[Nov-23]

GITAM (Deemed to be University)

[CSEN2031]

GST/GSS/GSB/GSHS Degree Examination

III SEMESTER

ARTIFICIAL INTELLIGENCE

(Effective for the admitted batch 2021-22)

Time: 2 Hours **Max. Marks: 30**

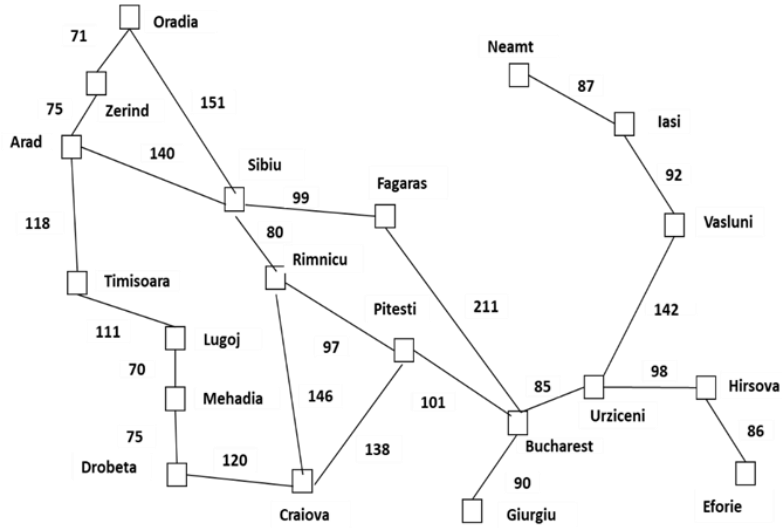
Instructions: All parts of the unit must be answered in one place only.

Section-A

1. Answer all Questions: **(5×1=5)**

a) The Missionary and Cannibals problem is stated below:
Three Missionaries and three cannibals come to a river. There is a boat on their side of the river that can be used by either one or two persons. How should they use this boat to cross the river in such a way that cannibals never outnumber missionaries on either side of the river?
Specify the form of state descriptions with appropriate starting state, and goal state for this problem.

b) What is the solution given by Depth First Search approach using tree search algorithm for finding route from Sibiu to Bucharest, if the order of search is from left to right. Consider the following child nodes' order in the search tree?
Sibiu (Arad, Oradia, Fagarus, Reminciu)
Arad (Zerind, Sibiu, Timisoara)
Zerind (Oradia, Sibiu)
Oradia (Sibiu, Zerind)
Fagarus (Bucharest, Sibiu)
(see the map below)



c) Suppose you have a very simple CSP with the variables A, B, and C, each with domain {1,2,3,4, 5} Suppose the constraints are A > B and B > C.
How many total assignments are tested using a Constraint Network which is domain and arc consistent?

d) Consider a robot that is able to lift a block, if the block is liftable (not too heavy) and if the robot's battery power source is adequate. If both of these conditions are satisfied, then when the robot tries to lift a block it is holding, its arm moves.
Represent the above in Propositional logic.

e) After a patient A's yearly checkup, the doctor has bad news and good news for the patient. The bad news is that A tested positive for a serious disease and that the test is 99% accurate (i.e., the probability of testing positive when A does have the disease is 0.99, as is the probability of testing negative when A doesn't have the disease). The good news is that this is a rare disease, striking only 1 in 10,000 people of A's age. What are the chances that A actually has the disease? Why is it good news that the disease is rare?

Section-B

Answer the following: **(5×5=25)**

UNIT-I

2. In the water jug puzzle, we are given a 3-liter jug, named Three, and a 4-liter jug, named Four. Initially, Three and four are empty. Either

jug can be filled with water from a tap, T, and we can discard water from either jug down a drain, D. Water may be poured from one jug into the other. There is no other measuring device. We want to find a set of operations that will leave precisely two liters of water in Four.

1. set up a state space search formulation of the water jug puzzle:
    a. give the initial atomic state description
    b. give a goal condition on states as some test
    c. name the operators on states and give precise descriptions of what each operator does to a state description.

2. Draw a graph of all of the distinct state-space nodes that are within three moves of the start node, label each node by its state description, and show at least one path to each node in the graph – labelling each arc by the name of the appropriate operator. In addition to these nodes, show all of the nodes and arcs (properly labelled) on a path to the solution.

OR

3. Analyze which type of agent depends on both the past and future actions and explain its structure.

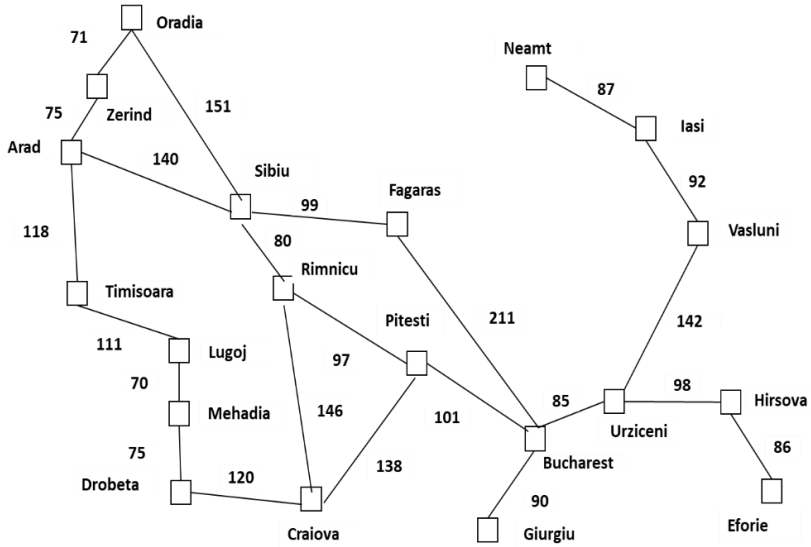
UNIT-II

4. Consider a finite tree of depth d and branching factor b (A tree consisting of only a root node has depth zero; a tree consisting of a root node and its b successors has depth 1; etc). Suppose the shallowest goal node is at depth $g \leq d$

1. What is the minimum and maximum number of nodes that might be generated by a depth first search with a depth bound equal to d?
2. What is the minimum and maximum number of nodes that might be generated by a breadth first search?
3. What is the minimum and maximum number of nodes that might be generated by a depth first iterative deepening search?

OR

5. Find the path using (i). Best First algorithm, (ii) Uniform Cost Search approach from Timisoara to Bucharest. see the map and the data given below. Indicate each step of route search with details. Compare approaches i and ii and give observations.



city	hsld to Bucharest	city	hsld to Bucharest
Arad	366	Mehadia	241
Bucharest	0	Neamt	234
Craiova	160	Oradea	380
Droheta	242	Pitesti	100
Eforie	161	Rimnicu	193
Fagaras	176	Sibiu	253
Giurgiu	77	Timisoara	329
Lasi	226	Urziceni	80
Lugoj	244	Vaslui	199
		Zerind	374

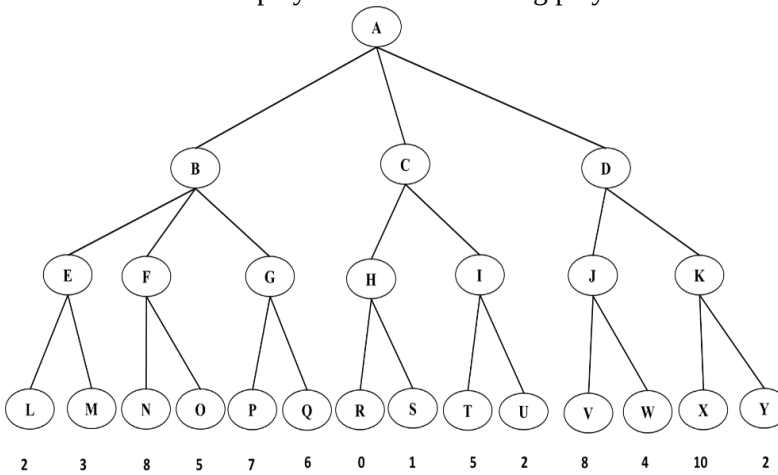
UNIT-III

6. A robot needs to schedule a set of activities for a manufacturing process, involving casting, milling, drilling. The robot has to satisfy various constraints arising from prerequisite requirements and resource use limitations. For each activity there is a variable that represents the time that it starts – A represents the start time for Casting, B represents the start time for Milling and C represents the start time for Drilling. A, B, C can have start times from {1, 2, 3, 4}. The constraints are A<B and B<C

a. How many schedules are required to be tested Using GAT (Generate and Test) approach to find appropriate schedules?
b. Draw a constraint graph for the scheduling problem and make the graph arc consistent. How many schedules are explored now to arrive at appropriate schedules?

OR

7. Consider the following game tree in which static scores (cut-off or terminal node values) are all from the first player's point of view. Assume that the first player is the maximizing player.



a) What move should the first player choose?
b)What nodes would not need to be examined using alpha-beta pruning (assuming that nodes are examined in left-to-right order)?

UNIT-IV

8. Shyam, Sundar and Satyam are elephants. We know the following facts about them:
   a) Shyam is black.
   b) Sundar is gray and likes Satyam.
   c) Satyam is either black or gray (but not both) and likes Shyam.

Use resolution refutation to prove that a gray elephant likes a black elephant; that is, prove $(\exists x,y)[gray(x) \wedge black(y) \wedge Likes(x,y)]$.

OR

9. The law says that it is a crime for an American to sell weapons to hostilenations. The country Nono, an enemy of America, has some missiles, andall of its missiles were sold to it by Colonel West, who is American.

Represent the problem in First Order Logic in the form of definitive clauses and prove that West is a criminal, using forward chaining approach

UNIT-V

10. Consider two medical tests, A and B, for a virus. Test A is 95% effective at recognizing the virus when it is present, but has a 10% false positive rate (indicating that the virus is present, when it is not). Test B is 90% effective at recognizing the virus, but has a 5% false positive rate. The two tests use independent methods of identifying the virus. The virus is carried by 1% of all people. Say that a person is tested for the virus using only one of the tests, and that test comes back positive for carrying the virus. Which test returning positive is more indicative of someone really carrying the virus? Justify your answer mathematically.

OR

11. The following examples are used as training set, for building a decision tree for predicting purchase of computer decision based on the input attributes - age, income, student, credit-rating. The information gain of the attributes is given below. What attribute is choosen as decision tree's root (parent) attribute? Justify your answer.

Information Gain (Age) =0.246,
Information Gain (Income) =0.029
Information Gain (Student) = 0.151,
Information Gain (credit_rating) =0.048

Example	Age	Income	Student	Credit-Rating	Buys-Computer
x1	<=30	High	No	Fair	no
x2	<=30	High	No	Excellent	no
x3	31-40	High	No	Fair	yes
x4	>40	Medium	No	Fair	no
x5	>40	low	Yes	Fair	yes
x6	>40	low	Yes	Excellent	no
x7	31-40	low	Yes	Excellent	yes
x8	<=30	medium	No	Fair	no
x9	<=30	low	Yes	Fair	yes
x10	>40	medium	Yes	Fair	no
x11	<=30	medium	Yes	Excellent	yes
x12	31-40	medium	No	Excellent	yes
x13	31-40	high	Yes	Fair	yes
x14	>40	medium	No	Excellent	no

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