

CBCS SCHEME



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18CS71

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? (05 Marks)
- (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)