

# 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?
- (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)