



# SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

DEPARTMENT OF INFORMATION TECHNOLOGY

TWO MARKS



## UNIT I PROBLEMSOLVING

**1 How will you measure the problem solving performance? AU: May-10**

**Ans.:** Problem solving performance is measured with 4 factors.

- 1) Completeness - Does the algorithm (solving procedure) surely finds solution, how if really the solution exists.
- 2) Optimality - If multiple solutions exist then do the algorithm returns optimal amongs them.
- 3) Time requirement.
- 4) Space requirement.

**.2 What is application of BFS.**

**Ans.:** It is simple search strategy, which is complete i.e. it surely gives solution if solution exists. If the depth of search tree is small then BFS is the best choice. It is useful in tree as well as in graph search.

**.3 State on which basis search algorithms are choosen. AU: Dec.-09**

**Ans.:** Search algorithms are choosen depending on two components.

- 1) How is the state space - That is, state space is tree structured or graph? Critical factor for state space is what is branching factor and depth level of that tree or graph.
- 2) What is the performance of the search strategy? A complete, optimal search strategy with better time and space requirement is critical factor in performance of search strategy.

**4 Evaluate performance of problem solving method based on depth-first-search algorithm.**

**AU: Dec.-10**

**Ans.** DFS algorithm performance measurement is done with four ways

- 1) **Completeness** - It is complete (gurantees solution).
- 2) **Optimality** - It is not optimal.
- 3) **Time complexity** - It's time complexity is  $O(b)$ .
- 4) **Space complexity** - It's space complexity is  $O(b^{d+1})$ .

**Q.5 What are the four components to define a problem? Define them.**

**AU: May-13**

**Ans.:** The four components to define a problem are,

- 1. Initial state** - It is the state in which agent starts in.
- 2. A description of possible actions** - It is the description of possible actions which are available to the agent.
- 3. The goal test** - It is the test that determines whether a given state is goal state (final) state.
- 4. A path cost function** - It is the function that assigns a numeric cost (value) to each path. The problem-solving agent is expected to choose a cost-function that reflects its own performance measure.

**.6 State on what basis search algorithms are chosen?**

(Refer Q.3) **AU: Dec.-09**

**.7 Define the bi-directed search.**

**Ans.:** As the name suggests bi-directional that is two directional searches are made in this searching technique. One is the forward search which starts from initial state and the other is the backward search which starts from goal state. The two searches stop when both the searches meet in the middle.

**.8 List the criteria to measure the performance of search strategies.**

(Refer Q.3) **AU: May-14**

**9 Why problem formulation must follow goal formulation?**

**Ans.:** Goal based agent is the one which solves the problem. Therefore while formulating problem one need to only consider what is the goal to be achieved so that problem formulation is done accordingly. Hence problem formulation must follow goal formulation.

**Q.10 Mention how the search strategies are evaluated? AU: Dec.-16**

**Ans.:** Search strategies are evaluated on following four criterion,

- 1. completeness:** does the search strategy always find a solution, if one exists?
- 2. time complexity:** how much time the search strategy takes to compute.
- 3. space complexity:** how much memory consumption search strategy has ?
- 4. optimality:** does the search strategy find the highest-quality solution? Define admissible and consistent heuristics.

**11 Define admissible and consistent heuristics. AU: Dec.- 16**

**Ans.:** Admissible heuristic: A heuristic is admissible if the estimated cost is never more than the actual cost from the current node to the goal node.

Consistent heuristic: A heuristic is consistent if the cost from the current node to a successor node, plus the estimated cost from the successor node to the goal is less than or equal to the estimated cost from the current node to the goal.

**12 What is the use of online search agent in unknown environment. AU: Dec.-16**

**Ans.:** Online search agents operate by interleaving computation and action: first it takes an action, and then it observes the environment and computes the next action. Therefore in unknown environment they became useful as the action is taken first then the environment is observed.

Also, online search is a necessary idea for an exploration problem, where the states and actions are unknown to the agent.

**13 List some of the uninformed search techniques. AU: May - 17**

**Ans.:** The uninformed search strategies are those that do not take into account the location of the goal. That is, these algorithms ignore where they are going until they find a goal and report success. The three most widely used uninformed search strategies are,

1. Depth-First Search - It expands the deepest unexpanded node.
2. Breadth-First Search - It expands the shallowest unexpanded node.
3. Lowest-Cost-First Search (Uniform Cost Search) - It expand the lowest cost node

**UNITII LOGICAL REASONING**

**Logical Agents and Reasoning**

1. What is a logical agent?
  - An agent that perceives its environment and reasons to achieve its goals.
2. What are the two main types of reasoning a logical agent can perform?
  - Deductive reasoning (drawing conclusions from existing knowledge) and inductive reasoning (learning general rules from specific examples). (1 mark per type)

**Propositional**

3. What are the basic connectives in propositional logic?
  - NOT, AND, OR, IMPLIES, IFF (0.5 marks each)
4. Give an example of a well-formed formula in propositional logic.
  - (A OR B) AND (NOT C)

**Inferences in Propositional Logic**

5. What is Modus Ponens?
  - A valid inference rule: If P implies Q, and P is true, then Q is true.
6. Can you prove that all tautologies are true using any truth table?
  - Yes, a tautology will always evaluate to true under any truth assignment.

**First-Order Logic (2 marks each)**

7. What are the main components of first-order logic?
  - Predicates, functions, constants, variables, and quantifiers. (0.5 marks each)
8. How does first-order logic differ from propositional logic?
  - First-order logic allows representing objects and relationships, while propositional logic deals only with propositions.

### **Inferences in First-Order Logic (2 marks each)**

9. What is universal instantiation?
  - A rule that allows inferring a specific case from a universally quantified statement.
10. What is the role of unification in first-order logic inference?
  - Unification finds a substitution for variables to make two expressions identical.

### **Propositional vs. First-Order Inference**

11. Why is first-order inference generally considered more complex than propositional logic inference?
  - First-order logic deals with variables and quantifiers, requiring additional steps like unification.

### **Unification and Substitutions (2 marks each)**

12. Give an example of a unification problem.
  - Unify the expressions: Brother(x) and John
13. What is a substitution in unification?
  - A mapping of variables to constants to make expressions identical.

### **Forward Chaining and Backward Chaining (2 marks each)**

14. What is the basic principle behind forward chaining?
  - It starts with known facts and applies inference rules to derive new facts.
15. What is the goal of backward chaining?
  - To prove a goal by searching for rules whose conclusion matches the goal.

### **Resolution (2 marks)**

16. What is the resolution rule used for?
  - It is a rule to derive new clauses from existing clauses in a knowledge base.
17. What is the role of the resolvent in resolution-based theorem proving?
  - The resolvent is a new clause obtained by resolving two existing clauses.

### **Advanced Topics (2 marks each)**

18. What is the difference between a definite clause and a Horn clause in logic programming?

- A definite clause has at most one positive literal on the left-hand side, while a Horn clause can have zero or one.
19. What is the halting problem in the context of logic?
- It asks whether there exists an algorithm to decide if a given program will ever halt or run forever.
20. What is the frame problem in AI reasoning?
- It refers to the challenge of maintaining knowledge about what remains unchanged when an action is taken.

### UNIT III PLANNING

#### **Planning and Search (2 marks each)**

1. **What is a state space in planning problems?**

- Answer: A representation of all possible configurations of the environment during the planning process.

2. **What is the difference between forward and backward state-space search?**

- Answer: Forward search starts from the initial state and explores reachable states. Backward search starts from the goal state and explores states that lead to it.

3. **What is the advantage of using a heuristic function in state-space search?**

- Answer: A heuristic function guides the search towards the goal by estimating the remaining cost to reach it.

4. **What is the benefit of partial-order planning (POP) compared to totally ordered planning?**

- Answer: POP allows for more flexibility by considering independent actions concurrently, potentially leading to shorter plans.

#### **Partial-Order Planning (2 marks each)**

5. **What is a key concept in partial-order planning that allows for flexibility?**

- Answer: **Non-linear ordering** of actions, where independent actions can be executed in any order.

6. **How does a planning graph represent ordering constraints between actions in POP?**

- Answer: Edges in a planning graph connect states that can be achieved by specific actions. Preconditions of actions become constraints on the graph.

7. **What is a potential drawback of using partial-order planning algorithms?**

- Answer: The search space in POP can be larger compared to totally ordered planning due to considering multiple action orderings.

### **Planning Graphs (2 marks each)**

**8. What are the two types of nodes in a planning graph?**

- Answer: State nodes represent world configurations, and action nodes represent actions that can be performed.

**9. How do planning graphs help identify inconsistencies in a planning problem?**

- Answer: The lack of a path from the initial state to the goal state in the planning graph indicates an inconsistency (unreachable goal).

**10. What is the role of mutex (mutually exclusive) relations in planning graphs?**

- Answer: Mutex relations identify states that cannot be true simultaneously, helping to prune irrelevant search paths.

### **Planning and Acting in the Real World (2 marks each)**

**11. What is the main challenge of applying planning algorithms directly in real-world scenarios?**

- Answer: Real-world environments are often dynamic and unpredictable, requiring replanning due to unexpected changes.

**12. How can an agent handle incomplete information in the real world during planning?**

- Answer: The agent might need to include information-gathering actions in the plan to gather missing details before proceeding.

**13. What is the trade-off between plan optimality and execution efficiency in real-world planning?**

- Answer: Finding the absolutely optimal plan might be too slow. Real-world agents often prioritize finding a "good enough" plan quickly for timely action.

**14. How can an agent monitor the execution of a plan in the real world?**

- Answer: Sensors can be used to monitor the environment and detect deviations from the expected state, triggering replanning if necessary.

### **Mixed Topics (2 marks each)**

**15. In state-space search, what is the role of the successor function?**

- Answer: The successor function generates all possible states reachable from a given state by applying available actions.

**16. What is a benefit of using hierarchical planning in complex domains?**

- Answer: Hierarchical planning decomposes the problem into smaller, sub-goals, making it easier to find solutions.

**17. How can case-based planning be used to improve planning efficiency?**

- Answer: By adapting existing successful plans from similar situations, the agent can save time on planning new ones from scratch.

**18. What is the importance of considering frame axioms in planning?**

- Answer: Frame axioms help maintain the state of the world that is not explicitly changed by an action.

**19. What is a trade-off between planning for long horizons and replanning due to uncertainty?**

- Answer: Planning too far ahead might be less effective in uncertain environments where replanning becomes frequent.

**20. How can an agent learn from its experience to improve its planning capabilities?**

- Answer: Reinforcement learning techniques can be used to learn successful actions and refine planning strategies based on past rewards and outcomes.

**UNIT IV UNCERTAIN KNOWLEDGE AND REASONING**

**Uncertainty - Review of Probability (2 marks each)**

**1. What is uncertainty, and how is probability theory used to represent it?**

- **Answer:** Uncertainty refers to the lack of complete knowledge about an event's outcome. Probability theory assigns numerical values between 0 and 1 to represent the likelihood of an event occurring.

**2. Differentiate between marginal probability and conditional probability.**

- **Answer:** Marginal probability is the likelihood of a single event happening, while conditional probability considers the probability of one event given that another event has already occurred.

**Probabilistic Reasoning (2 marks each)**

**3. What is the role of Bayes' theorem in probabilistic reasoning?**

- **Answer:** Bayes' theorem allows us to update our beliefs about an event (posterior probability) based on new evidence (likelihood) and our initial belief (prior probability).

**4. Explain the concept of independence in probabilistic reasoning.**

- **Answer:** Two events are independent if the occurrence of one does not affect the probability of the other.

### **Semantic Networks (2 marks each)**

5. **What are the basic components of a semantic network?**

- **Answer:** Semantic networks consist of nodes representing concepts and links representing relationships between those concepts.

6. **Describe one advantage and one disadvantage of using semantic networks for knowledge representation.**

- **Answer:** Advantage: Efficient representation of relationships between concepts. Disadvantage: Limited ability to express complex logical reasoning.

### **Bayesian Networks (2 marks each)**

7. **Define a Bayesian network and its two key components.**

- **Answer:** A Bayesian network is a graphical model that uses directed acyclic graphs (DAGs) and conditional probability tables to represent relationships between variables.

8. **What is the benefit of using Bayesian networks for probabilistic reasoning?**

- **Answer:** Bayesian networks allow for efficient inference by leveraging conditional independence relationships between variables.

9. **Explain the concept of marginalization in the context of Bayesian networks.**

- **Answer:** Marginalization is the process of summing out the probability of a variable in a Bayesian network to obtain the probability distribution of another variable.

### **Inferences in Bayesian Networks (2 marks each)**

10. **What is the difference between exact inference and approximate inference in Bayesian networks?**

- **Answer:** Exact inference finds the true probability of a variable given evidence. Approximate inference uses techniques to get a close estimate when exact computation is difficult.

11. **Give an example of a scenario where you might use a Bayesian network for inference.**

- **Answer:** (e.g.) Diagnosing a medical condition based on symptoms and test results.

### **Temporal Models (2 marks each)**

12. **What is the key difference between a static model and a temporal model?**

- **Answer:** Static models represent a system at a single point in time. Temporal models capture the evolution of a system over time.



**13. Describe one type of temporal model used in AI.**

- **Answer:** One example is a Markov chain, which represents a sequence of states where the probability of transitioning to the next state depends only on the current state.

**Hidden Markov Models (2 marks each)**

**14. What are the hidden states in a Hidden Markov Model (HMM)?**

- **Answer:** Hidden states are internal states of a system that cannot be directly observed, but their influence can be seen through observable outputs.

**15. What are the two main tasks associated with HMMs?**

- **Answer:** The two main tasks are: (1) decoding - finding the most likely sequence of hidden states given a sequence of observations, and (2) learning - estimating the parameters of the HMM from a set of observations.

**16. Give an example of a real-world application of HMMs.**

- **Answer:** HMMs can be used for tasks like speech recognition, where the hidden states represent the underlying phonemes and the observations are the acoustic features.

**17. How do HMMs differ from traditional Markov chains?**

- **Answer:** Traditional Markov chains have observable states, while HMMs have hidden states that cannot be directly observed.

**18. What are the limitations of using HMMs?**

- **Answer:** HMMs assume the system has a fixed number of hidden states and that observations are independent given the hidden state. These assumptions may not hold true in all situations.

**19. What are some alternative models to HMMs for representing sequential data?**

- **Answer:** Some alternatives include Conditional Random Fields (CRFs) and Long Short-Term Memory (LSTM) networks.

**20. Briefly describe the Viterbi algorithm used in HMMs.\*\***

- **Answer:** The Viterbi algorithm is a dynamic programming technique used to find the most likely sequence of hidden states that generated a given sequence of observations.

## UNITV LEARNING

### **Machine Learning and AI Security: 20 Two-Mark Questions**

#### **Learning from Observation (1 mark each)**

1. What is the key advantage of learning from observation compared to explicit programming?

○ Answer: Acquires knowledge without pre-defined rules, adapting to new situations.

2. Give an example of a real-world application that utilizes learning from observation.

○ Answer: Self-driving cars learning traffic patterns from observing human drivers.

#### **Inductive Learning (1 mark each)**

3. Briefly describe the process of inductive learning.

○ Answer: Identifies patterns in training data to make general predictions for unseen data.

4. What is a potential drawback of inductive learning?

○ Answer: Overfitting: Model performs poorly on new data due to memorizing training data.

#### **Decision Trees (1 mark each)**

5. What type of questions are asked at each node in a decision tree?

○ Answer: Questions that best split the data based on a specific attribute.

6. How can decision trees handle missing data points?

○ Answer: Assign data points to branches based on predefined rules or use average values.

#### **Explanation-Based Learning (1 mark each)**

7. Explain the core idea behind explanation-based learning.

○ Answer: Learns from explanations of existing solutions to solve new problems efficiently.

8. In what scenario would explanation-based learning be most beneficial?

○ Answer: When domain knowledge is limited and complex problem-solving steps need explanation.

#### **Statistical Learning Methods (1 mark each)**

9. What is the main focus of statistical learning methods?

○ Answer: Building models based on statistical relationships within data.

10. Give an example of a statistical learning method commonly used in machine learning.

- Answer: Linear regression: Creates a linear model to predict a continuous target variable.

**Reinforcement Learning (1 mark each)**

11. What type of feedback is provided in reinforcement learning?

- Answer: Rewards or penalties based on the agent's actions in an environment.

12. What is the exploration-exploitation dilemma in reinforcement learning?

- Answer: Balancing trying new actions (exploration) with exploiting known successful ones (exploitation).

**Neural Network Learning (1 mark each)**

13. Briefly describe the structure of a basic artificial neural network.

- Answer: Composed of interconnected layers of nodes (neurons) that process information.

14. How does a neural network learn during training?

- Answer: Adjusts the weights between neurons based on the difference between predicted and actual outputs.

**Genetic Algorithms (1 mark each)**

15. What is the concept of "fitness" in a genetic algorithm?

- Answer: A measure of how well a solution performs within the given problem.

16. How do genetic algorithms achieve improvements in solutions over time?

- Answer: Through selection, crossover, and mutation operations to create better offspring solutions.

**Case Study: Security in AI (1 mark each)**

17. Identify a potential security risk associated with using AI-powered home security systems.

- Answer: Vulnerability to hacking, allowing unauthorized access to control the system.

18. How can crime prevention cameras leverage AI to improve security?

- Answer: By using facial recognition to identify known criminals or suspicious behavior patterns.

19. Briefly discuss a security concern related to using AI in military reconnaissance.

- Answer: Potential for AI systems to be misled by enemy deception tactics or provide inaccurate information.

20. How can AI be used to enhance threat detection in offshore oil and gas operations?

- Answer: By analyzing sensor data to predict equipment failures or potential environmental hazards.