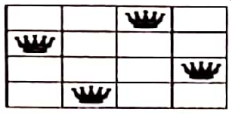
Sardar Vallabhbhai National Institute Of Technology, Surat
Department of Computer Science and Engineering
B.Tech-III (VI Semester)
End Semester Examinations - May 2022
CS308 - Artificial Intelligence

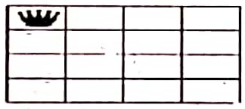
Date: 07/5/2022 Time: 12:00 PM to 3:00 PM Marks: 100

Q.1 Answer the following. (Attempt Any Three) **[36]**

1. The 4-Queens Problem : It is a board game where user need to place four queens on a 4 x 4 chessboard in such a way that "no two queens can capture each other".
   - That is no two queens are allowed to be placed on the same row, the same column or the same diagonal
   - Sample Solution:

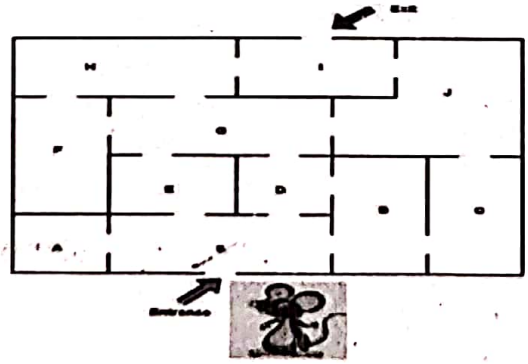


   a) Which type of environment is it?
   b) Design the heuristic to evaluate the State
   c) Design the strategy used to solve the problem
   d) Write Algorithm to solve the problem given initial State



   e) Demonstrate intermediate states resulted after each step of the algorithm

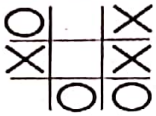
2. With Most Suitable Algorithm and Data structure to Find the Path for the mice to escape the maze. Demonstrate each intermediate state and path from "Entrance" to "Exit"with suitable representation.



3. Design a look-ahead strategy for the famous Tic-Tac-Toe game Where It keeps playing ahead until it reaches a terminal arrangement of the board **(terminal state)** resulting in a

tie, a win, or a loss. Once in a terminal state, the AI will assign an arbitrary positive score (+10) for a win, a negative score (-10) for a loss, or a neutral score (0) for a tie.

Write brief algorithm steps for the same and show the complete state space with required detail to reach the final state for the given current state:



4. a) Describe a state space in which iterative deepening search performs much worse than depth-first search
b) Write an algorithm steps of A* search. In which step of the algorithm, does it differ from BFS search?
c) Demonstrate with suitable example for data structure is used in AO* algorithm. What are the Advantages and Disadvantages of AO* algorithm over A* algorithm?

Q.2 Answer the following. **[19]**

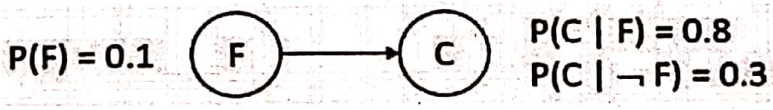
1. Determine formally whether the following arguments are valid or invalid: [3]
Premises:
   - You will get extra credit if you write a paper or if you solve the test problems.
   - You don't write a paper and you don't get extra credit.

   Conclusion: You have not solved the test problems.

2. Three candidates run for an election as a mayor in a city. According To Public opinion poll, their chances to win are 0.25, 0.35 and 0.40. The Chances that they build a bridge after they have been elected are 0.60, 0.90 and 0.80. What is the probability that the bridge will be built after the election? [4]

OR

Consider the following Bayesian network, where F = having flu and C =coughing:

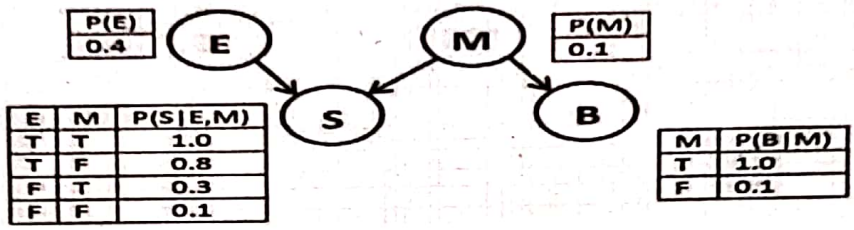


a) Write down the joint probability table specified by the Bayesian network
b) Are C and F independent in the Bayesian network of Part a?

3. Explain Fuzzy set and Find the union, intersection and complement of the given fuzzy sets: [4]
A = {1/2 + 0.5/3 + 0.5/4 + 0.2/5 + 0.4/6} and B = {0.5/1 + 0.6/3 + 0.4/4 + 0.7/5 + 0.3/6}

4. Explain in detail: a) Default Logic b) Inductive Reasoning [4]

8. A smell of sulfur (S) can be caused either by rotten eggs (E) or as a sign of the doom brought by the Mayan Apocalypse (M). The Mayan Apocalypse also causes the oceans to boil (B). The Bayesian network and corresponding conditional probability tables for this situation are shown below. [4]



E	M	P(S|E,M)
T	T	1.0
T	F	0.8
F	T	0.3
F	F	0.1

M	P(B|M)
T	1.0
F	0.1

a) Compute P(¬E,¬S,¬M,¬B)
b) What is the probability that the oceans boil?
c) What is the probability that the Mayan Apocalypse is occurring, given that the oceans are boiling?

Q.3 Answer the following. **[15]**

1. Express the following as semantics net with interconnected nodes and labeled arcs: Narola is a software development company. Three departments within the company are Sales, Administration and Programming. Rahul is a manager of programming. Aryan and Suhana are programmers. Suhana is married to Sam. Sam is editor of PHI. They have three children and they live on Elm street. Suhana wears glasses and is 5.5 feet tall.

2. Consider the following sentences:
1. All students and teachers invited to the party are late.
2. There is at least a person who is on time.
3. There is at least an invited person who is neither a teacher nor a student. Formalize the sentences and prove that 3. is not a logical consequence of 1 and 2.

3. Do the following:
a) Translate the sentence into propositional expressions: You can either stay in the room and watch TV or you can go to the marathon and spend some time there.
b) Design of Intelligent System Using PEAS and based on PEAS descriptions define appropriate task environments for the system.
i) Garbage Picking Robot ii) Online Book Shopping
c) Let P(x, y) be the statement "student x has taken class y:' where the domain for x consists of all students in your class and for y consists of all computer science courses at your school. Express each of these quantifications in English.
i) $\exists x \forall y P(x, y)$ ii) $\forall y \exists x P(x, y)$
d) Determine the following expression is uniable. If yes give a Most General Unifier (MGU): $W = \{Q(f(a), g(x)), Q(y, y)\}$

Q.4 Answer the following. **[30]**

1. For detecting COVID-19 patients based on fuzzy inference engines we have the following information. Use of this information and explain how fuzzy inference systems are able to detect COVID-19 patients (Infected or Normal).
   Four different input fuzzy sets are;
   White Blood Cell (WBC) = {"Low", "Medium", "High"}
   Lymphocyte (LYM) = {"Low", "Medium", "High"},
   Monocytes (MON) = {"Low", "Medium", "High"},
   Locate Dehydrogenase (LDH) = {"Low", "Medium", "High"}.
   Use Triangular membership function and center of gravity method.

$$\mu_{triangle}(x; a, b, c) = \max\left(\min\left(\frac{x-a}{b-a}, \frac{c-x}{c-b}\right), 0\right)$$

2. Consider the following sentences:

Ram likes all kind of food	Apples are food
Chicken is food	Anything anyone eats and is not killed by is a food
Sita eats everything shyam eats	Shyam eats peanuts and is still alive

   a) Translate these sentences into formulas in predicate logic
   b) Prove that ~~john~~ Shyam like peanuts using backward chaining

3. Define Expert system. Explain working of ES with block diagrams. How does the working of MYCIN-an expert system, fits in this block diagram?

4. Consider the following sentences:
   1. Anyone passing his history exams and winning the lottery is happy.
   2. Anyone who studies or is lucky can pass all his exams.
   3. John did not study but he is lucky.
   4. Anyone who is lucky wins the lottery.

   a) Convert the formula into clause form b) Prove that John is happy using resolution.

5. Enlist components of Natural Language Processing (NLP) and explain how all phases are used in Automatic Text Summarization.

OR

a) Perform tokenization: This is a coool # dummy smiley : He had lost < 3.
b) Consider the grammar G given below:

S → NP VP	N → ADJ N	D → the	VT → saw
VP → VT NP	N → boy	D → a	ADJ → young
NP → D N	N → giraffe		

Perform syntactic analysis of the following sentence using top-down and bottom up parsing method: **the young boy saw the giraffe**