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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 Posterior (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)