	
+e	0.4
–e	0.6

P(M)	
+m	0.1
–m	0.9

P(S / E,M)			
+e	+m	+s	1.0
+e	+m	–s	0.0
+e	–m	+s	0.8
+e	–m	–s	0.2
–e	+m	+s	0.3
–e	+m	–s	0.7
–e	–m	+s	0.1
–e	–m	–s	0.9



P(B \ M)		
+m	+b	1.0
+m	–b	0.0
–m	+b	0.1
–m	–b	0.9

The find :

(a) What is the probability that the oceans boil ?

(b) What is the probability that the Mayan Apocalypse is occurring, given that there is a smell of sulphur, the oceans are boiling, and there are rotten eggs ?

(c) What is the probability that the Mayan Apocalypse is occurring, given that the occeans are boiling ?

4. Imagine that you have given following set of training examples. Each feature can take up to three nominal values a, b, and c. 14

F_1	F_2	F_3	Class
a	c	a	+
c	a	c	+
a	a	c	−
b	c	a	−
c	c	b	−

How would the Naive system classify the following test example :

$F_1 = a, F_2 = c, F_3 = b.$

5. (a) Consider the following data set and perform KNN classification and predict the class for X(P1 = 2, P3 = 7), For K = 3. 7

P_1	P_2	Class
7	7	False
7	4	False
3	4	True
1	4	True

(b) Use the k-means algorithm and Euclidean distance to cluster the following 8 examples into 3 cluster : 7

Point- $A_1 = (2, 10)$, $A_2 = (2, 5)$, $A_3 = (8, 4)$ $A_4 = (5, 8)$, $A_5 = (7, 5)$, $A_6 = (6, 4)$, $A_7 = (1, 2)$, $A_8 = (4, 9)$.

Suppose that the initial seeds (centers of each cluster) are A_1, A_4 and A_7. Run the k-means algorithm for 1 each only. At the end of this epoch show : The new cluster (i. e. the examples belonging to each cluster).

6. (a) Write down the difference between Artificial Neural Network and Biological Neural Network. 7

(b) What are the different learning law in ANN, explain in brief ? 7

7. (a) What is linearly inseparable problem ? Show that Ex-OR and Ex-NOR are linearly inseparable. 7

(b) Explain Genetic Algorithm. Illustrate with a simple example. 7

8. (a) What is the significance of ensemble learning in machine learning ? Explain with suitable example. 7

(b) Explain logistic regression in machine learning. Explain with example. 7