

Title: Question Paper

FF No. 868

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Bansilal Ramnath Agarwal Charitable Trust's
VISHWAKARMA INSTITUTE OF TECHNOLOGY, PUNE - 411037.
 (An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Examination: ESE

Year: TY-BTech

Branch: Artificial Intelligence & Data Science

Subject: Artificial Intelligence

Subject Code: AI3001

Max. Marks: 60

Total Pages of Question Paper: 3

Day & Date: Wed, 08/12/24

Time: 10:30 am to 12:30 pm

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*		Max mark
Q. 1. A.	1,2	2	<p>In the game tree below it is Max's turn to move. At each leaf node is the estimated score of that resulting position as returned by the heuristic static evaluator.</p> <p>(1) Perform Mini-Max search and label each branch node with its value.</p> <p>(2) Cross out each leaf node that would be pruned by alpha-beta pruning.</p>	4
B.	1,2	2	Analyze the Chess problem & Monkey and Bananas problem with respect to the seven problem characteristics.	6
Q. 2. A.	1,2	2	<p>Give the initial state, goal state, successor function, and cost function for each of the following.</p> <ol style="list-style-type: none"> 1. You have to color a planar map using only four colors, in such a way that no two adjacent regions have the same color. 2. 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. 	4
B.	1,2	2	<p>Execute Tree Search through this graph. (Do not remember visited nodes.) Step costs are given next to each arc. Heuristic values are next to each node (as $h=x$). The successors of each node are indicated by the arrows out of that node. Successors are returned in left-to-right order.</p> <p>For each search strategy, show the order in which nodes are expanded (i.e., to expand a node means that its children are generated), ending with the goal node that is found. Show the path from start to goal or write "None". Give the cost of the path found.</p>	6
1. Hill Climbing Search 2. Depth First Search 3. A* Algorithm				

Q. A.	3	5	The Alloutgame is played on a 5x5 board. Each square can be in two positions, ON or OFF. The initial state is some state, where at least one square is ON. The moves constitute of clicking on a particular square. The effect of the click is toggle the positions of its four neighbouring squares. The task is to bring all squares to OFF position. Pose the above problem as a state space search problem.	6
			OR	
	3	5	Solve following problem using any of the Search technique. "A farmer wishes to cross a river taking his fox, goose, and grain with him. He can use boat which will accommodate only the farmer and one possession. If the fox is left alone with the goose, the goose will be eaten. If the goose is left alone with the grain it will be eaten." Draw state space search tree for this problem."	6
B.	6	1	Consider the problem of constructing crossword puzzles that is fitting words into rectangular grid. The grid, which is given as part of the problem, which specifies which squares are blank and which are shaded. Assume that list of words is provided and the task is to fill in the blank squares using any subset of the list. Formulate this problem. Choose an appropriate search algorithm; specify a heuristic function if needed and Also Explain: Is it better to fill in blanks one letter at a time or one word at a time.	1+2+1
Q. 4. A.	4	4	In this problem, Likes(A, B) means A likes B, and Sister(A, B) means A is a sister of B. Single-argument predicates have their intended meaning; Cat(A) means A is a cat, etc. State with Y (= Yes) or N (= No) depending on whether the following first order logic sentence correctly expresses the English sentence. Justify your answer. "All cats are mammals." $\forall x \text{ Cat}(x) \wedge \text{Mammal}(x)$ ✓ "Spot has a sister who is a cat." $\exists x \text{ Sister}(x, \text{Spot}) \wedge \text{Cat}(x)$ ✓ "Every person has someone that they like." $\forall x \exists y \text{ Likes}(x, y)$ ✓ "There is someone who likes everyone." $\exists x \forall y \text{ Likes}(x, y)$ ✓ "Everyone likes ice cream." $\forall x \text{ Likes}(x, \text{IceCream})$ ✓ "All men are mortal." $\forall x \text{ Man}(x) \Rightarrow \text{Mortal}(x)$ ✓	6
			OR	
	4	4	Prove the following assertions a. $\alpha \models \beta$ if and only if the sentence $(\alpha \rightarrow \beta)$ is valid. b. $\alpha \models \beta$ if and only if the sentence $(\alpha \rightarrow \beta)$ is unsatisfiable.	6
B.		4	Given the following symbols and sentences: • C to indicate that Gianni is a climber; • F to indicate that Gianni is fit; • L to indicate that Gianni is lucky; • E to indicate that Gianni climbs Mount Everest. If Gianni is a climber and he is fit, he climbs mount Everest. If Gianni is not lucky and he is not fit, he does not climb mount Everest. Gianni is fit. Formalize the above sentences in propositional logic.	4
Q. 5. A.	4	4	Describe two challenges of rule based Expert Systems	4
B.	4	4	AutoExpress Limited is an Automobile Selling Company. To improve customer service, the company is planning to reward customers who purchase a vehicle from them with basic vehicle diagnostic ability. The company plans to do this through an expert system. You have been contracted to develop the expert system. Design the expert system to satisfy their needs.	6
Q. 6 A.	6	6	Consider an Air-Cargo transport problem which involves loading and unloading cargo onto and off the planes and flying it from place to place. The problem can be defined with three actions: Load, Unload and Fly. The action affect two predicates In(c,p) means that cargo c is inside plane p, and At(x,a) means that object x (either plane or cargo) is at airport a. Note that cargo is not At anywhere when it is In a plane, so At really means "available for use at a given location". Design the operators required to describe this problem and apply goal stack planning to solve this problem.	6

B.	6	6	<p>Consider the problem of planning the assembly of bookshelves, such that every bookshelf needs 20 screws. The screws are modelled as a consumable resource in a STRIPS-formulation of the problem. There is also a <i>Refill</i> action that supplies screws if they run out. The problem is how to prevent POP from inserting <i>Refill</i> actions when in fact no such action is needed. Which of the following statements is true?</p> <p>(a) There is no need to take special measures, POP will not insert redundant <i>Refill</i> actions.</p> <p>(b) A special precondition has to be incorporated in the <i>Refill</i> action such that a <i>Refill</i> is only needed when there are too few screws.</p> <p>(c) POP cannot solve this problem, one needs a modified version of POP for this.</p> <p>(d) None of the above is true.</p> <p>Justify your answer.</p>	4
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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:

1. Remembering; 2. Understanding; 3. Applying; 4. Analyzing; 5. Evaluating; 6. Creating