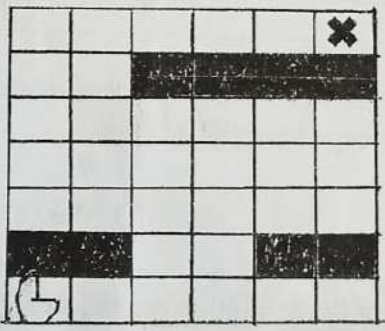
Max. Marks: 60 | Subject Code: AI3001

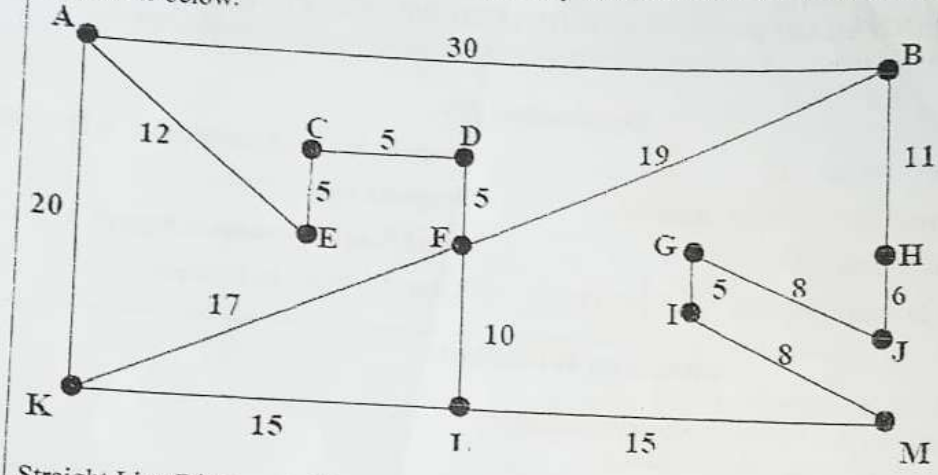
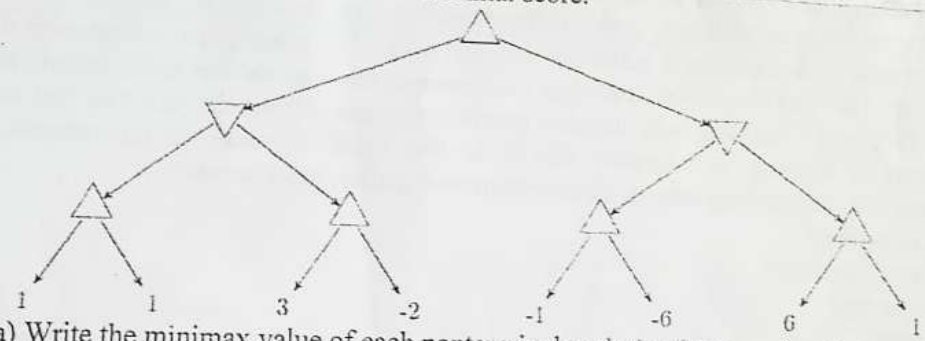
Day & Date: Wed. 22/11/2023 | Total Pages of Question Paper: 3

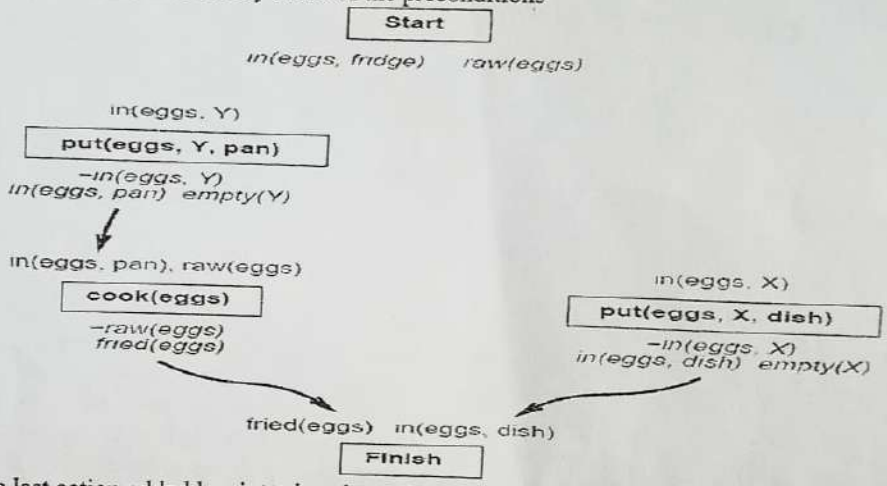
Time: 10.30 am to 12.30pm

Instructions to Candidate

1. All questions are compulsory.
2. Neat diagrams must be drawn wherever necessary.
3. Figures to the right indicate full marks.

Q. No.	CO No	BT* No		Max mark
Q. 1. A.	1,2	2	Consider an email spam filter as an intelligent agent. Every 10 seconds the agent runs a script, 'check.py', that checks the user's inbox and returns unread messages (or nothing). For all unread messages, another script is then run called, 'filter.py', which classifies each unread email as either spam or non-spam and then sends that email to the either the inbox or the spam folder, depending on the classification. Give an example of a sensor, a percept, an effector, and an action for this agent, and then give an example of a function that maps from the agent's percepts to an action. The function should include two possible mappings that map two different percepts to two different actions (i.e. it should be bijective).	4
B.	1,2	2	A student is developing a robot that can roll a die. The robot grips and releases the die with an arm that can also twist, and uses two cameras that can see the entire rolling area at once for feedback. The goal is to develop methods that can roll the die in a way that increases the chance of landing on a desired side of the die. Please consider the environment that is the robot, die, and rolling area. Is this environment (justify your answers!): • Accessible? • Deterministic? • Episodic? • Static? • Discrete?	6
Q. 2. A.	1,2	2	Write out a PEAS description for a grocery store shelf stocking robot. (PEAS = Performance Measure, Environment, Actuators, Sensors). Write reasonably brief descriptions for each of the four items. In addition, you can comment on how your descriptions could vary depending on whether or not there are multiple robots working at the same time and/or if (human) customers are shopping while the stocking is going on.	4
B.	1,2	2	Describe in the terms of complete and optimal with regards to evaluating following search strategies. 1. BFS, 2. DFS, 3. Iterative Deepening, 4. Depth Limited Search Illustrate with example.	6
Q. 3. A.	3	5	Given below the Pacman search problem, please show the order of node expansion for an A* search with Manhattan distance as the heuristic. Assume west, north, east, south order of traversal. Clearly show the open and closed list. 	6

	3	5	OR Use the A* algorithm to work out a route from town A to town M. Use the following cost functions. G(n) = The cost of each move as the distance between each town (shown on map). H(n) = The Straight Line Distance between any town and town M. These distances are given in the table below.  Straight Line Distance to M A 56 | B 22 | C 30 | D 29 E 29 | F 30 | G 14 | H 10 I 8 | J 5 | K 30 | L 15 M 0.00	6
B.	6	1	Two players, MAX and MIN, are playing a game. The game tree is shown below. Upward-Pointing triangles denote decisions by MAX; downward-pointing triangles denote decisions by MIN. Numbers on the terminal nodes show the final score: MAX seeks to maximize the final score, MIN seeks to minimize the final score.  (a) Write the minimax value of each nonterminal node (each upward-pointing or downward-Pointing triangle) next to it. (b) Suppose that the minimax values of the nodes at each level are computed in order, from Left to right. Draw an X through any edge that would be pruned (eliminated from consideration) using alpha-beta pruning. (c) In this game, alpha-beta pruning did not change the minimax value of the start node. Is there any deterministic two-player game tree in which alpha-beta pruning changes the Minimax value of the start node? Why or why not?	1+1+
Q. 4. A.	4	4	Convert following facts into predicate logic. ● Jack owns a dog ● Every dog owner is an animal lover. ● No animal lover kills an animal. ● Either Jack or Curiosity killed the cat, who is named Tuna. Prove that " **Did curiosity kill the cat"** using resolution	6
			OR	
	4	4	Give the proof for the following 1. Prove that "A valid sentence is true in all models (a tautology)" 2. Your knowledge base (KB) is this: B $B \Rightarrow C$ $B \wedge C \Rightarrow A$ Prove, using the resolution refutation algorithm, that A is True	6

B.		4	Prove the validity of the following implications $P \rightarrow (Q \rightarrow R)$ equivalent to $(P \rightarrow Q) \rightarrow (P \rightarrow R)$	4
Q. 5. A.	4	4	How backtracking is done using PROLOG? Explain with example.	4
B.	4	4	Design an expert to system for admission in various disciplines of Engineering. Define at least four rules in PROLOG. Expert system should guide them properly to select a proper discipline.	6
Q. 6.A.	6	6	Suppose we are using a Partial Order Planner (POP) to construct a plan for a meal of fried eggs in a dish. The diagram below shows the state of the plan after the planner has added three new actions to satisfy some of the preconditions  The last action added has introduced two threats into the plan. Identify the threats on the plan and show two different ways to resolve them.	6
B.	6	6	Design the STRIPS operators for the action paint. To paint an object a particular colour, the robot must be holding a paint brush of the right colour. The effect of the action is to change the colour of the object.	4

CO Statements:

1. Understand the basics of the theory and practice of Artificial Intelligence as a discipline and about intelligent agents capable of problem formulation.
2. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
3. Evaluation of different uninformed and informed search algorithms on well formulated problems along with stating valid conclusions that the evaluation supports.
4. Formulate and solve a given problem using Propositional and First Order Logic.
5. Analyze the AI problem using different planning techniques.
6. Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

***Blooms Taxonomy (BT) Level No:**