

# Bihar Engineering University, Patna

B.Tech. 5<sup>th</sup> Semester Examination, 2023

Course: B.Tech.

Code: 105501

Time: 03 Hours

Full Marks: 70

Subject: Artificial Intelligence

**Instructions:-**

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

**Q.1 Choose the correct answer to the following (Any seven questions only):** [2 x 7 = 14]

- (a) Which of the following best defines an intelligent agent?
  - (i) A device that follows a set of predetermined rules
  - (ii) A system that perceives its environment and takes actions to maximize its chances of success
  - (iii) A software that performs routine tasks
  - (iv) A human-like robot
- (b) Which search algorithm uses a heuristic to prioritize which paths to explore?
  - (i) Depth First Search
  - (ii) Breadth First Search
  - (iii) A\*
  - (iv) DFID
- (c) Simulated Annealing is an example of which type of search method?
  - (i) Uninformed search
  - (ii) Heuristic search
  - (iii) Stochastic search
  - (iv) Deterministic search
- (d) The exploration problem is where \_\_\_\_\_.
  - (i) Agent contains the knowledge of State and actions.
  - (ii) Agent does not contain the knowledge of State and actions.
  - (iii) Only actions are known to the agent.
  - (iv) None of the above
- (e) In genetic algorithms, what is the process of combining parts of two parent solutions to create offspring called?
  - (i) Crossover
  - (ii) Mutation
  - (iii) Selection
  - (iv) Evaluation
- (f) In Natural Language Processing, what is the purpose of tokenization?
  - (i) To remove irrelevant data
  - (ii) To split text into individual words or phrases
  - (iii) To translate text into another language
  - (iv) To analyze the sentiment of a text
- (g) The process of making 2 logical expressions look identical is called?
  - (i) Lifting
  - (ii) Unification
  - (iii) Inference process
  - (iv) None of the Above
- (h) Machines that try to imitate human intuition while handling vague information lie in the field of AI called?
  - (i) Functional Logic
  - (ii) Boolean Logic
  - (iii) Human Logic
  - (iv) Fuzzy Logic
- (i) In neural networks, what is the purpose of the activation function?
  - (i) To initialize weights
  - (ii) To introduce non-linearity into the model
  - (iii) To combine input features
  - (iv) To normalize the data
- (j) What does the term "epoch" refer to in the context of deep learning?
  - (i) The number of layers in the network
  - (ii) The number of nodes in a hidden layer
  - (iii) The size of the training dataset
  - (iv) One complete pass through the entire training dataset

- Q.2** (a) What is the Turing Test? Discuss its significance in the field of AI and highlight some of its main criticisms and limitations. [7]  
 (b) What is heuristic search in AI? Explain the A\* algorithm in detail. [7]
- Q.3** (a) Discuss the Minimax algorithm used in game playing. How does alpha-beta pruning improve its performance? Provide an example to illustrate. [10]  
 (b) Explain the state space approach for solving any AI problem. [4]
- Q.4** (a) What is an AND-OR search tree/graph? Give algorithm for searching AND-OR tree/graph. [8]  
 (b) Explain the concept of constraint satisfaction in artificial intelligence. Discuss the role of constraints and variables in problem representation. [6]
- Q.5** (a) Represent the following sentences using first-order logic: [8]  
 (i) One's mom is one's female parent. (ii) One's husband is one's male spouse  
 (iii) Parent and child are inverse relations.  
 (iv) A grandparent is a parent of one's parent.  
 (b) What is the difference between a predicate and a proposition in the context of logic? Describe the semantics of propositional logic with the truth table. [6]
- Q.6** (a) Explain how Bayesian networks represent uncertain knowledge. Discuss how inference is performed in Bayesian networks, and provide an example. [10]  
 (b) What is partial order planning, and how does it differ from linear (total order) planning? [4]
- Q.7** (a) Why is clustering important in machine learning? Show the steps of the k-means algorithm by taking a suitable example. Give the time complexity analysis of k-means. [10]  
 (b) Discuss the learning mechanism in multilayer neural networks using back-propagation. [4]
- Q.8** (a) Build a decision tree to find whether one can buy a computer or not based on the following information. [10]  
 "A middle-aged man having medium income with fair credit rating but is not a student."

RID	Age	Income	Student	Credit rating	Class: buys computer
1	Youth	High	No	Fair	No
2	Youth	High	No	Excellent	No
3	middle aged	High	No	Fair	Yes
4	Senior	Medium	No	Fair	Yes
5	Senior	Low	Yes	Fair	Yes
6	Senior	Low	Yes	Excellent	No
7	middle aged	Low	Yes	Excellent	Yes
8	Youth	Medium	No	Fair	No
9	Youth	Low	Yes	Fair	Yes
10	Senior	Medium	Yes	Fair	Yes
11	Youth	Medium	Yes	Excellent	Yes
12	middle aged	Medium	No	Excellent	Yes
13	middle aged	High	Yes	Fair	Yes
14	Senior	Medium	No	Excellent	No

- (b) Describe the difference between rule-based and knowledge-based expert systems. [4]

- Q.9** (a) Describe the roles of selection, crossover, and mutation in a genetic algorithm. How do these operations contribute to the evolution of solutions over generations? [6]  
 (b) Write the short note on **any two**: [4 × 2 = 8]  
 (i) Sentiment Analysis in NLP  
 (ii) Robot Perception (e.g., sensors, localization, mapping)  
 (iii) Bayesian Network