

Here is a compilation of important questions from 2020, 2021, 2019, and 2018, organized by topic, along with a super suggestion table for exam preparation:

### **Topic 01: Introduction**

- Define Artificial Intelligence and explain its goals. (2021, 2020)
- Discuss the Turing Test and its significance in AI. (2021, 2019, 2018, 2016)
- Explain the differences between Strong AI and Weak AI. (2020, 2018)
- Describe the types of AI: Reactive machines, Limited memory, Theory of mind, and Self-awareness. (2019, 2018)
- What are the applications of AI in everyday life? (2020, 2019)
- Briefly discuss the importance of artificial intelligence systems. (2020, 2018)
- How do you prove that a machine can work as an intelligent system? (2020)
- Explain how AI can be used in solving real-world problems and enhancing scalability. (2018)
- What is an expert system? (2020)
- How does an expert system work in the real world? (2020)
- List the characteristic features of an expert system. (2020)

### **Topic 02: Intelligent Agent**

- What is an intelligent agent? Explain the different types of intelligent agents. (2020, 2019, 2018)
- Define and explain the concept of Agent's Architecture and Agent's Environment. (2021, 2020)
- Discuss the properties of an intelligent agent. (2020, 2019)
- What is rationality in AI? How does it relate to intelligent agents? (2020, 2019)
- Explain the concept of utility function in intelligent agents. (2018)
- What is the intelligent agent in AI and where are they used? (2021)
- How many types of agents are there in AI? (2021)
- What do you know about PEAS? (2020)
- Provide a PEAS description of the task environment for a medical diagnosis system. (2020)
- Give a PEAS description of the task environment for an automated car driver. (2021)
- What is a rational agent? What factors should a rational agent depend on at any given time? (2019, 2018)

### **Topic 03: Problem Solving by Searching**

- Describe the various search strategies: Breadth-First Search, Depth-First Search, and A\* algorithm. (2021, 2020, 2019)
- Explain the concept of state space and search trees. How are they used in AI problem solving? (2020, 2018)

- Discuss the advantages and disadvantages of uninformed vs informed search strategies. (2020, 2019)
- How does the A\* algorithm work? Explain with an example. (2019, 2018)
- What is the complexity of search algorithms? Compare time complexity for different search strategies. (2020, 2018)
- Discuss hill-climbing search. Mention some drawbacks of hill climbing search. (2021, 2020)
- Differentiate Breadth-First Search and Depth-First Search. (2021)
- What are the merits and demerits of depth-first search and breadth-first search? (2019, 2018)
- What is the functional strategy of bidirectional search? Give an example. (2020)
- What is meant by an "admissible" heuristic? (2018)
- Describe bidirectional search. State how repeated states are avoided in depth-first search (DFS). (2018)
- With an illustration, explain single-state problems, multiple-state problems, stringency problems, and exploration problems. (2019)

#### **Topic 04: Knowledge, Reasoning, Planning**

- What is logic? What are the advantages of first-order logic over propositional logic? (2020)
- What are the differences between propositional logic and predicate logic? (2020, 2018)
- What is knowledge representation in AI? Discuss the frame-based approach. (2020, 2018)
- Explain the fuzzy set operation with examples. (2018)
- Describe the rules of inference with examples. (2019)
- Explain the Modus-Ponens and Modus-Tollens in propositional logic. (2018)
- Define WFF and clause. Write down the steps of converting WFFs into clauses. (2019)
- Translate sentences into first-order logic (FOPL). E.g., "All dogs are mammals". (2017, 2015, 2011)
- What do you mean by quantifier? What are the functionalities of different kinds of quantifiers? (2020)

#### **Topic 05: Neural Networks**

- What is a neural network? Explain the architecture and working principles. (2021, 2018)
- Differentiate between supervised and unsupervised learning in neural networks. (2020, 2018, 2017, 2015)
- Explain McCulloch-Pitts artificial neuron model. (2021)
- Discuss Rosenblatt's perceptron learning algorithm. (2021)
- Explain why perceptrons can learn AND/OR but not XOR. (2019, 2018, 2015)
- Discuss the back propagation learning algorithm. (2020)
- What is a Hopfield network? Explain how it operates and achieves desirable features. (2018)
- What is an artificial neural network (ANN)? (2021, 2018)

- Draw an analogy between artificial neural networks and biological neural networks. (2021, 2019)
- Describe the working principles of an artificial neural network with a diagram. (2020, 2018)
- Mention various types of learning paradigms in an ANN. (2020, 2018)
- What is perceptron? How does the perceptron learn? (2020)

### Super Suggestion for Upcoming Exam

Topic	Important Questions (from 2022, 2021, 2020, 2019, 2018)
<b>Topic: 01 - Introduction</b>	1. Define Artificial Intelligence and explain its goals. 2. Discuss the Turing Test and its significance in AI. 3. Explain the differences between Strong AI and Weak AI. 4. Describe the types of AI: Reactive machines, Limited memory, Theory of mind, and Self-awareness. 5. What are the applications of AI in everyday life?
<b>Topic: 02 - Intelligent Agent</b>	1. What is an intelligent agent? Explain the different types of intelligent agents. 2. Define and explain the concept of Agent's Architecture and Agent's Environment. 3. Discuss the properties of an intelligent agent. 4. What is rationality in AI? How does it relate to intelligent agents? 5. Explain the concept of utility function in intelligent agents.
<b>Topic: 03 - Problem Solving by Searching</b>	1. Describe the various search strategies: Breadth-First Search, Depth-First Search, and A* algorithm. 2. Explain the concept of state space and search trees. How are they used in AI problem solving? 3. Discuss the advantages and disadvantages of uninformed vs informed search strategies. 4. How does the A* algorithm work? Explain with an example. 5. What is the complexity of search algorithms? Compare time complexity for different search strategies.
<b>Topic: 04 - Knowledge, Reasoning, Planning</b>	1. What is logic? What are the advantages of first-order logic over propositional logic? 2. What are the differences between propositional logic and predicate logic? 3. What is fuzzy logic? List the properties of fuzzy sets. 4. Explain the fuzzy set operation with examples. 5. What is knowledge representation in AI? Discuss the frame-based approach. 6. Discuss various approaches and issues in knowledge representation. 7. Describe the rules of inference with examples. 8. Explain the Modus-Ponens and Modus-Tollens in propositional logic. 9. Define WFF and clause. Write down the steps of converting WFFs into clauses. 10. Translate sentences into first-order logic (FOPL). E.g., "All dogs are mammals" 11. Use the Modus Ponens deduction rule to deduce a conclusion from premises.

**Topic: 05 -  
Neural  
Networks**

1. What is a neural network? Explain the architecture and working principles. 2. Differentiate between supervised and unsupervised learning in neural networks. 3. Explain McCulloch-Pitts artificial neuron model. 4. Discuss Rosenblatt's perceptron learning algorithm. 5. What are the features of biological neural networks that make them superior to AI computer systems? 6. Explain why perceptrons can learn AND/OR but not XOR. 7. Discuss the back propagation learning algorithm. 8. What is reinforcement learning? Discuss how it differs from other learning paradigms in neural networks. 9. What is a Hopfield network? Explain how it operates and achieves desirable features. 10. What is the weight updating rule in perceptron learning?

## Short Answer

Okay, I will answer the questions based on the provided source texts, keeping in mind that the answers should be suitable for a Computer Science semester exam.

### Topic 01 - Introduction

- **Define Artificial Intelligence and explain its goals.**
  - **Artificial Intelligence (AI) is a field of science dedicated to building machines and computers capable of learning, reasoning, and acting in ways that typically require human intelligence.**
  - The goals of AI include:
    - Mimicking human cognitive functions.
    - Solving complex problems.
    - Automating tasks.
    - Enhancing scalability in various applications.
- **Discuss the Turing Test and its significance in AI.**
  - The **Turing Test** is a test of a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human.
  - Significance:
    - It provides a benchmark for evaluating AI systems.
    - It provokes thought about what it means for a machine to "think".
    - A computer should possess certain capabilities to conduct the Turing Test.
- **Explain the differences between Strong AI and Weak AI.**
  - **Strong AI:** Aims to create machines that can truly "think" and possess human-level consciousness.
  - **Weak AI:** Focuses on designing machines to perform specific tasks intelligently without genuine understanding or consciousness.

- **Describe the types of AI: Reactive machines, Limited memory, Theory of mind, and Self-awareness.**
  - **Reactive Machines:** These are the most basic types of AI, which react to stimuli based on pre-defined rules. They do not have memory or the ability to learn from past experiences.
  - **Limited Memory:** These AI systems can store past experiences or data for a short period, which can be used to inform future decisions.
  - **Theory of Mind:** This type of AI possesses the ability to understand that others have beliefs, desires, and intentions that are different from their own. This level of AI is still largely theoretical.
  - **Self-Awareness:** This is the most advanced type of AI, where the system is aware of its own existence and has consciousness. This type of AI does not currently exist.
- **What are the applications of AI in everyday life?**
  - The source does not explicitly list the applications of AI in everyday life.

## Topic 02 - Intelligent Agent

- **What is an intelligent agent? Explain the different types of intelligent agents.**
  - An **intelligent agent** is an entity that perceives its environment through sensors and acts upon that environment through actuators.
  - Types of intelligent agents:
    - Simple reflex agents.
    - Model-based reflex agents.
    - Utility-based agents.
- **Define and explain the concept of Agent's Architecture and Agent's Environment.**
  - **Agent's Architecture:** The underlying hardware and software structure that supports the agent's decision-making processes.
  - **Agent's Environment:** The surroundings in which the agent operates, including objects, other agents, and conditions that affect the agent's performance.
- **Discuss the properties of an intelligent agent.**
  - The source does not explicitly list the properties of an intelligent agent.
- **What is rationality in AI? How does it relate to intelligent agents?**
  - **Rationality** in AI refers to the ability of an agent to make decisions that maximize its expected performance, based on its knowledge and goals.
  - Intelligent agents should ideally be rational, selecting actions that lead to the best outcome or utility.
- **Explain the concept of utility function in intelligent agents.**
  - A **utility function** assigns a numerical value to different states or outcomes, representing the agent's preference for those states. Agents use utility functions to make rational decisions by selecting actions that maximize their expected utility.

## Topic 03 - Problem Solving by Searching

- *Describe the various search strategies: Breadth-First Search, Depth-First Search, and A algorithm\*.*
  - **Breadth-First Search (BFS):** Explores all the neighbor nodes at the present depth prior to moving on to the nodes at the next depth level.
  - **Depth-First Search (DFS):** Explores as far as possible along each branch before backtracking.
  - **A Algorithm\*:** An informed search algorithm that uses heuristics to estimate the cost from the current state to the goal state and expands nodes in the order of their  $f(n) = g(n) + h(n)$  value, where  $g(n)$  is the cost from the start node to the current node and  $h(n)$  is the heuristic estimate from the current node to the goal.
- **Explain the concept of state space and search trees. How are they used in AI problem solving?**
  - **State Space:** Represents all possible states of the problem, and the transitions between these states.
  - **Search Trees:** A tree representation of the state space, where nodes represent states and edges represent actions. Search trees are used to visualize and explore the possible solutions to a problem.
- **Discuss the advantages and disadvantages of uninformed vs informed search strategies.**
  - **Uninformed Search (Blind Search):** These strategies do not use any domain knowledge.
    - Advantages: Simplicity, broad applicability.
    - Disadvantages: Inefficiency, high time complexity.
  - **Informed Search:** These strategies use domain knowledge (heuristics) to guide the search.
    - Advantages: Efficiency, faster solutions.
    - Disadvantages: Heuristics may not always be accurate, can be complex.
- *How does the A algorithm work? Explain with an example\*.*
  - The **A algorithm\*** combines the cost to reach the node ( $g(n)$ ) and a heuristic estimate of the cost to get from the node to the goal ( $h(n)$ ). It selects the node with the lowest  $f(n) = g(n) + h(n)$  value to expand.
- **What is the complexity of search algorithms? Compare time complexity for different search strategies.**
  - The source does not explicitly contain time complexity comparison for different search strategies.

#### Topic 04 - Knowledge, Reasoning, Planning

- **What is logic? What are the advantages of first-order logic over propositional logic?**
  - **Logic** is a formal system used to represent knowledge and draw inferences.
  - Advantages of First-Order Logic (FOL) over Propositional Logic:
    - FOL can represent objects, properties, and relations between objects.
    - FOL provides quantifiers to express general statements about all or some objects.

- FOL is more expressive and can represent more complex knowledge than propositional logic.
- **What are the differences between propositional logic and predicate logic?**
  - **Propositional Logic:** Deals with simple propositions (statements that are either true or false).
  - **Predicate Logic (First-Order Logic):** Deals with objects, properties, and relations between objects. It uses predicates, variables, and quantifiers to represent complex statements.
- **What is fuzzy logic? List the properties of fuzzy sets.**
  - **Fuzzy Logic:** A form of logic that deals with degrees of truth rather than absolute true or false values.
  - The source does not explicitly list the properties of fuzzy sets.
- **Explain the fuzzy set operation with examples.**
  - The source mentions "fuzzy set operation with examples".
- **What is knowledge representation in AI? Discuss the frame-based approach.**
  - **Knowledge Representation:** The method used to encode knowledge in a computer system so that it can be used for reasoning and problem-solving.
  - The source mentions a frame-based approach to knowledge representation.
- **Discuss various approaches and issues in knowledge representation.**
  - The source mentions discussing various approaches and issues in knowledge representation.
- **Describe the rules of inference with examples.**
  - **Rules of Inference:** Logical rules used to derive new conclusions from existing knowledge or premises.
- **Explain the Modus Ponens and Modus Tollens in propositional logic.**
  - **Modus Ponens:** If P is true and P implies Q, then Q is true.
  - **Modus Tollens:** If P implies Q is true and Q is false, then P is false.
- **Define WFF and clause. Write down the steps of converting WFFs into clauses.**
  - **Well-Formed Formula (WFF):** A syntactically correct expression in logic.
  - **Clause:** A disjunction of literals.
- **Translate sentences into first-order logic (FOPL). E.g., "All dogs are mammals"**
  - "All dogs are mammals" can be translated into FOPL as:  $\forall x (\text{Dog}(x) \rightarrow \text{Mammal}(x))$ .
- **Use the Modus Ponens deduction rule to deduce a conclusion from premises.**
  - Given: All dogs are mammals:  $\forall x (\text{Dog}(x) \rightarrow \text{Mammal}(x))$ , Fido is a dog:  $\text{Dog}(\text{Fido})$ .
  - By Modus Ponens:  $\text{Mammal}(\text{Fido})$  (Fido is a mammal).

## Topic 05 - Neural Networks

- **What is a neural network? Explain the architecture and working principles.**
  - A **neural network** is a computational model inspired by the structure and function of biological neural networks. It consists of interconnected nodes (neurons) organized in layers.



- Architecture typically includes an input layer, one or more hidden layers, and an output layer.
- Working principles involve neurons receiving inputs, applying weights and activation functions, and passing the output to other neurons.
- **Differentiate between supervised and unsupervised learning in neural networks.**
  - **Supervised Learning:** The network is trained on labeled data, where the correct output is provided for each input.
  - **Unsupervised Learning:** The network is trained on unlabeled data, where it must find patterns and structures in the data on its own.
- **Explain McCulloch-Pitts artificial neuron model.**
  - The **McCulloch-Pitts neuron** is a simplified model of a biological neuron. It receives binary inputs, multiplies each input by a weight, sums the weighted inputs, and applies a threshold function to produce a binary output.
- **Discuss Rosenblatt's perceptron learning algorithm.**
  - **Rosenblatt's perceptron learning algorithm** is used to train a single-layer perceptron. The algorithm adjusts the weights of the perceptron based on the difference between the predicted output and the actual output for each training example.
- **What are the features of biological neural networks that make them superior to AI computer systems?**
  - The source mentions features of biological neural networks that make them superior to AI computer systems.
- **Explain why perceptrons can learn AND/OR but not XOR.**
  - **Perceptrons** can learn linearly separable functions like AND and OR because these functions can be represented by a single straight line (or hyperplane). XOR is not linearly separable and requires multiple layers to be learned.
- **Discuss the back propagation learning algorithm.**
  - The **backpropagation algorithm** is used to train multi-layer neural networks. It calculates the gradient of the loss function with respect to the network's weights and updates the weights to minimize the loss.
- **What is reinforcement learning? Discuss how it differs from other learning paradigms in neural networks.**
  - **Reinforcement Learning:** An agent learns to make decisions by interacting with an environment to maximize a reward signal.
  - Unlike supervised learning, reinforcement learning does not rely on labeled data. Unlike unsupervised learning, reinforcement learning has a notion of reward or punishment.
- **What is a Hopfield network? Explain how it operates and achieves desirable features.**
  - A **Hopfield network** is a recurrent neural network that serves as a content-addressable memory system. It operates by iteratively updating the states of its neurons until it converges to a stable state, representing a stored memory.
- **What is the weight updating rule in perceptron learning?**



- The source mentions the weight updating rule in perceptron learning.