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| Sl No. | Option | Question | Marks | Blooms | PO |
| 1. | a) | Develop a PEAS description, task environment and their characteristics for the Agent Medical Diagnosis System, Interactive English Tutor. | (8) |  |  |
|  | b) | Draw and Outline a Model–based, utility-based agent program that embodies the principles of all Intelligent systems. | (6) |  |  |
|  | c) | Define Rational Agent and its characteristics .How does a rational agent differ from Omniscient Agent? Give the difference between Performance Measure and Utility function. | (6) |  |  |
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| 2 | a) | Formulate with the necessary components the Toy problem- Vacuum World and draw the state space tree for it. | (8) |  |  |
|  | b) | Propose the idea given by Turing to build learning machines and then to teach them. Draw the general model of the agent he devised and explain all of its conceptual components. | (6) |  |  |
|  | c) | Examine the difference between State Space and a Search tree? Given graph of states ( S- start node and G – goal node)with arrows pointing to successors. Draw State space graph and a search tree. | (6) |  |  |
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| 3 | a) | Write the difference between a Table driven Agent and a Simple reflex Agent. | 8 |  |  |
|  | b) | Distingusih between rationality and Omniscience, information gathering and exploration with a valid example. | 6 |  |  |
|  | c) | List the task properties for the poker and image analysis task environments | 6 |  |  |
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| 4 | a) | Define i) Goal Based Agent ii) Autonomy iii) Agent Program  State and explain any two applications of Al. | 6 |  |  |
|  | b) | Explain with -the help of a neat diagram explain the general architecture of an agent.For the following agents, develop a PEAS description of the task environment. – i) Taxi driver ii) Internet- Book- Shopping agent | 8 |  |  |
|  | c) | Compare depth limited and iterative deepening search strategies. | 6 |  |  |
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| 5 | a) | With the help of suitable block diagrams, explain utility base agents and learning agents. For what types of applications do you prefer the above two models? Justify. | 10 |  |  |
|  | b) | Consider a state space where the start state is number 1, and the successor function for state n returns two states 2n and 2n+1. Draw the portion of the state space for states 1 to 15. Suppose the goal state is .11 list the order in which nodes will be visited for depth limited search with limit 3 and iterative deepening search. | 10 |  |  |
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| 6 | a) | What’s the difference between a world state, a state description, and a search node?  Why is this distinction useful? | 4 |  |  |
|  | b) | For each of the following assertions, say whether it is true or false and support your  answer with examples or counterexamples where appropriate.   1. An agent that senses only partial information about the state cannot be perfectly rational.   **b**. There exist task environments in which no pure reflex agent can behave rationally.  **c**. There exists a task environment in which every agent is rational.  **d**. The input to an agent program is the same as the input to the agent function.  **e**. Every agent function is implementable by some program/machine combination.  **f**. Suppose an agent selects its action uniformly at random from the set of possible actions.  There exists a deterministic task environment in which this agent is rational.  **g**. It is possible for a given agent to be perfectly rational in two distinct task environments.  **h**. Every agent is rational in an unobservable environment.  **i**. A perfectly rational poker-playing agent never loses. | 9 |  |  |
|  | c) | Give a complete problem formulation for each of the following. Choose a formulation  that is precise enough to be implemented.  a. You have three jugs, measuring 12 gallons, 8 gallons, and 3 gallons, and a water faucet.  You can fill the jugs up or empty them out from one to another or onto the ground. You  need to measure out exactly one gallon.  b. You have a program that outputs the message “illegal input record” when fed a certain  file of input records. You know that processing of each record is independent of the  other records. You want to discover what record is illegal. | 7 |  |  |
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| 7 | a) | Write pseudocode agent programs for the goal-based and utility-based agents. | 10 |  |  |
|  | b) | Compare any four uninformed search strategies in terms of the four evaluation criteria. Present the answer in a tabular form and explain its notations. | 10 |  |  |
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| 8 | a) | Perform A\* algorithm on the following graph to find the shortest path from node S to node G. Show the path found by the A\* algorithm on the graph in tabular column with iteration, node expanded, Priority queue at end of this iteration as columns. | 7 |  |  |
|  | b) | Do an LRTA\* agent gurantee to find a goal in any finite (n states), safely explorable environment. Justify your answer with its algorithm and the steps taken in worst case. | 8 |  |  |
|  | c) | Both the performance measure and the utility function measure how well an Agent is doing. Explain the difference between the two and List the properties of task Environments for the wumpus world. | 5 |  |  |
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| 9 | a) | Explain with examples the three ways to represent states and transition between them. | 9 |  |  |
|  | b) | List the five components required for defining the problem of moving from city A to Z and finding solution w.r to the following graph. | 6 |  |  |
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| 10 | a) | |  |  |  | | --- | --- | --- | | B | H | C | | A | F | D | | G |  | E |   Briefly explain the working of A\* algorithm using the example of the 8 puzzle problem. Start\_State : Goal\_State:   |  |  |  | | --- | --- | --- | | A | B | C | | H |  | D | | G | F | E |   Also prove that A\* using TREE-SEARCH is Optimal if h (n) is admissible. | 8 |  |  |
|  | b) | List and explain with suitable examples the properties of task environments | 12 |  |  |
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| 11 | a) | List the different types of Agents and explain in detail the agent that best suits for the following scenario. “The customer leaves the taxi very happy”. Which all factors is taken into consideration for building the model. | 8 |  |  |
|  | b) |  |  |  |  |
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| 12 | a) | Compare any four uninformed search strategies in terms of the four evaluation criteria. Present the answer in a tabular form and explain its notations. | 9 |  |  |
|  | b) | Write the pseudocode for a general graph search and comment on the optimality of graph search algorithm. | 6 |  |  |
|  | c) | Define formally the 8 Queen problem using the five components and suggest the solution for the same. | 5 |  |  |
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| 13) | a) | Justify the need for online search agents.Write the LRTA\* algorithm and commenet on its efficiency. | 10 | L4 | g |
|  | b) | Comment on the environmental characteristics of online search problems and justify with reasons why it is common to describe the performance in terms of entire state space. | 10 | L4 | g |
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| 14 | a) | Explain how LRTA\* enables the agent to escape from local minima in hill climbing in the context of robot navigation. | 10 | L3 | e |
|  | b) | Wtie the algorithm for an online search agent that uses depth first exploration and explain in which state space the agent is applicable. | 10 | L2 | e |
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| 15 | a) | Prove each of the following statements:  **a**. Breadth-first search is a special case of uniform-cost search.  **b**. Depth-first search is a special case of best-first tree search.  **c**. Uniform-cost search is a special case of A∗ search. | 6 | L5 | e |
|  | b) | Construct a search agent for the vacuum world, and evaluate its performance in a set of 3×3 worlds with probability 0.2 of dirt in each square. Include the search cost as well as path cost in the performance measure, using a reasonable exchange rate. | 8 | L6 | d |
|  | c) | n vehicles occupy squares (1, 1) through (n, 1) (i.e., the bottom row) of an n×n grid.The vehicles must be moved to the top row but in reverse order; so the vehicle i that starts in(i, 1) must end up in (n−i+1, n). On each time step, every one of the n vehicles can move one square up, down, left, or right, or stay put; but if a vehicle stays put, one other adjacent vehicle (but not more than one) can hop over it. Two vehicles cannot occupy the same square.  a. Calculate the size of the state space as a function of n.  b. Calculate the branching factor as a function of n. | 6 | L5 | d |
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| 16 | a) | Invent a heuristic function for the 8-puzzle that sometimes overestimates, and show how it can lead to a suboptimal solution on a particular problem.  Prove that if h never overestimates by more than c, A∗ using h returns a  solution whose cost exceeds that of the optimal solution by no more than c. | 6 |  |  |
|  | b) | Prove that if a heuristic is consistent, it must be admissible. Construct an admissible heuristic that is not consistent.s | 5 |  |  |
|  | c) | Consider the unbounded version of the regular 2D grid shown below.    The start state is at the origin, (0,0), and the goal state is at (x, y).  **a**. What is the branching factor b in this state space?  **b**. How many distinct states are there at depth k (for k > 0)?  **c**. What is the maximum number of nodes expanded by breadth-first tree search?  **d**. What is the maximum number of nodes expanded by breadth-first graph search?  **e**. Is h = |u − x| + |v − y| an admissible heuristic for a state at (u, v)? Explain.  **f**. How many nodes are expanded by A∗ graph search using h?  **g**. Does h remain admissible if some links are removed?  **h**. Does h remain admissible if some links are added between nonadjacent states? | 9 |  |  |
| 17 | a) | Show that the 8-puzzle problem states are divided into two disjoint sets, such that any state is reachable from any other state in the same set, while no state is reachable from any state in the other set. Devise a procedure to decide which set a given state is in, and explain why this is useful for generating random states. | 6 |  |  |
|  | b) | Define in your own words the following terms: state, state space, search tree, search node, goal, action, transition model, and branching factor. | 8 | L1 |  |
|  | c) | Which of the following are true and which are false? Explain your answers.  **a**. Depth-first search always expands at least as many nodes as A∗ search with an admissible heuristic.  **b**. h(n) = 0 is an admissible heuristic for the 8-puzzle.  **c**. A∗ is of no use in robotics because percepts, states, and actions are continuous.  **d**. Breadth-first search is complete even if zero step costs are allowed.  **e**. Assume that a rook can move on a chessboard any number of squares in a straight line, vertically or horizontally, but cannot jump over other pieces. Manhattan distance is an admissible heuristic for the problem of moving the rook from square A to square B in the smallest number of moves. | 6 | L5 |  |
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| 18 | a) | Define relaxed problem.Mention the way you generate admissible heuristics from relaxed problems. Take 8 Puzzle problem to justify. | 8 | L4 |  |
|  | b) | For the given 8 puzzle problem, find the heuristic function(h1 & h2) , branching factor and no of steps to reach the goal states. | 6 |  |  |
|  | c) |  | 6) |  |  |
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| 19 | a) | From the given SLD table and route of city Romania, apply RBFS algorithm to reach Bucharest from Arad. Compare the advantages and limitations of it. Present your answer with state space tree. | 10 |  |  |
|  | b) | Using the above diagrm from q.no: 19 a, show the tree search and graph search versions of A\* and prove its optimality. | 10 |  |  |
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| 20 | a) | List and explain the conditions used for optimality. Use the diagram in 19 a) to justify your answer. | 6 |  |  |
|  | b) | Compare the informed Best-first search with greedy best first search . use the figure from Q.19 a to justify your answer to perform the search to reach Bucharest from arad. | 6 |  |  |
|  | c) | Draw a general learning agent and explain its conceptual components with examples | 8 |  |  |