MSAI3105 Exam Preparation: Questions & Answers

Lecture 1: Introduction to AI

Q: Who proposed the Turing Test?
A: Alan Turing (1950).

Q: What does AI stand for?
A: Artificial Intelligence.

Q: Which of the following is *not* one of the four AI definitions? (a) Thinking humanly (b) Thinking rationally (c) Acting mechanically (d) Acting humanly
A: c) Acting mechanically.

Q: What is the main idea of the Turing Test?
A: If a machine can imitate human responses so well that a human interrogator cannot reliably distinguish it from a person, it is considered intelligent.

Q: The Dartmouth Conference in _____ officially coined the term 'Artificial Intelligence.'
A: 1956.

Q: What are the four main approaches to defining AI?
A: Systems that (1) think like humans, (2) think rationally, (3) act like humans, (4) act rationally.

Q: Cognitive science emerged in which decade?
A: 1960s.

Q: What is a rational agent?
A: An entity that chooses actions expected to maximize its performance measure, given its percept history.

Q: AI can be broadly divided into _____ AI and _____ AI.
A: Narrow AI (Weak AI) and General AI.

Q: Give two examples of risks of AI.
A: Autonomous weapons, biased decision making, surveillance, cybersecurity threats.

Q: Which of the following is considered an early AI milestone? (a) Samuel’s checkers program (b) Kasparov vs. Deep Blue (c) GPT-4 passing a Turing test (d) ImageNet challenge
A: a) Samuel’s checkers program.

Q: What is the 'gorilla problem' analogy in AI risk?
A: Just as humans control gorillas despite evolving together, AI might surpass and control humans.

Q: Aristotle’s *laws of thought* inspired the _____ approach to AI.
A: Rational thinking / logic-based.

Q: List three disciplines that influenced the development of AI.
A: Philosophy, mathematics, neuroscience, psychology, linguistics, economics.

Q: What is the main limitation of the Turing Test?
A: It is not reproducible, constructive, or mathematically rigorous.

Lecture 2: Agents & Problem Solving

Q: What is an agent?
A: Anything that perceives its environment through sensors and acts upon it with actuators.

Q: The agent function maps _____ to actions.
A: Percept histories.

Q: What does PEAS stand for?
A: Performance measure, Environment, Actuators, Sensors.

Q: In the vacuum cleaner world, the agent's actions are _____, _____, _____, and _____.
A: Left, Right, Suck, NoOp.

Q: What is the difference between simple reflex agents and model-based agents?
A: Simple reflex agents act on current percepts only, while model-based agents maintain internal state.

Q: Which of these is a goal-based agent? Automated taxi agent.
A: Yes, because it considers goals.

Q: Define rationality in agents.
A: Choosing actions that maximize expected performance based on percepts and knowledge.

Q: Rational ≠ _____ and Rational ≠ _____.
A: Omniscient; Clairvoyant.

Q: Give an example of an environment property.
A: Observable vs. partially observable, deterministic vs. stochastic, static vs. dynamic, episodic vs. sequential.

Q: What is a utility-based agent?
A: One that chooses actions to maximize an internal utility function.

Q: Example of Internet shopping agent PEAS?
A: Performance: price/quality; Environment: WWW; Actuators: display, form-fill; Sensors: HTML pages.

Q: Which environment type is Solitaire?
A: Observable and Deterministic.

Q: What is the main limitation of BFS in search?
A: High space complexity (O(b^d)).

Q: The Romania problem starts in _____ and ends in _____.
A: Arad → Bucharest.

Q: What is the difference between nodes and states in search?
A: States describe the world; nodes are data structures in the search tree containing state, parent, and path cost.

Lecture 3: Search Strategies & Heuristics

Q: What are the four evaluation criteria for search strategies?
A: Completeness, Optimality, Time complexity, Space complexity.

Q: BFS is complete if?
A: Branching factor is finite and step cost is uniform.

Q: Why is DFS not optimal?
A: It may return a longer path if it encounters a non-optimal solution first.

Q: Time complexity of BFS?
A: O(b^d).

Q: Space complexity of DFS?
A: O(bm).

Q: What problem does UCS solve that BFS cannot?
A: Handles varying edge/path costs.

Q: UCS uses a _____ queue ordered by path cost g(n).
A: Priority queue.

Q: What is a heuristic?
A: An estimate of the cost from the current state to the goal.

Q: Example of admissible heuristic for 8-puzzle?
A: Manhattan distance, misplaced tiles.

Q: Greedy Best-First Search uses evaluation function?
A: h(n).

Q: A* evaluation function f(n) = _____.
A: g(n) + h(n).

Q: Condition for heuristic admissibility?
A: h(n) ≤ true cost from n to goal.

Q: What happens if heuristic is inconsistent?
A: A* may not guarantee optimality.

Q: Manhattan distance heuristic is used for _____.
A: Grid problems like 8-puzzle.

Q: Advantage of A* over Greedy search?
A: A* is both complete and optimal with admissible heuristics.

Lecture 4: Advanced Search & Local Optimization

Q: Two heuristic functions for the 8-puzzle?
A: h1 = misplaced tiles; h2 = Manhattan distance.

Q: What does dominance of heuristics mean?
A: If $h2 \geq h1$ and both admissible, h2 dominates.

Q: Typical nodes expanded by A*(h2) at depth 24 in 8-puzzle?
A: ~1,641 nodes.

Q: What is local search used for?
A: Optimization problems where the goal matters, not the path.

Q: Example of local search problem?
A: N-Queens, TSP.

Q: Hill climbing can get stuck in _____ and _____.
A: Local maxima, plateaus.

Q: How does simulated annealing differ from hill climbing?
A: It accepts worse moves with a probability.

Q: What is the probability function in simulated annealing?
A: $P = e^{(-\Delta E / T)}$.

Q: What is a genetic algorithm inspired by?
A: Biological evolution (selection, crossover, mutation).

Q: Which search is guaranteed complete?
A: Random restart hill climbing.

Q: Example of real-world use of simulated annealing?
A: VLSI layout, airline scheduling.

Q: What is a pattern database heuristic?
A: Precomputed exact costs for subproblems.

Lecture 5: Game Playing

Q: Who first described the minimax algorithm?
A: Ernst Zermelo (1912).

Q: What is a zero-sum game?
A: One player’s gain equals the other’s loss.

Q: Example of stochastic game?
A: Backgammon.

Q: Branching factor in chess?
A: About 35.

Q: What is the minimax value of a node?
A: Utility for MAX assuming optimal play.

Q: Optimality of minimax?
A: Optimal against an optimal opponent.

Q: Alpha-beta pruning reduces search complexity to _____.
A: O(b^(m/2)) with perfect ordering.

Q: What is the horizon effect?
A: Mis-evaluating because key events are beyond cutoff depth.

Q: What is quiescence search?
A: Extend search in unstable positions to avoid horizon effect.

Q: Which program defeated Kasparov in 1997?
A: Deep Blue.

Q: What is an evaluation function?
A: Function estimating utility of a state.

Q: Example feature in chess evaluation?
A: Piece values (pawn=1, queen=9).

Q: What is Expectiminimax used for?
A: Games with chance nodes.

Q: Which AI milestone won checkers (1994)?
A: Chinook.

Q: Why was Go difficult for AI?
A: Branching factor > 300.

Lecture 6: Constraint Satisfaction Problems (CSPs)

Q: Define a CSP.
A: Assign values to variables subject to constraints.

Q: Map coloring requires that _____ regions get different colors.
A: Adjacent.

Q: Two examples of CSPs?
A: Sudoku, N-Queens.

Q: What does backtracking search do?
A: DFS assigning one variable at a time, undoing when constraints fail.

Q: What is forward checking?
A: Eliminates values that would violate constraints with current assignment.

Q: Heuristic choosing variable with fewest values?
A: MRV (Minimum Remaining Values).

Q: What is the least constraining value heuristic?
A: Value that rules out fewest options for other variables.

Q: What is arc consistency?
A: Every value in one variable’s domain must be consistent with some value in another.

Q: CSPs are generally _____ problems.
A: NP-complete.

Q: What is SAT problem?
A: Check if Boolean formula is satisfiable.

Q: Unary, binary, and n-ary constraints?
A: Single variable; pairs; multiple variables.

Q: Example scheduling CSP constraint?
A: Class A before Class B.

Q: Why heuristics make CSP efficient?
A: Reduce branching, detect failures earlier.

Q: What does MCV stand for?
A: Most Constraining Variable.

Q: Which algorithm enforces arc consistency?
A: AC-3.