Nirma University

Institute of Technology
Semester End Examination (IR), December - 2022
B. Tech. in Computer Science and Engineering, Semester-VII
2CSDE85 Artificial Intelligence

Roll /
Exam
No.

Supervisor's
initial with
date

Time: 3 Hours

Max. Marks : 100

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Assume suitable data whenever required
4. Draw neat sketches wherever necessary.
5. Use a Section-wise answer sheet.

SECTION-I

Q.1 Answer the following [18]

A.
BL3
COL2
Analyze the Travelling salesman problem with respect to key dimensions before applying heuristic on it. Also, provide counter example of each. Suggest one the heuristic of the Travelling salesman problem. — 8

OR

A.
BL3
CLO4
Apply the Steepest Ascent Hill climbing and Simple Hill Climbing algorithm to the block world problem shown in Fig. 1, which leads to the goal state from the initial state. Which algorithm provides the best result? Does the algorithm/s find ridge or plateau or local minima? Justify your answer. — 8
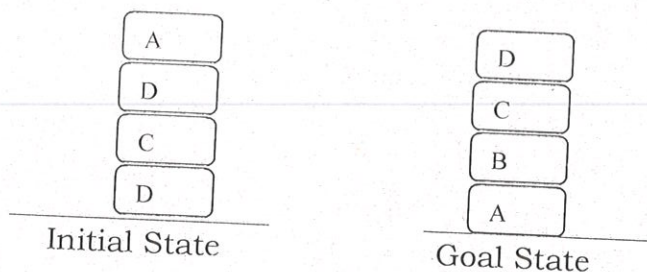

Initial State   Goal State
Fig. 1

B.
BL2
CLO2
Discuss the four categories of production systems and write an example of each. — 6

C.
BL3
CLO2
What is a First-order predicate? Give the difference between predicate logic and propositional logic with an example. — 4

Q.2 **Answer the following**

[14]

A.
BL3
CLO3
Write the production rules for following the water jug problem in a GENERALIZED way. There are three jugs with 7 liters, 4 liters, and 2 liters capacities with no measuring markers. Initially, 7 liters jug is completely full of water. At the end, we want 3 liters of water in 7 liters jug. Water is not allowed to pour out of any jug, on the ground. Provide at least one solution using designed production rules.

10

B.
BL2
CLO1
Discuss Dependency directed backtracking with a suitable example.

4

OR

B.
BL2
CLO1
Discuss the forward vs. backward reasoning with a suitable example.

4

Q.3 **Answer the following.**

[18]

A.
BL3
CLO2
Solve the following cryptarithmetic problem. Show each step with a solution tree.

8

```
    B A N A N A
+     G U A V A
-------------------------
    O R A N G E
```

B.
BL2
CLO3
Consider following Table No 1, which shows an undirected graph having nodes and cost associated with connected edges. Table No. 2 shows heuristic values(h(x)) from a node to reach the goal node.
1. Draw an undirected graph and label it with values given in Table No. 1 and 2.
2. Apply A* algorithm to an undirected graph to find a path from initial node (S) to goal node (G). Show the status of open and close queue after each step as per A* algorithm.

10

Node	S	A	B	C	D	E	F	G
S	0	7	5	9	-	-	-	-
A	7	0	-	-	-	6	-	-
B	5	-	0	-	8	6	-	-
C	9	-	-	0	6	-	-	-
D	-	-	8	6	0	-	5	-
E	-	6	6	-	-	0	5	-
F	-	-	-	-	5	5	0	4
G	-	-	-	-	-	-	4	0

Table No. 1

Node	S	A	B	C	D	E	F	G
h (x)	18	10	12	4	2	4	1	0

Table No. 2

Q.4   **Answer the following**

A.
BL3
CLO2
Write the prolog program to find strings accepted by DFA (as per Figure 2). State 0(zero) is initial state and state 2 (two) is accepted state.   **[20]**   8

Example: if you provide the following predicate.
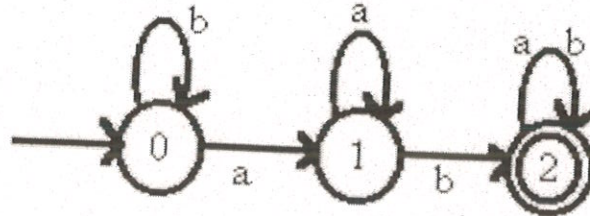check([a,b,a,b]) will result true and check([a,a,a]) will result false.

Figure 2

OR

A.
BL2
CLO2
Discuss the role of Justification based Truth Maintenance System in non-monotonic symbolic reasoning with example.   8

B.
BL4
CLO4
Consider the following axioms(statements):
1. There are exactly three blind mice.
2. All blind mice run.
3. There is only one farmer's wife.
4. All blind mice chase a farmer's wife.
5. All farmer's wives cut the tail off blind mice that chase them.
6. If someone cuts off your tail, you have no tail.
Convert each statement in predicate logic and to CNF. Use resolution procedure to prove or disprove that "All blind mice do not have tails.".   12

Q.5   **Answer the following.**

A.
BL4
CLO3
Apply MinMax search to the Tic-tac-toe game and generate a game tree with a depth of 2 layers. Show the best move (path) a player will consider at a point of time. Write the improvements which can be applied in the MinMax search.   **[14]**   9

B.
BL2
CLO4
Discuss the roles of components of the Expert System. List the limitation of the Expert System.   5

OR

B.
BL2
CLO1
How does Dempster-Shaeffer's theory help to prove the hypothesis in Nonmonotonic reasoning? Give one example.   5

Q.6   **Answer the following**

A.
BL1
CLO1
Consider a Vehicle fault diagnosis system where expert knowledge is embedded as a set of rules and suggests the parts to replace in the Vehicle.   **[16]**   [6]

1. Define certainty factors which are used for such rule-based system.
2. Calculate the certainty factor of several rules relates to single hypothesis.

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B.

BL3
CLO3 A financial institution has built a fraud detection system with the [10]
following case.

When the cardholder travels abroad, a fraudulent transaction is more likely since tourists are prime targets for thieves. More precisely, 2% of transactions are fraudulent when the cardholder travels, whereas only 0.3% of the transactions are fraudulent when he is not traveling. On average, 6% of all transactions happen while card holder is traveling. If a transaction is fraudulent, then the likelihood of a foreign purchase increases unless the cardholder happens to be traveling. More precisely, when the cardholder is not traveling, 11% of the fraudulent transactions are foreign purchases, whereas only 2% of the legitimate transactions are foreign purchases. On the other hand, when the cardholder travels,91% of the transactions are foreign purchases, regardless of the legitimacy of the transactions.

1. Build the Bayesian Network, which describes the above scenario.
2. Suppose The System has detected the foreign purchase. What is the probability of fraud if we don't know whether the cardholder is traveling or not?