Chapter 1: Introduction to AI

[Short Answer Questions]

1. Define Artificial Intelligence and discuss the various views of AI in the field of computer science. How do these views influence the development and application of AI technologies?
2. Explain the concept of an intelligent agent in AI. Describe the different types of agents, including simple reflex, goal based and model based agent.
3. Describe the different types of environments in which intelligent agents operate. Provide examples of each type and explain how agents adapt their behavior based on the characteristics of the environment.
4. What is the Turing Test, and what criteria must a machine meet to pass it? Discuss the significance of the Turing Test in evaluating machine intelligence and its limitations.

Chapter 2: Problem Solving

[Short Answer Questions]

5. Define problem formulation in AI. Explain with an example how a problem can be formulated and represented for an AI system to solve.
6. Describe the state-space representation of the 8-puzzle problem. What are the initial and goal states, and how can the problem be solved using search algorithms?
7. Give examples of deterministic and non deterministic problem space. You are given two jugs, a 4 liters gallon one and a 3 liters gallon one. Neither have any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 liters of water into the 4 liters gallon jug? Solve this problem with state space representation.
8. Explain the Farmer, Wolf, Goat, and Cabbage problem. Provide a detailed solution and discuss the reasoning process involved.
9. Discuss the constraints satisfaction problem (CSP). Provide an example to illustrate the process of solving a CSP, detailing the variables, domains, and constraints involved.

Chapter 3: Search Techniques

[Short Answer Questions]

10. Explain the Breadth-First Search (BFS) algorithm. What are its advantages and limitations? Provide an example to illustrate its application.
11. Describe the Depth-First Search (DFS) algorithm and provide an example of its application. Discuss scenarios where DFS is preferred over BFS.
12. Discuss the Uniform Cost Search algorithm and how it differs from BFS and DFS. Provide an example to demonstrate its use.
13. Explain the concept of Depth-Limited Search and its use cases. How does it address the limitations of DFS?
14. Describe the Iterative Deepening Depth-First Search (IDDFS) algorithm. Explain its benefits and provide an example of its application.

[Long Answer Questions]

15. Explain the Greedy Best-First Search algorithm. How does it differ from other search strategies? Provide an example to illustrate its application.
16. Explain the A* Search algorithm. How does it use heuristics to find the optimal path? Provide an example to demonstrate its effectiveness and discuss the conditions under which it guarantees optimality.
17. Describe the Hill-Climbing Search algorithm and its variants. What are the drawbacks of hill-climbing search, and how can these be mitigated? Provide examples of scenarios where hill-climbing search is used.
18. Explain the Minimax algorithm and Alpha-Beta Pruning in adversarial search. How do these techniques improve the efficiency of game-playing agents? Provide examples to illustrate their application in games like chess or tic-tac-toe.
19. Describe the Simulated Annealing algorithm. Explain how it avoids local minima and provide an example of its application in optimization problems.

Chapter 4: Knowledge, Inference and Reasoning

[Short Answer Questions]

20. Define propositional logic and explain the use of connectives and truth tables. Provide examples of how propositional logic is used in AI.
21. What do you understand by the term Tautology? Discuss the rules of inferences for proposal logic.
22. Explain the role of quantifiers in FOPL. Provide examples of universal and existential quantifiers and discuss their significance in logical reasoning.
23. Explain the difference between forward chaining and backward chaining in rule-based systems. Provide examples to illustrate their applications.
24. Discuss the Conjunctive Normal Form (CNF) and its significance in logical reasoning. How is CNF used in resolution refutation?

[Long Answer Questions]

25. Describe the process of resolution refutation in propositional logic with an example. Explain how it helps in proving theorems for solving logical problems with an appropriate example.
26. What do you understand by the terms soundness and completeness? Use the propositional logic to prove that the hypothesis “It is not sunny this afternoon and it is colder than yesterday”, “We will go swimming only if it is sunny”, “If we do not go swimming then we take a canoe trip”, and “If we take a canoe trip then we will be home by sunset” lead to the conclusion “We will be home by sunset”.
27. Why do we need predicate logic after propositional logic? Mention the rules of inferences of predicate logic. Convert the following statements into FOPL:
    - Some students are brilliant
    - If it rains, the ground will be wet.
    - All humans are mortal.
    - All purple mushrooms are poisonous.
    - There exists a person who likes every kind of ice cream.
    - Every book in the library is either checked out or available.
    - For every integer, there is another integer that is greater.
    - All planets orbit a star.
28. Discuss the application of Bayes’ theorem in statistical reasoning. Provide a detailed example to demonstrate its use in probabilistic inference.
29. Discuss the importance of well-formed formulas (WFFs) and horn clauses in logic programming. How are they used in rule-based systems?

Chapter 5: Structured Knowledge Representation

[Long Answer Questions]

30. Discuss the issues in knowledge representation. How can these issues be addressed in AI systems? Provide examples to illustrate the strategies used to mitigate these problems.
31. Discuss the various approaches to knowledge representation in AI. Compare and contrast semantic networks and frames. Provide examples to illustrate how each approach can be used to represent structured knowledge in a real-world application.
32. Explain the role of semantic networks in AI. How do they facilitate knowledge representation and reasoning? Provide a detailed example of a semantic network representing a scenario.
33. Describe the process of converting between semantic networks and frames. Provide a detailed example demonstrating the conversion from a semantic network to a frame-based representation.
34. Convert the following statements into a semantic network and a frame-based representation:
    - Dipak is a professor at the Far Western University.
    - Dipak teaches Artificial Intelligence and Software Engineering.
    - Juna is a student at the University of Knowledge.
    - Juna is enrolled in the Artificial Intelligence course.
    - The Artificial Intelligence course is offered by the SoE.
    - The SoE is part of the Far Western University.

Chapter 6: Machine Learning and Machine Vision

[Long Answer Questions]

35. Define machine learning and discuss its different types: supervised, unsupervised, reinforced, and semi-supervised learning. Provide examples of each type and explain the key differences in their approaches and applications.
36. What do you mean by inductive bias learning? Describe the decision tree learning algorithm (ID3). Explain the process of constructing a decision tree, including the selection of attributes and the calculation of information gain. Provide a detailed example to illustrate how a decision tree is
37. Explain the concept of fuzzy inference and its methods in fuzzy learning. Discuss the structure and components of a fuzzy inference system, including fuzzification, rule evaluation, and defuzzification. Provide an example to demonstrate how a fuzzy inference system is applied to a real-world problem.
38. Discuss the challenges and opportunities in the application of machine vision in AI. Provide examples of innovative applications and their potential impact on various industries.
39. Explain the concept of explanation-based learning and its significance in AI. Describe the process of explanation-based learning, including how prior knowledge is used to explain and generalize new examples. Provide an example of how explanation-based learning can be applied to a practical problem.

Chapter 7: Neural Networks and Expert Systems

[Long Answer Questions]

40. Define an artificial neuron and explain its basic elements and activation function. How is ANN related to BNN?
41. Describe the structure and function of a perceptron. What are its limitations?
42. Explain the concept of a multilayer perceptron (MLP) and its significance in neural networks.
43. What is the backpropagation algorithm? Briefly describe its role in training neural networks.

[Long Answer Questions]

44. Describe the architecture of a multilayer perceptron (MLP). Explain how MLPs are trained using the backpropagation algorithm. Provide a detailed example to illustrate the training process.
45. Describe the key components of an expert system. Explain the advantages and limitations of expert systems, and provide examples of their applications in various fields.
46. Discuss the architecture and working mechanism of the Hopfield neural network. Explain how it is used for associative memory and pattern recognition. Provide an example to demonstrate the functioning of a Hopfield network.
47. Describe the Kohonen network, also known as the self-organizing map (SOM). Explain its architecture and learning algorithm. Discuss its applications in data clustering and visualization, providing examples to illustrate its use.
48. Discuss the categories of knowledge used in expert systems: declarative knowledge, procedural knowledge, and meta-knowledge. Explain how the knowledge is acquired, represented and used in expert systems.

Chapter 8: Neural Networks and Expert Systems

[Short Answer Questions]

49. Describe NLP in AI. Why is NLU considered more difficult than NLG? Explain.
50. Discuss the basic terminologies used in NLP: phonology, morphology, syntax, semantics, and pragmatics. Provide a brief example for each.
51. What is the use of a parse tree? Demonstrate with use of a parse tree by taking an appropriate example.
52. Differentiate between lexical analysis and syntax analysis. Mention some popular libraries used in NLP.

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