a. Brief Answer Questions: 2023 2. How does deterministic environment differ from stochastic environment? 3. What is constraint satisfaction problem? 4. Give an example of skolemization. 5. List the problem of depth limited search. 6. What is the limitation of sigmoid activation function? Write any two conflict resolution strategy in production system. 7. Numerically illustrate fuzzy union operation 8. How does utility based agent differ with goal based agent? 9. Write the heuristic function for A* search. 10. What are the types of crossover in genetic algorithm?	a. 2022 AI TU 11. Why do we need to make the machine learn? 12. What is rational agent? 13. Give an example of CNF expression. 14. What are the four ways to evaluate the performance of searching? 15. Why do we need to analyze semantics over syntactic? 16. What is the function of inference engine in expert system? 17. Why we need probabilistic reasoning in AI? 18. List out any two activation functions. 19. Why do we need to address fuzzy logic in AI? 20. What do you mean by reinforcement learning?
a. Make 2020 21. What are the requirements to pass the Turing Test? 22. What is agent function? 23. Convert given statement into predicate logic "Every teacher is liked by some student". 24. Define triggering in production system. 25. Compare fuzzy logic with binary logic. 26. What do you mean by machine learning? 27. Differentiate between universal and existential quantifiers. 28. Define plateau problem. 29. Why natural language processing is a difficult task? 30. Define knowledge engineering in expert system.	a. 2019 31. Define Omniscience. 32. Define sequential environment. 33. Write Modus Ponen Rule. 34. In NLP, why semantic analysis is used? 35. What does a Production Rule Consist Of? 36. Define fuzzy set and crisp set. 37. Compare expert system and human expert. 38. Define disjunctive normal form. 39. Write any one importance of artificial intelligence. 40. What do you mean by fringe nodes?
a. 2018 41. What is learning agent? 42. What is alpha beta pruning? 43. Define inference engine. 44. List the components of problem definition. 45. What is meant by logical consequence? 46. In which situation fuzzy logic can be used? 47. What is meant by expert system shell? 48. With suitable example write on crossover operator in genetic algorithm. 49. What is pragmatic analysis? 50. What is DENDRAL?	a. 2017 51. When machine is termed intelligent in Turing Test? 52. Define agent function. 53. Why pragmatic analysis is necessary in NLP? 54. In what type of situation fuzzy logic can be used? 55. "Every husband loves his wife", convert the above statement in FOPL. 56. What is unsupervised learning? 57. Write any two conflict resolution strategies in production system. 58. What is skolemization? 59. What do you mean by Admissible heuristics? 60. What is alpha-beta purning?
2015 61. What is Artificial Intelligence? 62. Define omniscience. 63. How is performance of search algorithm measured? 64. What is cryptarithmetic? 65. What is the limitation of propositional logic over predicate logic? 66. State Modus Ponens inference rule with suitable example.	2015 67. Define conjunctive normal form with suitable example. 68. Define mutation in genetic algorithm. 69. Define rule based expert system. 70. What is meant by machine translation in NLP?

Brief answers questions:
2023

2. Deterministic vs. Stochastic Environment:
- **Deterministic Environment: The outcome of every action is predictable and certain.**
- **Stochastic Environment: The outcome of actions involves some level of randomness or uncertainty.**

3. Constraint Satisfaction Problem (CSP):
- **A problem where the goal is to find values for variables that satisfy a set of constraints.**

4. Example of Skolemization:
- **Original statement: "Every student is taught by a teacher."**
- **Skolemized form: "For every student x, there exists a specific teacher t_x such that x is taught by t_x."**

5. Problems of Depth-Limited Search:
- **Incompleteness: It may not find a solution if it is deeper than the depth limit.**
- **Inconsistency: Solutions may be found that are not the best because it does not explore all possibilities.**

6. Limitation of Sigmoid Activation Function:
- **Vanishing Gradient Problem: Gradients become very small, causing slow convergence during training.**
- **Conflict Resolution Strategies in Production Systems:**
  - **Specificity: Prefer rules with more specific conditions.**
  - **Recency: Prefer rules that have been recently used.**

7. Fuzzy Union Operation:
- **For fuzzy sets A and B with membership values $\mu_A(x)$ and $\mu_B(x)$ respectively, the fuzzy union is defined as $\mu_{A \cup B}(x) = \max(\mu_A(x), \mu_B(x))$.**

8. Utility-Based vs. Goal-Based Agent:
- **Utility-Based Agent: Chooses actions based on a utility function to maximize overall satisfaction.**
- **Goal-Based Agent: Chooses actions to achieve specific goals, without considering the overall satisfaction.**

9. Heuristic Function for A* Search:
- **The heuristic function $h(n)$ estimates the cost from node n to the goal. The total cost function used is $f(n) = g(n) + h(n)$, where $g(n)$ is the cost to reach node n from the start.**

10. Types of Crossover in Genetic Algorithms:
- **Single-Point Crossover: A crossover point is chosen randomly, and segments are swapped.**
- **Two-Point Crossover: Two crossover points are chosen, and segments between them are swapped.**

2022

11. Need for Machine Learning:
- **To enable systems to improve performance and make decisions based on data and experience without being explicitly programmed.**

12. Rational Agent:
- **An agent that acts to maximize its expected performance measure based on its knowledge and goals.**

13. Example of CNF Expression:
- **$(A \lor B) \land (\neg A \lor C)$**

14. Four Ways to Evaluate Search Performance:
- **Completeness: Whether the algorithm finds a solution if one exists.**
- **Optimality: Whether the solution found is the best.**
- **Time Complexity: How the running time grows with problem size.**
- **Space Complexity: How memory usage grows with problem size.**

15. Analyzing Semantics Over Syntactics:
- **Semantics deals with meaning, which is crucial for understanding context and ensuring correct interpretation, while syntax is just about structure.**

16. Function of Inference Engine in Expert Systems:
- **To apply logical rules to the knowledge base to derive new information or make decisions.**

17. Need for Probabilistic Reasoning in AI:
- **To handle uncertainty and make decisions when there is incomplete or uncertain information.**

18. Two Activation Functions:
- **Sigmoid: $\sigma(x) = \frac{1}{1 + e^{-x}}$**
- **ReLU (Rectified Linear Unit): $\text{ReLU}(x) = \max(0, x)$**

19. Addressing Fuzzy Logic in AI:
- **To handle imprecise or ambiguous information and make decisions in complex or uncertain environments.**

20. Reinforcement Learning:
- **A type of machine learning where an agent learns to make decisions by receiving rewards or penalties for actions in an environment.**

2020

21. Requirements to Pass the Turing Test:
- **The machine must exhibit intelligent behavior indistinguishable from that of a human during a conversation.**

22. Agent Function:
- **Defines the behavior of an agent, mapping from percepts to actions.**

23. Convert to Predicate Logic:
- **$\forall x \text{ (Teacher(x) → ∃y \text{ (Student(y) ∧ Likes(y, x))})}$**

24. Triggering in Production Systems:
- **The process of determining when the conditions of a rule are satisfied so that the rule can be applied.**

25. Fuzzy Logic vs. Binary Logic:
- **Fuzzy Logic: Deals with degrees of truth and partial membership.**
- **Binary Logic: Uses strict true/false values.**

26. Machine Learning:
- **A field of AI focused on developing algorithms that allow computers to learn from and make predictions or decisions based on data.**

27. Universal vs. Existential Quantifiers:
- **Universal Quantifier (∀): Indicates that a statement is true for all elements in a domain.**
- **Existential Quantifier (∃): Indicates that there is at least one element in a domain for which the statement is true.**

28. Plateau Problem:
- Occurs when the search algorithm encounters a flat local maximum and gets stuck, unable to proceed.

29. Difficulty in Natural Language Processing:
- Due to ambiguity, context sensitivity, and the vast variability of human language.

30. Knowledge Engineering in Expert Systems:
- The process of developing and maintaining the knowledge base and inference rules of an expert system.

2019

31. Omniscience:
- The property of knowing everything, often used to describe an idealized agent with complete knowledge of the environment.

32. Sequential Environment:
- An environment where the agent's actions have a clear sequence and future states depend on the current state and action.

33. Modus Ponens Rule:
- If P implies Q and P is true, then Q must also be true.

34. Semantic Analysis in NLP:
- To understand the meaning and context of words and sentences to improve the accuracy of language processing.

35. Production Rule Consists Of:
- Condition (if part) and Action (then part) that determine the rule's applicability and resultant action.

36. Fuzzy Set vs. Crisp Set:
- Fuzzy Set: Membership is gradual and can have values between 0 and 1.
- Crisp Set: Membership is binary, either 0 or 1.

37. Expert System vs. Human Expert:
- Expert System: Uses predefined rules and knowledge to provide expertise.
- Human Expert: Applies intuition, experience, and contextual understanding.

38. Disjunctive Normal Form (DNF):
- A logical formula in which the expression is a disjunction of conjunctions (e.g., $(A \land B) \lor (\neg C \land D)$).

39. Importance of Artificial Intelligence:
- To automate tasks, enhance decision-making, and solve complex problems that are difficult or impractical for humans.

40. Fringe Nodes:
- Nodes that have been generated but not yet expanded in a search algorithm.

2018

41. Learning Agent:
- An agent that improves its performance over time by learning from its experiences.

42. Alpha-Beta Pruning:
- An optimization technique for the minimax algorithm to reduce the number of nodes evaluated in the search tree.

43. Inference Engine:
- The component of an expert system that applies logical rules to the knowledge base to derive new information.

44. Components of Problem Definition:
- Initial State: Starting point.
- Actions: Possible moves or operations.
- Goal State: Desired outcome.
- Path Cost: Cost associated with actions.

45. Logical Consequence:
- A statement that must be true if the premises are true.

46. Situation for Using Fuzzy Logic:
- When dealing with uncertain, imprecise, or qualitative information.

47. Expert System Shell:
- A software framework that provides the basic components for developing an expert system without specifying the knowledge base.

48. Crossover Operator in Genetic Algorithm:
- Example: In single-point crossover, a random point is selected in two parent chromosomes, and segments are exchanged to create offspring.

49. Pragmatic Analysis:
- The study of how context influences the interpretation of language, including speaker intentions and social aspects.

50. DENDRAL:
- An early expert system used for chemical analysis, specifically for identifying molecular structures from mass spectrometry data.

2017

51. Machine Intelligence in Turing Test:
- When a machine's responses are indistinguishable from those of a human in a conversation.

52. Agent Function:
- A function that maps percepts to actions, defining the agent's behavior.

53. Necessity of Pragmatic Analysis:
- To

understand the intended meaning behind language use, including context, tone, and implied meanings.

54. Situation for Using Fuzzy Logic:
- When precise information is unavailable and decision-making requires handling of partial truths.

55. FOPL Conversion:
- \(\forall x \text{ (Husband(x) → Loves(x, Wife(x)))}\)

56. Unsupervised Learning:
- **A type of machine learning where the model learns patterns and structures from unlabeled data.**

57. Conflict Resolution Strategies:
- **Priority: Resolve conflicts based on predefined priorities.**
- **Random Selection: Choose rules randomly when conflicts occur.**

58. Skolemization:
- **The process of removing existential quantifiers by introducing Skolem functions or constants.**

59. Admissible Heuristics:
- **Heuristics that do not overestimate the cost to reach the goal, ensuring optimality in search algorithms.**

60. Alpha-Beta Pruning:
- **An optimization technique for the minimax algorithm to eliminate branches that cannot affect the final decision.**

2015

1. Artificial Intelligence (AI):
- **AI is the field of computer science focused on creating systems that can perform tasks requiring human intelligence, such as learning, reasoning, problem-solving, and understanding natural language.**

2. Omniscience:
- **Omniscience refers to the property of having complete and unlimited knowledge about all aspects of a domain or environment.**

3. Performance of Search Algorithm:
- **Time Complexity: The amount of time it takes to find a solution.**
- **Space Complexity: The amount of memory required.**
- **Completeness: Whether it finds a solution if one exists.**
- **Optimality: Whether it finds the best solution.**

4. Cryptarithmetic:
- **A type of mathematical puzzle where letters stand for digits in arithmetic equations, and the goal is to find the digit corresponding to each letter to satisfy the equation.**

5. Limitation of Propositional Logic over Predicate Logic:
- **Lack of Expressiveness: Propositional logic cannot express statements about objects and their relationships, unlike predicate logic which can handle quantifiers and more complex statements.**

6. Modus Ponens Inference Rule:
- **Rule: If \(P \rightarrow Q\) (if \(P\) then \(Q\)) and \(P\) is true, then \(Q\) must also be true.**
- **Example: If it is raining (P), then the ground will be wet (Q). It is raining (P). Therefore, the ground will be wet (Q).**

7. Conjunctive Normal Form (CNF):
- **A logical formula is in CNF if it is a conjunction of one or more disjunctions of literals.**
- **Example: \((A \lor B) \land (\neg A \lor C)\)**

8. Mutation in Genetic Algorithm:
- **Mutation is an operation that introduces random changes to an individual's genetic code (chromosome) to maintain genetic diversity within the population and prevent premature convergence.**

9. Rule-Based Expert System:

- A system that uses a set of "if-then" rules to make decisions or infer new information from a knowledge base. It applies these rules based on given conditions to derive conclusions or actions.

10. Machine Translation in NLP:

- Machine Translation (MT) is the automatic process of translating text or speech from one language to another using computational algorithms and models.