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Internal Assessment Test 1 – Sept. 2019

Sub:	ARTIFICIAL INTELLIGENCE				Sub Code:	17CS562	Branch:	OPEN ELECTIVE (ISE V)
Date:	09/09/2019	Duration:	90 min's	Max Marks: 50	Sem / Sec:	V		OBE

Answer any five full questions
PART -1

		MARKS	CO	RBT
1 (a)	List and explain the problems characteristics which must be analyzed before deciding on a proper heuristic search?	[10]	CO1	L2

Ans Problems characteristics which must be analyzed before deciding on a proper heuristic search are:

1. Is the problem decomposable into a set of independent smaller or easier problems?
2. Can solution step be ignored or at least undone if they prove unwise?
3. Is the problem's universe predictable?
4. Is a good solution the problem obvious without comparison to all other possible solutions?
5. Is the desired solution a state or a path to state?
6. Is a large amount of knowledge absolutely required to solve the problem, or is knowledge important only to constrain the search?
7. Is the solution to the problem require interaction between the computer and a person?

PS: Elaborate on these characteristics.

		MARKS	CO	RBT
2 (a)	Explain the components and categories of production system. List the requirement of good control strategies.	[4+4+2]	CO1	L1

Ans: Production System is the structure of AI programs that facilitates search process.
A production system consists of:

- A set of rules
- One or more knowledge/databases that contain the appropriate information.
- A control strategy
- A rule applier.

Types of production system:

- Monotonic Production system:
- Non-monotonic production system:
- Partially commutative production system
- Commutative production system

Requirement of good control strategy:

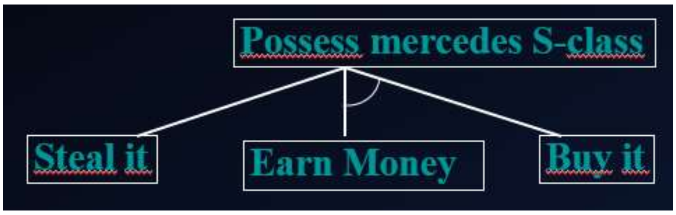
- A good control strategy must cause motion i.e change of states towards goal state.
- A good control strategy must be systematic.

		MARKS	CO	RBT
3 (a)	Explain how AND-OR graphs are used in problem reduction with suitable example.	[10]	CO2	L2

Ans Problem reduction:

- Useful for representing the solution of problems that can be solved by decomposing them into a set of smaller problems, all of which must be then solved.

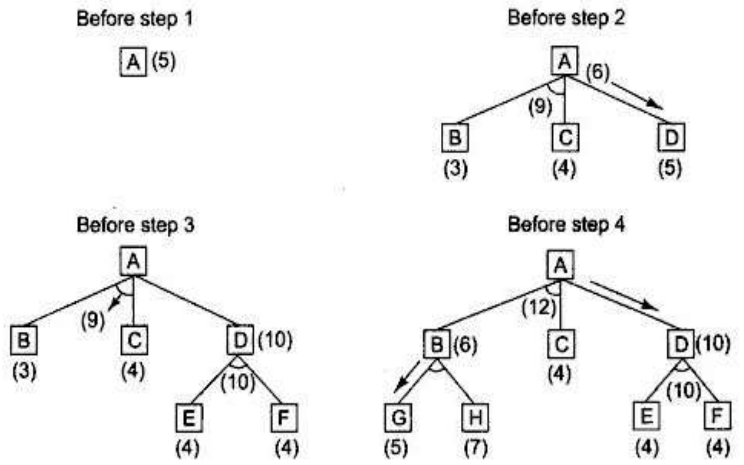
- Some problems are best represented as achieving sub goals, some of which achieved simultaneously and independently (AND)



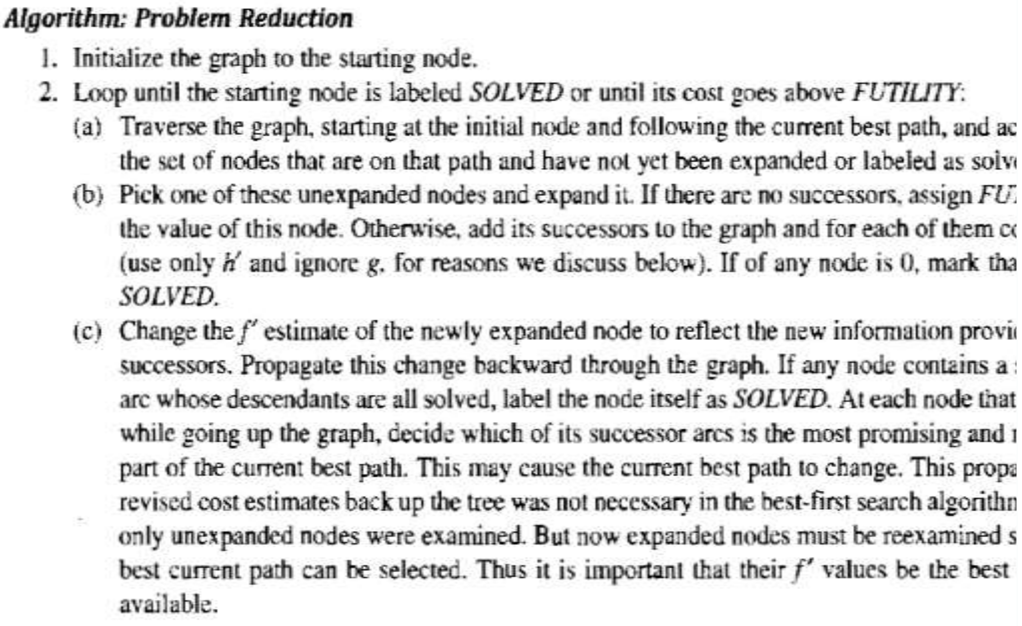
- Algorithm similar to Best First Search but with the ability to handle AND arcs.

- Must examine several nodes simultaneously when choosing the next move.

- The choice of the next node to expand depends not only n f' value of the node but also on whether that node is part of the current best path form the initial mode.



(Optional algorithm)



Algorithm: Problem Reduction

1. Initialize the graph to the starting node.
2. Loop until the starting node is labeled *SOLVED* or until its cost goes above *FUTILITY*:
   (a) Traverse the graph, starting at the initial node and following the current best path, and ac the set of nodes that are on that path and have not yet been expanded or labeled as solv
   (b) Pick one of these unexpanded nodes and expand it. If there are no successors, assign *FU* the value of this node. Otherwise, add its successors to the graph and for each of them co (use only *h'* and ignore *g*, for reasons we discuss below). If of any node is 0, mark tha *SOLVED*.
   (c) Change the *f'* estimate of the newly expanded node to reflect the new information provi successors. Propagate this change backward through the graph. If any node contains a arc whose descendants are all solved, label the node itself as *SOLVED*. At each node that while going up the graph, decide which of its successor arcs is the most promising and part of the current best path. This may cause the current best path to change. This propa revised cost estimates back up the tree was not necessary in the best-first search algorithn only unexpanded nodes were examined. But now expanded nodes must be reexamined s best current path can be selected. Thus it is important that their *f'* values be the best available.

4 (a) Define AI. What are the different levels of modeling in AI? List the task domains of AI. [2+3+5] CO1 L1

Ans AI is the study of technique for solving exponentially hard problems in polynomial time by exploiting knowledge about the problem domain.

AI (artificial intelligence) is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using rules to reach approximate or definite conclusions) and self-correction.

Artificial Intelligence (or AI) is "the study and design of intelligent agents"

Task Domains:

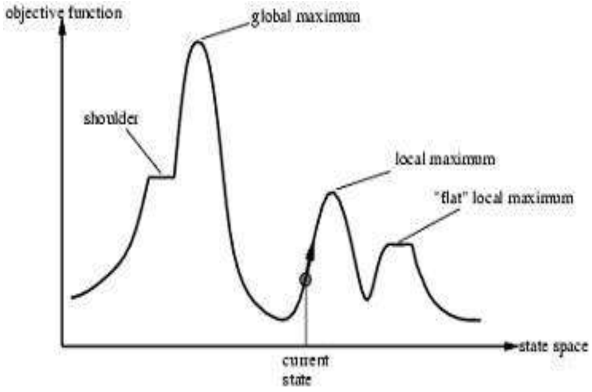
- Perception,
- Natural Language,
- Reasoning,
- Games,
- Mathematics,
- Engineering,
- Scientific Analysis, etc

(PS: Elaborate on few of the above task domains)

5 (a) Write and explain steepest hill climbing search algorithm. Comment on its drawbacks and how to overcome these drawbacks [6+2+2] CO2 L2

Ans Algorithm for Steepest Hill Climbing:

1. Evaluate the initial state. If it is also a goal state, then return it and quit. Otherwise, continue with the initial state as current state.
2. Loop until a solution is found or until a complete iteration produces no changes to current state.
    a. Let SUCC be a state such that any possible successor of the current state will be better than SUCC.
    b. For each operator that applies to the current state do:
        i. Apply the operator and generate a new state.
        ii. Evaluate the new state , If it is a goal state, then return it and quit. If not compare it to SUCC. If it is better , then set SUCC to this state.
        iii. If SUCC is better than current state, set current state to SUCC.



Drawbacks:

1. Local Maximum/minimum
2. Plateau
3. Ridge

Dealing with problems:

a) Back track to some earlier nodes and try a different direction. This is a good way of dealing with local maxim.

b) Make a big jump in some direction to a new area in the search. This can be done by applying two more rules or the same rule several times, before testing. This is a good strategy in dealing with plateaus and ridges.

c) Apply two or more rules before doing the test.

6 Consider trying to solve the following instance of 8-puzzle using **Best-First search**. Apply any heuristic function appropriate to solve the following example and write the search tree. [10] CO2 L3

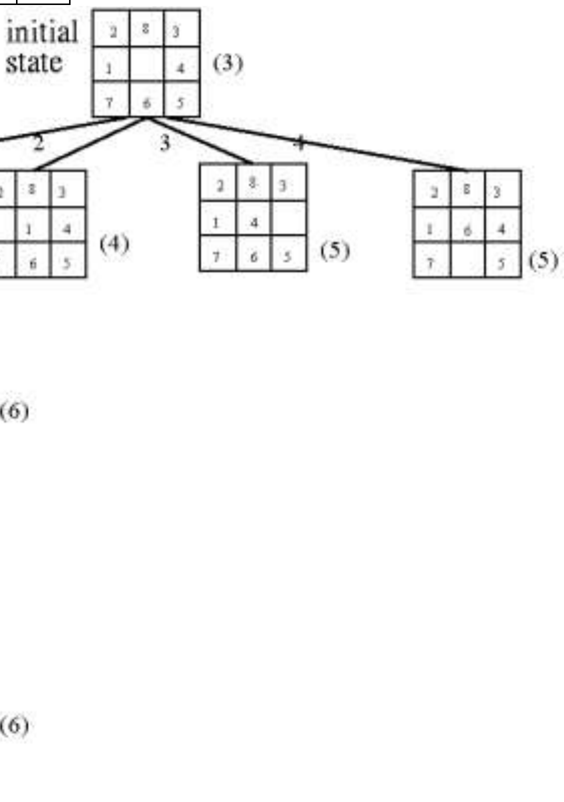
Start State

2	8	3
1		4
7	6	5

Goal State

1	2	3
8		4
7	6	5

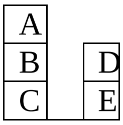
Ans



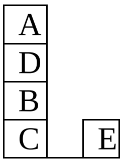
Heuristic : h(n)= depth of node(n)+ misplaced tiles(n)

7 Apply appropriate heuristic to solve the following block word problem using **steepest ascent hill climbing** method, show the steps using search tree. [10] CO2 L3

Start State



Goal State



Ans

8. You are given two jugs, a 5-gallon one and a 3-gallon one, a pump which has unlimited water which you can use to fill the jug, and the ground on which water may be poured. Neither jug has any measuring markings on it. How can you get exactly 4 gallons of water in the 5-gallon jug? Write production rules and give state transitions for any one possible solution for the above problem. [6+4] CO1 L3

Ans

1. (x,y) If x<5	**(5,y)**	**Fill the 5 gallon jug**
2. (x,y) If y<3	**(x,3)**	**Fill the 3 gallon jug**
3. (x,y) If x>0	**(0,y)**	**Empty the 5 gallon jug on the ground**
4. (x,y) If y>0	**(x,0)**	**Empty the 3 gallon jug on the ground**
5.(x,y) **If x+y>=5 and y>0**	**(5,y-(5-x))**	**Pour water from 3-gallon jug in to the 5 gallon jug until the 5 gallon jug is full**
6 .(x,y) **If x+y>=3 and x>0**	**(x-(3-y),3)**	**Pour water from 5-gallon jug in to the 3 gallon jug until the 3 gallon jug is full**
7. (x,y) **If x+y<=3 and x>0**	**(0,x+y)**	**Pour all water from 5-gallon jug in to the 3 gallon jug**
8. (x,y) **If x+y<=5 and y>0**	**(x+y,0)**	**Pour all water from 3-gallon jug in to the 5 gallon jug**

9. (x,y) If x>0	(x-d,y)	Pour some water out of 5 gallon jug
10. (x,y) If y>0	(x,y-d)	Pour some water out of 4 gallon jug

5-Gallon jug	3-Gallon jug	Rule Applied
0	0	1
5	0	6
2	3	4
2	0	7
0	2	1
5	2	7
4	3	Final state