SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

QUESTION BANK

IV SEMESTER

AD3461 – ARTIFICIAL INTELLIGENCE - I

Regulation – 2023

Academic Year 2024 – 2025 (EVEN)

Prepared by

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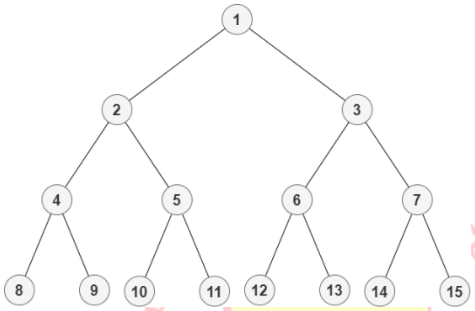
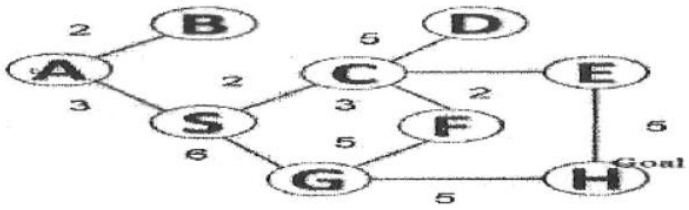
QUESTION BANK

SUBJECT : AD3461 – Artificial Intelligence - I
YEAR/SEM : II Year / IV Semester

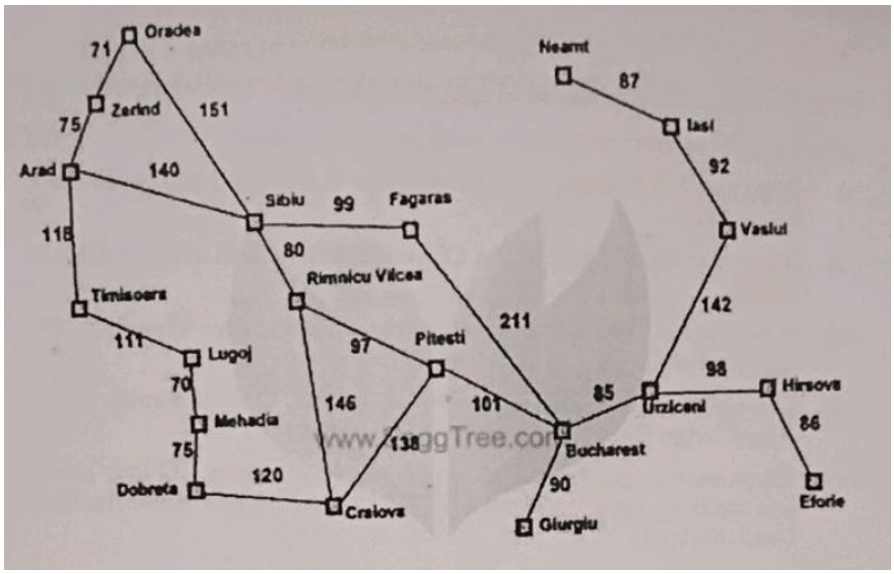
UNIT I INTELLIGENT AGENT			
Introduction to AI – Agents and Environments – Concept of Rationality – Nature of Environments – Structure of Agents – Problem Solving Agents – Search Algorithms – Uninformed Search Strategies.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1	Define an agent.	**BTL1**	**Remember**
2	Define Artificial Intelligence (AI).	**BTL1**	**Remember**
3	What is the role of agent program?	**BTL1**	**Remember**
4	What are the components that define a problem in Artificial Intelligence?	**BTL1**	**Remember**
5	What is an agent function? Differentiate an agent function and an agent program.	**BTL1**	**Remember**
6	What is meant by Turing test?	**BTL1**	**Remember**
7	State the concept of rationality.	**BTL1**	**Remember**
8	Give the structure of agent in an environment.	**BTL1**	**Remember**
9	List some of the uninformed search techniques.	**BTL1**	**Remember**
10	What are the steps involved to solve a problem in AI?	**BTL1**	**Remember**
11	List the properties of task environments.	**BTL1**	**Remember**
12	What is a task environment? How is it specified?	**BTL1**	**Remember**
13	Why problem formulation must follow goal formulation?	**BTL2**	**Understand**
14	List down the characteristics of intelligent agent.	**BTL2**	**Understand**
15	What are the factors that a rational agent should depend on at any given time?	**BTL2**	**Understand**
16	Differentiate between Intelligence and Artificial Intelligence.	**BTL2**	**Understand**
17	Give the general model of a learning agent.	**BTL2**	**Understand**
18	Compare Deterministic vs Stochastic environment.	**BTL2**	**Understand**
19	Give PEAS description for Part picking robot.	**BTL2**	**Understand**
20	Give performance evaluation measure for BFS, DFS, UCs, IDDFS, DLS.	**BTL2**	**Understand**
21	Characterize the environment of an agent playing soccer.	**BTL2**	**Understand**

22	Can an agent that senses only partial information about the state always be perfectly rational?	**BTL2**	**Understand**
23	For each of the environment below determine what type of agent architecture is most appropriate (table lookup, simple reflex, goal-based or utility-based). a) Medical Diagnosis System b) Satellite Image Analysis System c) Part Picking Robot d) Interactive English Tutor	**BTL2**	**Understand**
24	Formulate PEAS for an automated taxi driver.	**BTL2**	**Understand**
	PART-B		
1	Explain the architecture of an intelligent agent. Include a diagram to illustrate the components and their interactions. (16)	**BTL3**	**Apply**
2	Consider a state space given below.  i. If the goal state is numbered '11', list the order in which the states will be visited using (1) breadth first search (2) depth first search (3) depth limited search with a limit 2 (depth of the root is 0) (4) Iterative deepening search. (8) ii. If iterative deepening search is used to traverse the state space, how many times will the state space tree be constructed to reach the goal. (4) iii. If bidirectional search is used to reach the goal state, what would be the branching factor in the forward and backward direction? (4)	**BTL3**	**Apply**
3	Explain the structure of a typical intelligent agent with an example. Discuss how the structure influences the agent's performance. (16)	**BTL3**	**Apply**
4	Perform BFS, DFS, Uniform Cost Search strategies on the following graph and also formulate the algorithm. (16)  	**BTL3**	**Apply**
5	Explain the concept of rationality in AI agents and analyze how it affects their decision-making process in uncertain environments. (16)	**BTL3**	**Apply**

6	Describe the structure of a Goal-Based Agent and explain how it differs from a simple reflex agent. Analyze the implications of these differences in a dynamic environment.	**BTL3**	**Apply**
7	Describe the components necessary to define a problem in AI and discuss how each component contribute to the problem-solving process. (16)	**BTL3**	**Apply**
8	Consider the water jug problem: You are given two jugs, a 4 gallon one and 3-gallon one. Neither has any measuring marker on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallon of water from the 4-gallon jug? Explain the state space representation and apply an optimal sequence of actions to solve it. (16)	**BTL3**	**Apply**
9	Describe the PAES representation for an automated taxi driver, an ATM system, and a medical diagnosis system. Explain each component in the context of the agents. (16)	**BTL4**	**Analyze**
10	What is an Intelligent agent? Define and explain the terms percept, percept sequence, agent function, and agent program using the vacuum cleaner example. (16)	**BTL4**	**Analyze**
11	Define an agent. Explain the four basic agents that embody the principles underlying intelligent systems with examples. (16)	**BTL4**	**Analyze**
12	Explain in detail the uninformed search strategies: Breadth-First Search (BFS), Depth-First Search (DFS), and Uniform Cost Search (UCS). Provide a comparison of their working principles, advantages, and limitations. (16)	**BTL4**	**Analyze**
13	List the basic kinds of intelligent agents and explain any two agents with neat schematic diagram. (16)	**BTL4**	**Analyze**
14	Explain the concept of the Turing Test and analyze its relevance in evaluating AI systems. Discuss it advantages and disadvantages as a measure of intelligence. (16)	**BTL4**	**Analyze**
15	What is an Agent? How does it interact with environment? Explain. (6) What is informed search technique? Explain any one in detail. (10)	**BTL4**	**Analyze**
16	Explain in detail the uninformed search strategies: Depth-First Search (DFS), Iterative Deepening Depth-First Search (IDDFS), and Depth-Limited Search (DLS). Discuss their methodologies, applications, and limitations. (16)	**BTL4**	**Analyze**
17	Explain the differences between Uninformed Search and Informed Search algorithms, and analyse their effectiveness in a specific problem-solving scenario. (16)	**BTL4**	**Analyze**

UNIT II PROBLEM SOLVING			
Informed (Heuristic) Search Strategies – Heuristic Functions – Local search and optimization problems – Local search in continuous space – Search with non-deterministic actions – Search in partially observable environments – Online search agents and unknown environments.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1	Define Greedy BFS.	**BTL1**	**Remember**
2	List the various search strategies.	**BTL1**	**Remember**
3	List the various informed search strategies.	**BTL1**	**Remember**
4	Define A* search.	**BTL1**	**Remember**
5	What is Recursive BFS?	**BTL1**	**Remember**
6	What is local search?	**BTL1**	**Remember**
7	Define Global minimum and Global maximum.	**BTL1**	**Remember**
8	Define annealing.	**BTL1**	**Remember**
9	What is an online search agent?	**BTL1**	**Remember**
10	Give the procedure of IDA* search.	**BTL1**	**Remember**
11	What is heuristic search strategy?	**BTL1**	**Remember**
12	What is the advantage of heuristic function?	**BTL1**	**Remember**
13	Define the effect of heuristic accuracy on performance.	**BTL2**	**Understand**
14	What is the use of online search agent?	**BTL2**	**Understand**
15	Differentiate greedy search and A* search.	**BTL2**	**Understand**
16	Define admissible and dominant heuristics.	**BTL2**	**Understand**
17	What do you mean by local maxima with respect to search technique.	**BTL2**	**Understand**
18	Define Hill climbing search.	**BTL2**	**Understand**
19	Define variants of hill climbing search.	**BTL2**	**Understand**
20	State the reason when hill climbing often gets stuck.	**BTL2**	**Understand**
21	What is the purpose of a contingency plan?	**BTL2**	**Understand**
22	Compare and contrast admissible and consistent heuristics.	**BTL2**	**Understand**
23	What is Heuristic Function?	**BTL2**	**Understand**
24	What are the things that agents know in online search problem?	**BTL2**	**Understand**
PART-B			
1	Explain the working of hill climbing algorithm with suitable example. (16)	**BTL3**	**Apply**
2	Explain various local search algorithm in detail. (16)	**BTL3**	**Apply**
3	Explain various informed or heuristic search technique in detail. (16)	**BTL3**	**Apply**
4	Explain how you would implement a heuristic function for a specific problem, such as the 8-puzzle problem. (16)	**BTL3**	**Apply**
5	Discuss on Online Search Agents that uses depth-first exploration. (16)	**BTL3**	**Apply**
6	Describe how you would use the Best-First Search algorithm to navigate a maze. (16)	**BTL3**	**Apply**

7	Outline A* Algorithm. Trace the algorithm to find the shortest route from Lugoj to Bucharest using the straight-line distance heuristic. Show the sequence of nodes traversed by the algorithm. The straight lines distance is given below. (16)	**BTL3**	**Apply**
8	Consider the following 8-Puzzle problem where we have a start state and a goal state. Our task is to slide the tiles of the current / start state and place it in order followed in the goal state. There can be four moves either left, right, up or down. There can be several ways to convert the current / start state to the goal state, solve the following puzzle. Explain procedure. (16)	**BTL3**	**Apply**
9	Explain in detail about A* algorithm with suitable example. (16)	**BTL4**	**Analyze**
10	Explain in details about variants of A* algorithm. (16)	**BTL4**	**Analyze**



Town	Air Dist.	Town	Air Dist.
Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
Dobreta	242	Pitesti	100
Eforie	161	Rimnicu Vilcea	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Hirsova	151	Urziceni	80
Lasi	226	Vaslui	199
Lugoj	244	Zerind	374

Initial State

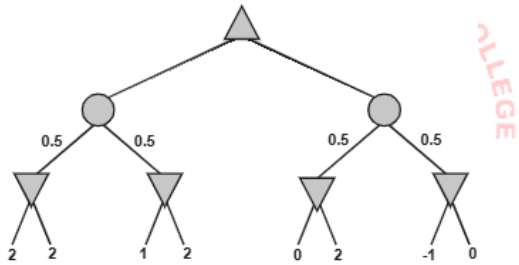
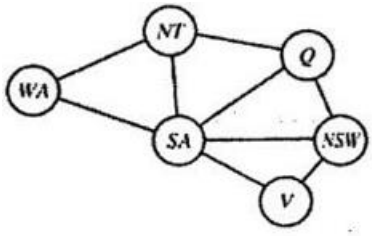
1	2	3
8		4
7	6	5

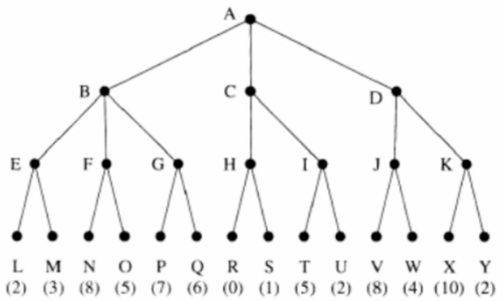
Goal State

2	8	1
	4	3
7	6	5

11	Explain the types of hill climbing techniques. (16)	**BTL4**	**Analyze**
12	Explain the performance of online search algorithm in an unknown environment. (16)	**BTL4**	**Analyze**
13	Discuss Greedy BFS and Recursive BFS with suitable example in detail. (16)	**BTL4**	**Analyze**
14	Discuss how searching is done in non-deterministic and partially observable environment. (16)	**BTL4**	**Analyze**
15	i. What is heuristic search technique in AI? How does heuristics search works? Explain its advantages and disadvantages. (8) ii. Describe the local search algorithm with neat sketch (8)	**BTL4**	**Analyze**
16	i. Explain the steps involved in formulating problems with example. (10) ii. Write a short note on genetic algorithm. (6)	**BTL4**	**Analyze**
17	Elaborate on the need for local search algorithms and discuss any one algorithm in detail. (16)	**BTL4**	**Analyze**

UNIT III GAME PLAYING AND CSP			
Game theory – Optimal decisions in games – Alpha-beta search – Monte-Carlo tree search – stochastic games – Partially observable games – Constraint Satisfaction Problems – Constraint Propagation – Backtracking search for CSP – Local Search for CSP – Structure of CSP.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1	What is a game?	**BTL1**	**Remember**
2	What is Nash equilibrium?	**BTL1**	**Remember**
3	What is a game tree?	**BTL1**	**Remember**
4	What is a ply in game tree?	**BTL1**	**Remember**
5	What is minimax algorithm?	**BTL1**	**Remember**
6	What is alpha beta pruning?	**BTL1**	**Remember**
7	What is constraint satisfaction Problem.	**BTL1**	**Remember**
8	Define forward checking and backtracking in CSP.	**BTL1**	**Remember**
9	Give applications of game theory.	**BTL1**	**Remember**
10	What are stochastic games?	**BTL1**	**Remember**
11	How alpha beta pruning overcome the drawback of minimax algorithm?	**BTL1**	**Remember**
12	List the types of constraints in CSP.	**BTL1**	**Remember**
13	What do you mean by constrain propagation?	**BTL2**	**Understand**
14	How do we represent the structure of problems in CSP.	**BTL2**	**Understand**
15	Define Cycle Cutset.	**BTL2**	**Understand**
16	List the types of assignments in CSP.	**BTL2**	**Understand**
17	What is Tree Decomposition.	**BTL2**	**Understand**

18	Define Conflict directed backjumping	**BTL2**	**Understand**
19	How can minimax also be extended for game of chance.	**BTL2**	**Understand**
20	Define MRV and LCV in CSP. i. Minimum remaining values heuristic chooses the variable with the fewest "legal" values. ii. Least constraining value heuristic prefers the value that rules out the fewest choices for the neighboring variables in the constraint graph.	**BTL2**	**Understand**
21	Justify why we cannot use traditional min max for games with an element of chance, such as backgammon.	**BTL2**	**Understand**
22	Write the components of a game.	**BTL2**	**Understand**
23	Give a precise formulation of the following constraint satisfaction problem in terms of variable, domain and constraints: There are five professors and 10 classrooms, a list of classes to be offered, and a list of possible time slots for each class. Each professor has a set of classes that he or she can teach.	**BTL2**	**Understand**
24	In the game tree given below, △ represents Max node, ▽ represents Min node and o represents chance nodes, Find the utility value of the root node. 	**BTL2**	**Understand**
	PART-B		
1	Describe about Constraint Satisfaction Problem with an algorithm for solving cryptoaritmetic problem. (16)	**BTL3**	**Apply**
2	How minmax procedure can be modified to play multiplayer games in detail. (16)	**BTL3**	**Apply**
3	Consider the map coloring problem with 6 variables and three colors (red, green, blue). The constraint graph for the problem is given below. How does backtracking search solve the given problem? What are the heuristics used to improve the efficiency of the search? How are failures detected early in backtracking? Can Breadth First Search be applied to the above problem? State reasons for your answer. (16) 	**BTL3**	**Apply**

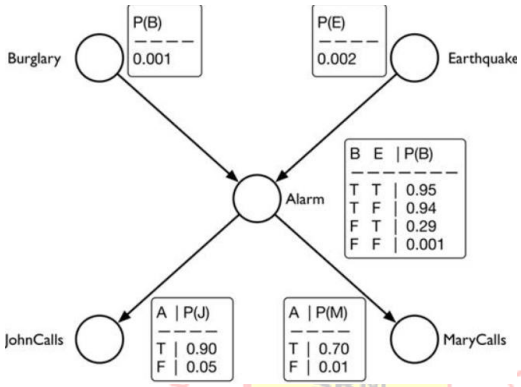
4	Consider the following game tree in which the static scores (in parentheses at the tip nodes) are all from the first players point of view. Assume that the first player is the maximizing player.  Which move should the first player choose? Use minmax algorithm on the game tree and list the nodes which would not be examined using the alpha-beta algorithm assuming that nodes are examined in left-to-right order? Will the same branches be pruned if the nodes are examined in right-to-left order? Is alpha-beta algorithm guaranteed to force a win whenever possible? State reasons. (16)	**BTL3**	**Apply**
5	Explain minmax game playing algorithm in detail with suitable example. (16)	**BTL3**	**Apply**
6	Explain alpha beta pruning in detail with an example. (16)	**BTL3**	**Apply**
7	Explain in detail about constraint propagation. (16)	**BTL3**	**Apply**
8	Discuss about backtracking in constraint satisfaction problem. (16)	**BTL3**	**Apply**
9	What are partially observable games? How are they solved in a deterministic environment? (16)	**BTL4**	**Analyze**
10	Brief on map-coloring problem as CSP and explain with an example. (16)	**BTL4**	**Analyze**
11	Brief on Min-Max algorithm and also discuss the need for alpha-beta pruning. (16)	**BTL4**	**Analyze**
12	Explain the constraint satisfaction problem and the variations on constraint satisfaction problem with example. (16)	**BTL4**	**Analyze**
13	i. Write short notes on Monte-Carlo search. (6) ii. Define local consistency. What are the different types of local consistency? Explain anu two.	**BTL4**	**Analyze**
14	i. How does alpha beta search algorithm differ from Minmax algorithm. Analyze. (6) ii. Explain the concept of game theory and its role in artificial intelligence. Discuss the process of making optimal decisions in games with suitable example. (10)	**BTL4**	**Analyze**
15	Briefly describe the structure of problem in constraint satisfaction problem. (16)	**BTL4**	**Analyze**
16	Explain in detail about local search in constraint satisfaction problem, (16)	**BTL4**	**Analyze**
17	What are stochastic games? Explain their characteristics and strategies for decision-making with examples. (16)	**BTL4**	**Analyze**

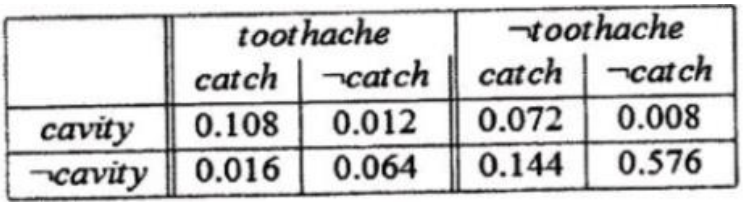
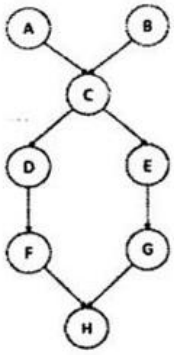
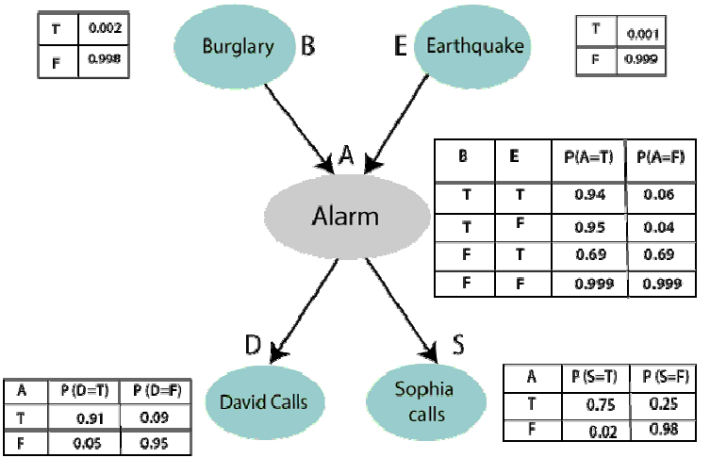
UNIT IV LOGICAL AGENTS			
Knowledge-based agents – Propositional logic – Propositional theorem proving – Propositional model checking – Agents based on propositional logic – First-order logic – Syntax and semantics – Knowledge representation and engineering – Inferences in first-order logic – Forward chaining – Backward chaining – Resolution.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1	What is a Knowledge-Based Agent?	**BTL1**	**Remember**
2	What is Horn clause and Definite Clause?	**BTL1**	**Remember**
3	Name two standard quantifiers.	**BTL1**	**Remember**
4	What are the limitations in using propositional logic to represent a knowledge base?	**BTL1**	**Remember**
5	What is the purpose of unification?	**BTL1**	**Remember**
6	Define meta rules.	**BTL1**	**Remember**
7	Define atomic and complex sentences.	**BTL1**	**Remember**
8	Define first-order definite clause.	**BTL1**	**Remember**
9	State the generalized modus ponens.	**BTL1**	**Remember**
10	What is Skolemisation?	**BTL1**	**Remember**
11	List various inference rules in propositional logic.	**BTL1**	**Remember**
12	List various inference rules in predicate logic.	**BTL1**	**Remember**
13	What is resolution?	**BTL2**	**Understand**
14	Give the grammar to represent propositional logic.	**BTL2**	**Understand**
15	Give the grammar to represent predicate logic.	**BTL2**	**Understand**
16	Distinguish between propositional logic and predicate logic.	**BTL2**	**Understand**
17	Differentiate forward and backward chaining.	**BTL2**	**Understand**
18	Represent the following sentence in predicate form: "All the children like sweets."	**BTL2**	**Understand**
19	Define causal and diagnostic rules with an example.	**BTL2**	**Understand**
20	What factors justify whether reasoning is to be done in forward or backward reasoning?	**BTL2**	**Understand**
21	State the converse and contrapositive of the statement “when I stay up late, it is necessary that I sleep until noon”.	**BTL2**	**Understand**
22	Define the terms belief state and state estimation.	**BTL2**	**Understand**
23	Some people like every vegetable. Convert it to First order logic.	**BTL2**	**Understand**
24	What are the three levels in describing knowledge-based agent?	**BTL2**	**Understand**
PART-B			
1	What is conjunctive normal form? Illustrate and explain the procedure to convert sentences into conjunctive normal form with a neat example. Depict real images where it could be applied. (16)	**BTL3**	**Apply**

2	During a murder investigation, you have gathered some clues. Express them as propositions and solve the following scenario using laws of inference. The clues gathered are given below: • If the knife is in the store room, then we saw it when we cleared the store room. • The murder was committed at the basement or inside the apartment. • If the murder was committed at the basement, then the knife is in the yellow dust bin. • We did not see a knife when we cleared the store room. • If the murder was committed outside the building, then we are unable to find the knife. • If the murder was committed inside the apartment, then the knife is in the store room. Find: "Where is the knife?". (16)	**BTL3**	**Apply**
3	i. Brief on the concept of resolution and explain the propositional resolution algorithm. (7) ii. Prove the following axioms using the resolution algorithm. (9) • All hounds how! At night. • Anyone who has any cats will not have any mice. • Light sleepers do not have anything which howls at night. • John has either a cat or a bound. • (conclusion) If John is a light sleeper, then John does not have any mice.	**BTL3**	**Apply**
4	Give the rules of inference in propositional logic. (9) Which rule of inference is used in each argument below? (7) Alice is a Math major and a CSI major. Therefore, Jerry is a math major. Jerry is a Math major and a CSI major. Therefore, Jerry is a math major. If it is rainy, then the pool will be closed. It is rainy. Therefore, the pool is closed. If it snows today, the university will close. The university is not closed today. Therefore, it did not snow today. If I go swimming, then I will stay in the sun too long. If I stay in the sun too long, then I will sunburn. Therefore, if I go swimming, then I will sunburn.	**BTL3**	**Apply**
5	Describe forward chaining and backward chaining algorithms in detail. Apply both the algorithms to prove that "West is a Criminal." (16)	**BTL3**	**Apply**

6	Express the following statements as predicates: • All people who are not poor and are smart are happy • Those people who read are not stupid. • John can read and is wealthy. • Happy people having exciting lives. Skolemnize the above statements if required and prove the following by resolution: "Can anyone be found with an exciting life?" (Assume ~ stupid ≡ smart, wealthy ≡ ~poor). (16)	**BTL3**	**Apply**
7	Explain unification algorithm used for reasoning under predicate logic with an example. (16)	**BTL3**	**Apply**
8	Explain the steps involved in knowledge engineering process. (16)	**BTL3**	**Apply**
9	What are logical connectives? Explain in detail. (9) Describe an algorithm for general propositional inference based on model checking. (7)	**BTL4**	**Analyze**
10	Discuss the Knowledge Engineering Process with proper illustration. Depict the concept of forward chaining. (16)	**BTL4**	**Analyze**
11	Describe the procedure for converting a sentence into CNF with an example. (16)	**BTL4**	**Analyze**
12	i. Explain standard quantifiers of first-order logic with examples. (9) ii. Give the five logical connectives used to construct complex sentences and give the formal grammar of propositional logic. (7)	**BTL4**	**Analyze**
13	Explain inferencing process in first order predicate logic. Apply both the algorithm to prove that "West is Criminal". (16)	**BTL4**	**Analyze**
14	i. Write the algorithm for deciding entailment in propositional logic. (8) ii. Explain the concepts of resolution in detail. (8)	**BTL4**	**Analyze**
15	i. Explain the completeness of proof of resolution. (8) ii. What are the steps to convert FOL to Normal Form? Explain each step. (8)	**BTL4**	**Analyze**
16	Explain in detail the inference in the First order logic (FOL). (16)	**BTL4**	**Analyze**
17	i. Discuss the propositional theorem proving in detail. (6) ii. Explain the knowledge-based agents in detail with neat sketch. (10)	**BTL4**	**Analyze**

UNIT V KNOWLEDGE REPRESENTATION AND PLANNING			
Ontological engineering – Categories and objects – Events – Mental objects and modal logic – Reasoning systems for categories – Reasoning with default information – Classical planning – Algorithms for classical planning – Heuristics for planning – Hierarchical planning – non-deterministic domains – Time, schedule, and resources – Analysis.			
PART – A			
Q.No	**Questions**	**BT Level**	**Competence**
1	Define Dampster-Shafer theory.	**BTL1**	**Remember**
2	Define Bayes Theorem.	**BTL1**	**Remember**
3	Define Uncertainty.	**BTL1**	**Remember**
4	State Bayes rule.	**BTL1**	**Remember**
5	What is reasoning?	**BTL1**	**Remember**
6	Define prior probability.	**BTL1**	**Remember**
7	State the types of approximation methods.	**BTL1**	**Remember**
8	What is causal networks?	**BTL1**	**Remember**
9	Why does uncertainty arise?	**BTL1**	**Remember**
10	What is Baye's rule? Mention its use.	**BTL1**	**Remember**
11	How are Bayesian networks represented?	**BTL1**	**Remember**
12	What is the purpose of relational probability models?	**BTL1**	**Remember**
13	Justify the purpose of Bayesian networks.	**BTL2**	**Understand**
14	Give the full specification of Bayesian Network.	**BTL2**	**Understand**
15	What do you mean by hybrid Bayesian network?	**BTL2**	**Understand**
16	What is the logic used in reasoning with uncertain information.	**BTL2**	**Understand**
17	State the types of inference in Bayesian network.	**BTL2**	**Understand**
18	Why does probabilistic reasoning necessary in AI?	**BTL2**	**Understand**
19	What is Naïve Bayes algorithm.	**BTL2**	**Understand**
20	What is the relationship between probability distribution and a Bayesian Network?	**BTL2**	**Understand**
21	What is meant by Joint probability and conditional probability.	**BTL2**	**Understand**
22	List the components of a Bayesian Network.	**BTL2**	**Understand**
23	Mention some applications of Bayes' theorem.	**BTL2**	**Understand**
24	What type of graph is used to represent a Bayesian Network?	**BTL2**	**Understand**
PART-B			
1	Define uncertain knowledge, prior probability and conditional probability. State Bayes theorem. How is it useful for decision making under uncertainty. Explain belief network briefly. (16)	**BTL3**	**Apply**
2	i. Explain in detail about Bayesian Inference. (8) ii. Describe the Bayesian network in detail. (8)	**BTL3**	**Apply**
3	Describe the Naïve Bayes algorithm in detail with suitable example. (16)	**BTL3**	**Apply**

<table>
<tr><td>4</td><td>You have a new burglar alarm installed at home. It is fairly reliable at detecting a burglary, but also responds on occasion to minor earthquakes. You also have two neighbors, Joh and Mary, who have promised to call you at work when they hear the alarm. John nearly always calls when he hears the alarm, but sometimes confuses the telephone ringing with the alarm and calls then, too, Mary, on the other hand, likes rather loud music and often misses the alarm altogether. The Bayesian network and the conditional probability table (CPT) for the scenario is given below. In the CPTs, the letters B, E, A, J, and M stand for Burglary, earthquake, Alarm, John Calls and Mary calls, respectively. From the Bayesian network, find P (B/J, M) using variable elimination. (16)
 
</td><td>BTL3</td><td>Apply</td></tr>
<tr><td>5</td><td>Suppose we have a dataset of weather conditions and corresponding target variable "Play". So, using this dataset we need to decide that whether we should play or not on a particular day according to the weather conditions. (16)
<table><tr><th></th><th>Outlook</th><th>Play</th></tr><tr><td>0</td><td>Rainy</td><td>Yes</td></tr><tr><td>1</td><td>Sunny</td><td>Yes</td></tr><tr><td>2</td><td>Overcast</td><td>Yes</td></tr><tr><td>3</td><td>Overcast</td><td>Yes</td></tr><tr><td>4</td><td>Sunny</td><td>No</td></tr><tr><td>5</td><td>Rainy</td><td>Yes</td></tr><tr><td>6</td><td>Sunny</td><td>Yes</td></tr><tr><td>7</td><td>Overcast</td><td>Yes</td></tr><tr><td>8</td><td>Rainy</td><td>No</td></tr><tr><td>9</td><td>Sunny</td><td>No</td></tr><tr><td>10</td><td>Sunny</td><td>Yes</td></tr><tr><td>11</td><td>Rainy</td><td>No</td></tr><tr><td>12</td><td>Overcast</td><td>Yes</td></tr><tr><td>13</td><td>Overcast</td><td>Yes</td></tr></table></td><td>BTL3</td><td>Apply</td></tr>
</table>

6	Describe the action under uncertainty with suitable example in detail. (16)	**BTL3**	**Apply**
7	i. Consider there are 3 Boolean variables toothache, catch and cavity. From the full joint distribution given below, calculate the following: (9)  (1) P (toothache) (2) P (Cavity) (3) P (Toothache | Cavity) (4) P (Cavity | toothache v catch) ii. What is d-separation? Where are two nodes d-separated? From the Bayesian network given below, find whether D and E d-separated given evidence about both A and B? State reasons for your answer. (7) 	**BTL3**	**Apply**
8	i. Calculate the probability that alarm has sounded, but there is neither a burglary, nor an earthquake occurred, and David and Sophia both called the Harry. (10)  ii. Discuss the applications of Bayesian Network in detail. (6)	**BTL3**	**Apply**

	toothache		*¬toothache*	
	catch	*¬catch*	*catch*	*¬catch*
cavity	0.108	0.012	0.072	0.008
¬cavity	0.016	0.064	0.144	0.576

T	0.002
F	0.998

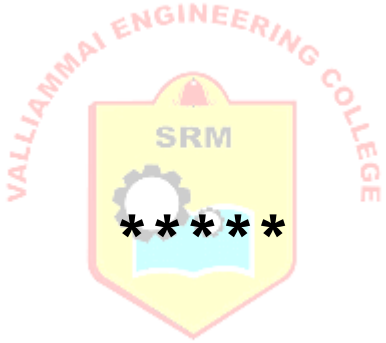
T	0.001
F	0.999

B	E	P(A=T)	P(A=F)
T	T	0.94	0.06
T	F	0.95	0.04
F	T	0.69	0.69
F	F	0.999	0.999

A	P (D=T)	P (D=F)
T	0.91	0.09
F	0.05	0.95

A	P (S=T)	P (S=F)
T	0.75	0.25
F	0.02	0.98

9	What is Bayesian network? Explain the method for constructing Bayesian networks. (16)	**BTL4**	**Analyze**
10	i. What are the ways to understand the semantics of Bayesian Networks? (8) ii. Discuss the exact inference in Bayesian networks. (8)	**BTL4**	**Analyze**
11	How does direct sampling methods help in approximate inference?	**BTL4**	**Analyze**
12	Briefly explain exact inference in Bayesian Networks. (16)	**BTL4**	**Analyze**
13	Design a Bayesian belief network for the diagnosis of car's electrical system. (16)	**BTL4**	**Analyze**
14	What is Bayesian Network? How Bayesian network is used to represent knowledge in uncertain domain. (16)	**BTL4**	**Analyze**
15	Explain the method of performing exact inference in detail. (16)	**BTL4**	**Analyze**
16	Explain the method of performing approximate inference in detail. (16)	**BTL4**	**Analyze**
17.	i. Describe in detail about causal network. (8) ii. How to represent knowledge in an uncertain domain. (8)	**BTL4**	**Analyze**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