MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING
(A Unit of Rajalaxmi Education Trust®, Mangalore)
Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi
Accredited by NAAC with A+ Grade & ISO 9001:2015 Certified Institution

Model Question Paper

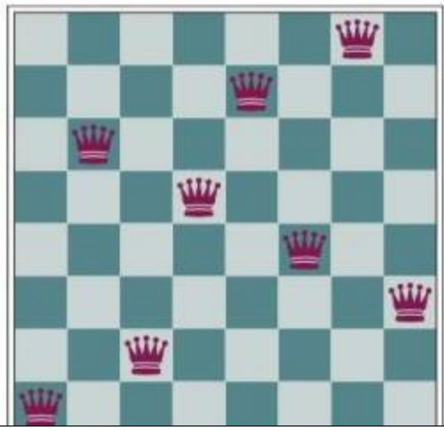
Fourth Semester BE Degree Examination

Introduction to AI and ML for Robotics

Time: 3 Hours **Max. Marks: 100**

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M: Marks, L: RBT (Revised Bloom's Taxonomy) level, C: Course outcomes.

<table>
<tr><th colspan="3">Module -1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td rowspan="2">Q1</td><td>a.</td><td>Explain the difference between breadth-first search and depth-first search. Construct a seven-node binary tree using both methods.</td><td>10</td><td>L3</td><td>CO1</td></tr>
<tr><td>b.</td><td>Using a real-world case study, illustrate how AI enhances the functionality of a robot.</td><td>10</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="2">Q2</td><td>a.</td><td>Construct a binary tree and illustrate depth limiting search strategy. Explain the role of diameter on the efficiency of the search.</td><td>10</td><td>L3</td><td>CO1</td></tr>
<tr><td>b.</td><td>Considering the airline travel problem, illustrate the implementation of problem-solving methodology.</td><td>10</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6">Module- 2</td></tr>
<tr><td rowspan="2">Q3</td><td>a.</td><td>Illustrate four iterations of iterative deepening search using a binary tree with depth varying from 0 to 3.</td><td>10</td><td>L3</td><td>CO2</td></tr>
<tr><td>b.</td><td>The table below shows straight-line distances to Bucharest. Show the progress of greedy best-first search and find a path from Arad to Bucharest.
<table>
<tr><td>Arad</td><td>366</td><td>Mehadia</td><td>241</td></tr>
<tr><td>Bucharest</td><td>0</td><td>Neamt</td><td>234</td></tr>
<tr><td>Craiova</td><td>160</td><td>Oradea</td><td>380</td></tr>
<tr><td>Drobeta</td><td>242</td><td>Pitesti</td><td>100</td></tr>
<tr><td>Eforie</td><td>161</td><td>Rimnicu Vilcea</td><td>193</td></tr>
<tr><td>Fagaras</td><td>176</td><td>Sibiu</td><td>253</td></tr>
<tr><td>Giurgiu</td><td>77</td><td>Timisoara</td><td>329</td></tr>
<tr><td>Hirsova</td><td>151</td><td>Urziceni</td><td>80</td></tr>
<tr><td>Iasi</td><td>226</td><td>Vaslui</td><td>199</td></tr>
<tr><td>Lugoj</td><td>244</td><td>Zerind</td><td>374</td></tr>
</table></td><td>10</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
</table>

Q4	a.	Consider the problem statement: "Place 8 queens shown on the board such that no queen can attack another." Illustrate how hill climb algorithm can be applied to solve the problem statement. 	10	L3	CO2
	b.	Explain how the 8-puzzle problem can be solved using A* algorithm.	10	L3	CO2
Module - 3					
Q5	a.	Write a function newlist that takes one argument and returns it as a list, if the argument is already a list, including the empty list, newlist returns it without change. If the argument is an atom, it returns it as a list.	10	L3	CO3
	c.	Write a LISP function to convert Fahrenheit to centigrade.	10	L3	CO3
OR					
Q6	a.	Write a PROLOG program that answers questions about family members and relationships. Include predicates and rules that define sister, brother, father, mother, grandchild, grandfather, and uncle. The program should be able to answer queries such as the following: father(X, bob). grandson(X, Y). uncle(bill, sue). mother(mary, X).	10	L3	CO3
	b.	Write a LISP function to convert meters per second to kilometers per hour.	10	L3	CO3
Module - 4					
Q7	a.	Implement an inference engine that uses forward chaining to decide the best action for a robotic arm sorting objects based on color and weight. Explain how the engine will process the rules and data.	10	L3	CO4
	b.	Design an expert system for a robotic assembly line that can diagnose and resolve common mechanical failures. How will the system prioritize potential faults and suggest corrective actions?	10	L3	CO4
OR					
Q8	a.	Design a knowledge base for a robotic vacuum cleaner that includes rules for navigating different types of flooring and avoiding obstacles. How would you structure the data and rules to optimize decision-making?	10	L3	CO4
	b.	Create a set of rules for a drone's expert system to determine its path when delivering a package, considering factors like weather, no-fly zones, and battery levels. Demonstrate how these rules are applied in a hypothetical scenario.	10	L3	CO4
Module - 5					
Q9	a.	Apply Q-learning to a robotic path-planning problem where a drone must navigate from a start point to a target while avoiding obstacles. Show the learning process through a sample reward table.	10	L3	CO5
	b.	Develop a CNN-based system for a robot to classify different objects in its	10	L3	CO5

		environment.			
OR					
Q10	a.	Explain how reinforcement learning can be applied to a robotic manipulator.	10	L3	CO5
	b.	Design an RNN model for a humanoid robot to predict and respond to human gestures in a sequence of interactions.	10.	L3	CO5

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