

Name: ..... ID: .....

**Q.1 Choose the correct answer: [ 20 QUESTIONS ]**

- 1) Rational agents in AI are designed to (a) Mimic human behaviour. (b) Achieve specified goals efficiently. (c) Understand human emotions. (d) Process large amounts of data.
- 2) A machine that can perform a specific task with human-level proficiency is an example of (a) Strong AI. (b) Weak AI. (c) Superintelligence. (d) None of the above.
- 3) Unsupervised learning differs from supervised learning primarily in that: (a) It requires labelled data. (b) It does not require labelled data. (c) It is used for regression problems only. (d) It is primarily used for classification problems.
- 4) In a factory robot that tries to copy human workers' movements, the robot's approach is closest to \_\_\_\_\_. Meanwhile, an AI program that suggests new songs based on the ones you like is an example of \_\_\_\_\_. (a) Both are Acting Like Humans. (b) Both are Acting Rationally. (c) Acting Rationally / Acting Like Humans. (d) Thinking Like Humans / Thinking Rationally. (e) Acting Like Humans / Acting Rationally.
- 5) When a hospital computer system learns from patient records to predict diseases, it uses \_\_\_\_\_. Meanwhile, a store computer system that looks for patterns in sales data to plan product placement better is using \_\_\_\_\_. (a) Both are Machine Learning. (b) Both are Data Mining. (c) Data Mining / Machine Learning. (d) Machine Learning / Data Mining.
- 6) In a vacuum cleaning robot, which part of PEAS is the motor that makes the vacuum move? (a) Performance Measure. (b) Environment. (c) Actuators. (d) Sensors.
- 7) An intelligent agent should make appropriate choices given perceptual limitations (bounded rationality) & limited resources (bounded optimality). Which scenario best illustrates the agent's decision-making under these constraints? (a) A chess-playing agent that considers all possible moves & outcomes before making a move. (b) An autonomous car that evaluates available real-time traffic conditions and selects the optimal route within seconds. (c) A language translation system that exhaustively explores every possible translation option for a given text.
- 8) Consider a 3-puzzle where, like in the usual 8-puzzle game, a tile can only move to an adjacent space. Given the initial state as below, which of the following states cannot be reached? (a) A (b) B (c) C (d) D (e) None of the above.

Initial State	(A)	(B)	(C)	(D)																				
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- 9) All of the following games and puzzles have Fully Observable, Sequential, Static, and Discrete environments, except for: (a) Chess. (b) Tic-Tac-Toe. (c) N-Queens. (d) Playing Cards (e.g., Poker, Blackjack, and Bridge). (e) Sudoku.
- 10) What is John Searle's conclusion regarding "Strong AI" based on the Chinese Room Argument? (a) That Strong AI is true. (b) That Strong AI is false.

**11)** Match the following AI concepts with their real-world characteristics and/or applications:

- |                              |   |
|------------------------------|---|
| a. The Turing Test           | 1. AI systems that try to act like humans in conversations.                 |
| b. The Chinese Room Argument | 2. AI systems that are made for specific tasks like virtual assistants.     |
| c. Weak AI                   | 3. AI systems with a human-like mind and understanding.                     |
| d. Strong AI                 | 4. An argument saying a machine doesn't truly "understand" what it's doing. |
- (a) 1 4 3 2   (b) 4 1 3 2   (c) 4 1 2 3   (d) 1 2 3 4   **(e) 1 4 2 3**

**12)** Match the following machine learning tasks with their descriptions:

- |                             |   |
|-----------------------------|---|
| a. Classification           | 1. Grouping similar data points.                                    |
| b. Regression               | 2. Predicting a continuous value, like a house price.               |
| c. Dimensionality Reduction | 3. Reducing the amount of data while keeping important information. |
| d. Clustering               | 4. Assigning data points to a specific category.                    |
- (a) 4 2 3 1**   (b) 2 4 3 1   (c) 3 2 1 4   (d) 4 1 3 2   (e) 1 3 4 2

**13)** In a security system using facial recognition, which type of mistake would mean letting in someone who should not be allowed? (a) True Positive. (b) True Negative. **(c) False Positive.** (d) False Negative. (e) All of the above.

**14)** An AI that must manage its time carefully to optimise its performance is best described as operating in a: (a) Partially Observable Environment. (b) Dynamic Environment. (c) Sequential Environment. (d) Known Environment. **(e) Semi-Dynamic Environment.**

**15)** In which environment does an AI agent need to consider a sequence of moves and plan for long-term outcomes? (a) Semi-Dynamic Environment. (b) Dynamic Environment. (c) Partially Observable Environment. **(d) Sequential Environment.**

**16)** In a Partially Observable Environment, an AI agent must: (a) Respond to the actions of other agents. **(b) Make decisions based on incomplete information.** (c) Follow a sequence of actions to achieve a goal. (d) Interact and learn from a new environment over time.

**17)** In a Strategic Environment, AI design involves: (a) Planning a sequence of actions for long-term success. (b) Adapting quickly to new situations. **(c) Anticipating and responding to the actions of others.** (d) Maximizing performance based on time constraints.

**18)** An AI agent that quickly adapts to sudden changes in its surroundings is working in a: **(a) Dynamic Environment.** (b) Stochastic Environment. (c) Semi-Dynamic Environment. (d) Multi-Agent Environment.

**19)** In a Multi-Agent Environment, the AI agent's design includes strategies for: **(a) Cooperation and competition.** (b) Fast adaptation to changing conditions. (c) Predicting outcomes based on probabilistic models. (d) Making decisions with incomplete information.

**20)** In an Unknown Environment, the design of an AI agent can use pre-defined strategies and rules, while in a Known Environment, the design includes learning algorithms that allow the agent to adapt and gather information over time. (a) True. **(e) False.**

Question 1: When designing an intelligent solution for each of the following real-world applications, select from the provided list the most suitable machine learning approach to follow [Classification, Regression, Dimensionality Reduction, Clustering, and Ensemble Learning]. (5 points, 1 each)

- a) Grouping customer purchase histories to identify market segments for personalised product recommendations: \_\_\_\_\_ **Clustering** \_\_\_\_\_.
- b) Sorting news articles into sports, politics, and entertainment categories: \_\_\_\_\_ **Classification** \_\_\_\_\_.
- c) Improving weather forecasting accuracy by combining multiple weather prediction models: \_\_\_\_\_ **Ensemble Learning** \_\_\_\_\_.
- d) Reducing the complexity of customer data while preserving important customer segments for targeted marketing: \_\_\_\_\_ **Dimensionality Reduction** \_\_\_\_\_.
- e) Predicting the price of a house based on its features such as size, location, and number of bedrooms: \_\_\_\_\_ **Regression** \_\_\_\_\_.

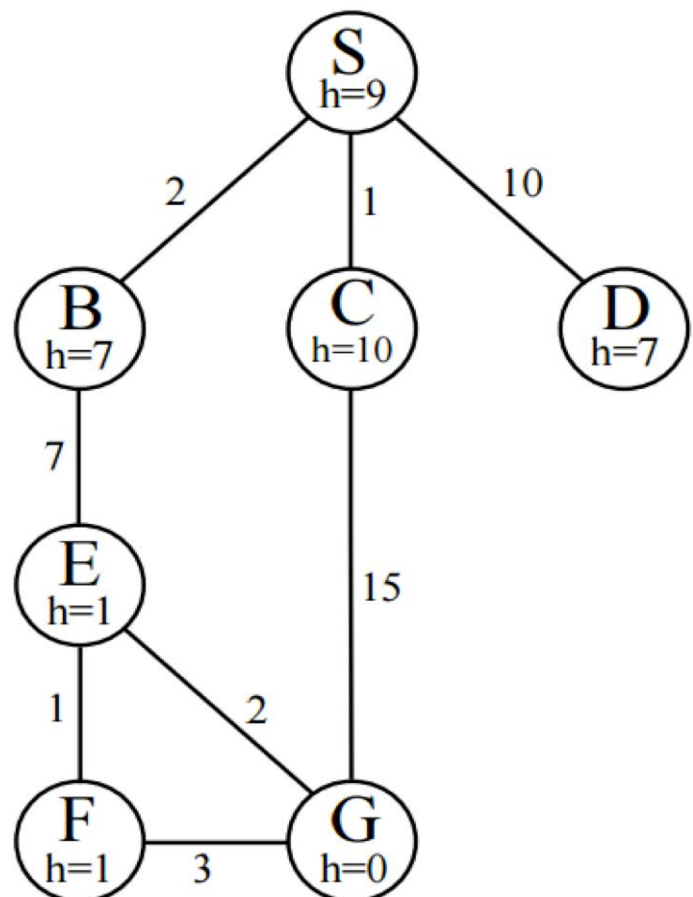
Question 2: Indicate whether True or False and justify your answer. (6 points, 2 each)

- a) It is impossible for an agent to act rationally in a partially observable environment.  
\_ **FALSE.** Rationality implies choosing an action that optimises the expected outcome given what you know, which may only be partial. An agent can act rationally in a partially observable environment using probabilistic models, predictions, or decision-making strategies that maximise performance despite incomplete information. For example, self-driving cars operate in partially observable environments and make rational decisions based on sensors and probabilistic reasoning. \_\_\_\_\_
- b) Iterative deepening search involves re-running breadth-first search repeatedly with increasing depth limits. \_ **FALSE.** It does this with the depth-first search, not the breadth-first search. \_\_\_\_\_
- c) The main advantage of hill-climbing search is space efficiency.  
\_ **TRUE:** hill-climbing stores only the current node on the OPEN list, whereas other search algorithms (e.g., depth-first/breadth-first searches) store all nodes on the current frontier. \_\_\_\_\_

Question 3: To properly implement the Best-First Search (BFS) algorithm and the Uniform-Cost Strategy (UCS) algorithm, state which data structure you would use to store the fringe nodes for each algorithm and briefly justify your answer. (4 points)

\_For Best-First Search (BFS), the ideal data structure for the fringe is a priority queue because the BFS prioritises nodes based on an evaluation function ( $f(n)$ ) that estimates their distance from the goal. A priority queue efficiently stores and retrieves elements based on their priority. In BFS, the lower the  $f(n)$  value (indicating closer to the goal), the higher the priority. Thus, the priority queue ensures that BFS first explores the most promising nodes, leading to a more efficient search. For Uniform-Cost Search (UCS), the ideal data structure for the fringe is a priority queue as well. While UCS doesn't use an evaluation function like BFS, it prioritises nodes based on their path cost ( $g(n)$ ) from the starting state. Like BFS, the UCS priority queue prioritises nodes with lower values. Here, the lower the  $g(n)$  (cumulative cost), the higher the priority for exploration. The priority queue ensures UCS first explores the path with the lowest cumulative cost, finding the optimal solution regarding total cost. Therefore, both BFS and UCS utilise a priority queue to manage the fringe. However, the prioritisation criteria differ: (1) BFS: Lower estimated distance to goal ( $f(n)$ ), and (2) UCS: Lower cumulative path cost ( $g(n)$ )

Question 4: Consider the search graph shown below. S is the start state, and G is the goal state. All edges are bidirectional and are annotated with their cost. A node's heuristic value is shown inside the node (e.g.,  $h=9$ ). Apply the best first search strategy, give the path that would be returned, or write none if no path will be returned. If there are any ties, assume alphabetical tiebreaking (i.e., nodes for states earlier in the alphabet are expanded first in the case of ties). [ S – B – E – G ] (5 points)



Question 1: Choose the right answer: (15 points – Each question is for 0.66)

1. In which of the following situations might a blind search be acceptable? (a) Real-life situations. (b) Complex games. (c) Small search spaces. (d) All of the mentioned.
2. A. M. Turing developed a technique for determining whether a computer could or could not demonstrate an artificial Intelligence, this technique is called: (a) Imitation Game. (b) Algorithm. (c) Boolean Algebra. (d) Propositional & Predicate Calculi.
3. The performance of an intelligent agent can be improved by: (a) Observing. (b) Perceiving. (c) Learning. (d) None of the above.
4. Which search algorithm imposes a fixed depth limit on nodes? (a) Depth-limited search. (b) Depth-first search. (c) Iterative-deepening search. (d) Backtracking search.
5. Customer Segmentation Systems are considered \_\_\_\_\_, while Predicting Students' Letter Grades (as 'A', 'B', etc.) is considered \_\_\_\_\_. (a) Clustering / Regression. (b) Reinforcement Learning / Classification. (c) Clustering / Classification. (d) Reinforcement Learning / Regression. (e) None of the above.
6. Machine learning and data mining often employ the same methods and overlap significantly. However, Machine learning focuses on prediction (*based on known properties learned from the training data*) while Data mining focuses on the discovery of (*previously*) unknown properties in the data. (a) True. (e) False.
7. The \_\_\_\_\_ is a touring problem in which each node must be visited exactly once. The aim is to find the shortest tour. (a) Finding the shortest path between a source and a destination. (b) Travelling Salesman problem. (c) Euler Tour. (d) Depth-first search traversal on a map represented as a graph.
8. In a task's environment, what does PEAS stand for? (a) Peer, Environment, Actuators, Sense. (b) Perceiving, Environment, Actuators, Sensors. (c) Performance, Environment, Actuators, Sensors. (d) None of the above.
9. Goal-driven state-space search arrives at (reaches): (a) Goals starting from facts. (b) Facts starting from goals. (c) Rules starting from facts. (d) Search strategies. (e) Heuristics.
10. Which environment can be defined as semi-dynamic? (a) An Environment the does not change with the passage of time. (b) An Agent's performance changes change with the passage of time. (c) An Environment that will be changed. (d) An Environment does not change with the passage of time, but the Agent's performance changes.
11. If an Intelligent Agent is playing "Chess with a clock", its environment can NOT be described as: (a) Fully observable. (b) Strategic. (c) Static. (d) Sequential. (e) Discrete.
12. Which is used to improve the performance of heuristic search? (a) The quality of nodes. (b) The quality of heuristic function. (c) A Simpler form of nodes. (d) None of the above.

13. General tree search algorithms must detect and eliminate loops from possible solution paths, whereas graph searches may gain efficiency by eliminating this test and its overhead. I.e., that test is not required by graph searches. (a) True. (e) False.
14. A Semantic Network is: (a) A data structure. (b) A way of representing knowledge. (c) A data type. (d) None of the above.
15. Intelligence has been described in this course as: (a) very fast information processing. (b) the firing of neurons. (c) remembering correct answers. (d) storing information. (e) making wise choices about what to do next.
16. A Reflex agent: (a) Considers how the world WOULD BE, not how the world IS. (b) Decides based on (hypothesized) consequences of actions, not on current percept. (c) Must have a model of how the world evolves in response to actions. (d) Do not consider the future consequences of actions. (e) None of the above.
17. Big data, it is often described using five Vs. Veracity refers to: (a) the vast amounts of data generated every second. (b) the speed at which new data is generated and the speed at which data moves around. (c) the different types of data we can now use. (d) the messiness or trustworthiness of the data. (e) that unless we can turn it into value it is useless.
18. What is the term used for describing the judgmental or commonsense part of problem solving (i.e., a rule-of-thumb/experience that guides state-space search)? (a) Critical. (b) Value based. (c) Heuristic. (d) Analytical. (e) None of the above.
19. In a game tree (e.g. chess), vertices are: (a) cities. (b) players. (c) moves. (d) board positions. (e) pieces.
20. The Imitation Game (Turing Test) considers Artificial Intelligence as: (a) Systems that act like humans. (b) Systems that think rationally. (c) Systems that think like humans. (d) Systems that act rationally.
21. John Searle (in the Chinese Room Argument) argues that without "understanding" we can't describe what the machine is doing as "thinking", & since it does not think, it doesn't have a "mind". Thus, he concluded that "Strong AI" is false. (a) True. (e) False.
22. Which of the following cases can be searched using a directed acyclic graph? (a) The Tic-Tac-Toe game. (b) The 8-Puzzle. (c) Chess. (d) a & c. (e) None of the above.
23. Training algorithms are categorized as Supervised & Unsupervised; Unsupervised training requires the pairing of each input vector with a target vector representing the desired output together these are called a training pair. (a) True. (e) False.



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- e) Predicting the price of a house based on its features such as size, location, and number of bedrooms: \_\_\_\_\_ **Regression** \_\_\_\_\_.

Question 2: Indicate whether each of the following statements is True or False. (4 points, 1 each)

In the documentary: "God and Robots - Will AI Transform Religion?" Dr. Beth Singler (an AI Research fellow at the University of Cambridge) said: "I think there is a danger in assuming that AI has super agency; that it is, in fact, making beneficial decisions on our behalf intentionally because it wants to." In light of that, which of the following statements is true?

- (a) AI systems optimise for specific objectives based on training data and algorithms. They don't "want" to make beneficial decisions; they simply execute tasks within the parameters they've been given. \_\_\_\_ **True** \_\_\_\_
- (b) The outputs of AI are inherently limited by the data they are trained on, often reflecting human biases or systemic flaws. Believing these outputs are intentional decisions might mask these limitations. \_\_\_\_ **True** \_\_\_\_
- (c) AI systems, no matter how advanced, operate based on pre-defined algorithms and learned patterns. They lack intentions, consciousness, or desires. \_\_\_\_ **True** \_\_\_\_
- (d) If people perceive AI as having agency, they might absolve developers, operators, or users of accountability for the outcomes of AI-driven decisions. \_\_\_\_ **True** \_\_\_\_

Question 3: Indicate whether True or False and justify your answer. (2 points)

- a) It is impossible for an agent to act rationally in a partially observable environment.

\_\_\_\_ **FALSE**. Rationality implies choosing an action that optimises the expected outcome given what you know, which may only be partial. An agent can act rationally in a partially observable environment using probabilistic models, predictions, or decision-making strategies that maximise performance despite incomplete information. For example, self-driving cars operate in partially observable environments and make rational decisions based on sensors and probabilistic reasoning. \_\_\_\_\_

Question 4: Consider the four main approaches to AI—Acting Humanly, Thinking Humanly, Thinking Rationally, and Acting Rationally. For the following AI application in psychology, identify which approach best describes the system and briefly justify your choice:

(a) A virtual therapist system that engages users in text-based or voice-based conversations responding to their emotional states with empathy, offering therapeutic advice, and helping patients work through personal or psychological issues. (4 points)

Acting Humanly  
A virtual therapist system mimics human interactions by engaging users empathetically and responding to emotional states. It aligns with the "Acting Humanly" approach because the system's goal is to replicate human-like communication and behaviour.

Question 5: Consider the search graph shown below. S is the start state and G is the goal state. All edges are bidirectional and are annotated with their cost. A node's heuristic value is shown inside the node (e.g.,  $h=9$ ). Apply the backtracking search strategy, give the path that would be returned, or write none if no path will be returned. If there are any ties, assume alphabetical tiebreaking (i.e., nodes for states earlier in the alphabet are expanded first in the case of ties). S-B-E-F-G (5 points)

