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Seventh Semester B.E. Degree Examination, July/August 2022
Artificial Intelligence and Machine Learning

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1. a. What is Artificial Intelligence? Discuss the branches of Artificial Intelligence. **(10 Marks)**
   b. What is a state space? Explain the concept of state space representation using the water jug problem **(10 Marks)**

OR

2. a. Explain any two AI techniques for solving tie-tar-toe problem. **(10 Marks)**
   b. Write the algorithms for breadth first search and depth-first search. Enlist the advantages of each. **(10 Marks)**

Module-2

3. a. Explain the properties of a good knowledge representation system. **(04 Marks)**
   b. Define the following terms W.A.F machine learning : (i) Concept learning (ii) Inductive learning hypothesis (iii) Consistent hypothesis (iv) Version space (v) General Boundary (vi) Specific boundary. **(06 Marks)**
   c. Apply candidate elimination algorithm on the following data set to obtain the complete version space.

Example	Sky	Air Temp	Humidity	Wind	Water	Forest	Enjoy
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	NO
4	Sunny	Warm	High	Strong	Cool	Change	Yes

(10 Marks)

OR

4. a. Explain the use of predicate logic as a way of representing knowledge using the following sentences :

i)	Marcus was a man.	v)	All Romans were either loyal to Caesar or hated him
ii)	Marcus was a Pompeian.	vi)	Everyone is loyal to someone.
iii)	All Pompeian were Romans	vii)	People only try to assassinate rulers they are not loyal to.
iv)	Caesar was a ruler.	viii)	Marcus tried to assassinate Caesar.

(10 Marks)

   b. Write Find-S algorithm. Apply the same on the following data set for the target "Play Tennis".

Day	Outlook	Temperature	Humidity	Wind	Play Tennis
1	Sunny	Hot	High	Weak	No
2	Sunny	Hot	High	Strong	No
3	Overcast	Mild	High	Weak	Yes
4	Overcast	Mild	Normal	Weak	Yes
5	Overcast	Cool	Normal	Weak	Yes

(10 Marks)

Module-3

5. a. Define the following : (i) Decision tree   (ii) Entropy   (iii) Information gain (iv) Restriction Bias (v) Preference Bias **(05 Marks)**
   b. Write ID3 algorithm to construct decision tree. **(05 Marks)**

c. Construct a decision tree for the following data set to find whether a seed is poisonous or not.

Example	Colour	Toughness	Fungus	Appearance	Poisonous
1	Green	Soft	Yes	Wrinkled	Yes
2	Green	Hard	Yes	Smooth	No
3	Brown	Soft	No	Wrinkled	No
4	Brown	Soft	Yes	Wrinkled	Yes
5	Green	Soft	Yes	Smooth	Yes
6	Green	Hard	No	Wrinkled	No
7	Orange	Soft	Yes	Wrinkled	Yes

(10 Marks)

OR

6 a. Design a perceptron that implements AND function. Why is that a single layer perceptron cannot be used to represent XOR function? **(05 Marks)**

b. Derive an equation for gradient descent rule to minimize the error. **(05 Marks)**

c. Write an algorithm for back propagation algorithm which uses stochastic gradient descent method. Comment on the effect of adding momentum to the network. **(10 Marks)**

Module-4

7 a. Define Maximum Likelihood (ML) hypothesis. Derive an equation for ML hypothesis using Bayes theorem. **(05 Marks)**

b. A patient takes a lab test and the result comes back positive. It is known that the test returns a correct positive result in only 99% of the cases and a correct negative result in only 98% of the cases. Furthermore, only 0.08 of the entire population has this disease.
  (i) What is the probability that this patient has Cancer?
  (ii) What is the probability that he does not have Cancer? **(05 Marks)**

c. Write EM algorithm and explain. **(10 Marks)**

OR

8 a. Write Brute-force Maximum A Posterion (MAP) learning algorithm. **(05 Marks)**

b. Describe the features of Bayesian learning methods. **(05 Marks)**

c. Estimate conditional probabilities of each attributes {Colour, Legs, Height, Smelly} for the species classes : {M, H} using the data given in the table. Using those probabilities estimate the probability values for the new instance – {Colour = Green, Legs = 2, Height = Tall and Smelly = NO}

Example	Colour	Legs	Height	Smelly	Species
1	White	3	Short	Yes	M
2	Green	2	Tall	No	M
3	Green	3	Short	Yes	M
4	White	3	Short	Yes	M
5	Green	2	Short	No	H
6	White	2	Tall	No	H
7	White	2	Tall	No	H
8	White	2	Short	Yes	H

(10 Marks)

Module-5

9 a. Write K-Nearest neighbor algorithm for approximation of a discrete-valued target function and also for a real valued target function. **(10 Marks)**

b. Explain CADET system using case based reasoning. **(10 Marks)**

OR

10 a. What is reinforcement learning? Explain the concepts of reinforcement learning problem and its characteristics. **(10 Marks)**

b. Derive an expression for a function. Using the same, write an algorithm for learning. **(10 Marks)**