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DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Internal Assessment Test 1 – Sept. 2017
ARTIFICIAL INTELLIGENCE (10CS562) Scheme and Solution by Prasad B S

	Answer any three from Part-I and any one from part-II PART -1	MARKS	CO	RBT
1 (a)	Define AI and discuss on its various task domains.	[07]	CO1	L2
Soln:	Any one definition of AI: The study of technique for solving exponentially hard problems in polynomial time by exploiting knowledge about the problem domain.	2		
	Task Domains: Perception, Natural Language, Reasoning, Games, Mathematics, Engineering, Scientific Analysis, etc elaborate on few of the above	5		
(b)	Explain the different levels of modeling in AI.	[05]	CO1	L2
Soln:	Three levels of modelling with explanation: • Is it to produce programs that do intelligent things that people do? • To produce programs that do the task the same way the people do? • To produce programs that simply do the task in whatever way appears easiest?	5		
2 (a)	What are Physical symbol systems? State the physical symbol system hypothesis and write a note on arguments in favor of and against the hypothesis with suitable example.	[1+2+4]	CO1	L2
Soln:	**Physical symbol system:** A physical symbol system takes physical patterns (symbols), combining them into structures (expressions) and manipulating them (using processes) to produce new expressions.	1		
	Hypothesis: A physical symbol system has the necessary and sufficient means for general intelligent action.	2		
	One argument in favor and against the hypothesis.	4		
(b)	What are production systems? List and explain different classes of production system.	[1+4]	CO1	
Soln:	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.	1		
	Types of production system: • Monotonic Production system: • Non-monotonic production system: • Partially commutative production system Commutative production system example for each	4		

3 Describe the importance of defining the problem as a state space and search. Demonstrate the same with respect to water jug problem. [4+8] CO1 L2

Soln: Importance of state space and search: 4

1. Define a state space that contains all the possible configurations of the relevant objects.
2. Specify initial state.
3. Specify goal state.
4. Specify set of rules that describe action available.

Water jug problem state, space and set of rules . 8

4 List and explain the problems characteristics which must be analyzed before deciding on a proper heuristic search?. [12] CO2 L2

Soln: 6x2=12

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?

Explain each with proper example.

5 (a) Explain steepest hill climbing search technique with an algorithm. Comment on its drawbacks and how to overcome these drawbacks. [6] CO2 L2

Soln: Algorithm for Steepest Hill Climbing: 4

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.

2

Drawbacks:

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

Methods to overcome these drawbacks.

(b) Give an algorithm for simulated annealing search technique. [6] CO2 L2

Soln: 6

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. Initialize BEST-SO-FAR to the current state.
3. Initialize T according to the annealing schedule.

4. Loop until a solution is found or until there are no new operations left to be applied in the current state.
    a. Select an operator that has not yet been applied to the current state. Apply it to produce a new state.
    b. Evaluate the new state: compute
        ΔE= value of current – value of new state.
        1. If the new state is a goal state , then return and quit.
        2. If it is not a goal state, but better than the current state, then make it the current state.Set it as BEST_SO_FAR.
        3. If it is not better than the current state, then make it the current state with probability P' . A random number in the range [0.1] is produced by a random number generator and move accepted if
        $p' = e^{-\Delta E/T} > random[0,1]$
    a. Revise T as necessary according to the annealing schedule.

Return BEST_SO_FAR as the answer

PART-II

			CO	RBT
6	Analyze any one of the following problem with respect to the seven problem characteristics. a. 8-Puzzle b. Travelling Salesman Problem c. Blocks world	[14]	CO2	L4
Soln:	Each problem must be analyzed with respect to the problem characteristics listed.	7*2=14		
7	Consider trying to solve the 8-puzzle using hill climbing. Apply any heuristic function appropriate to solve the following example and write the search tree.	[14]	CO3	L3

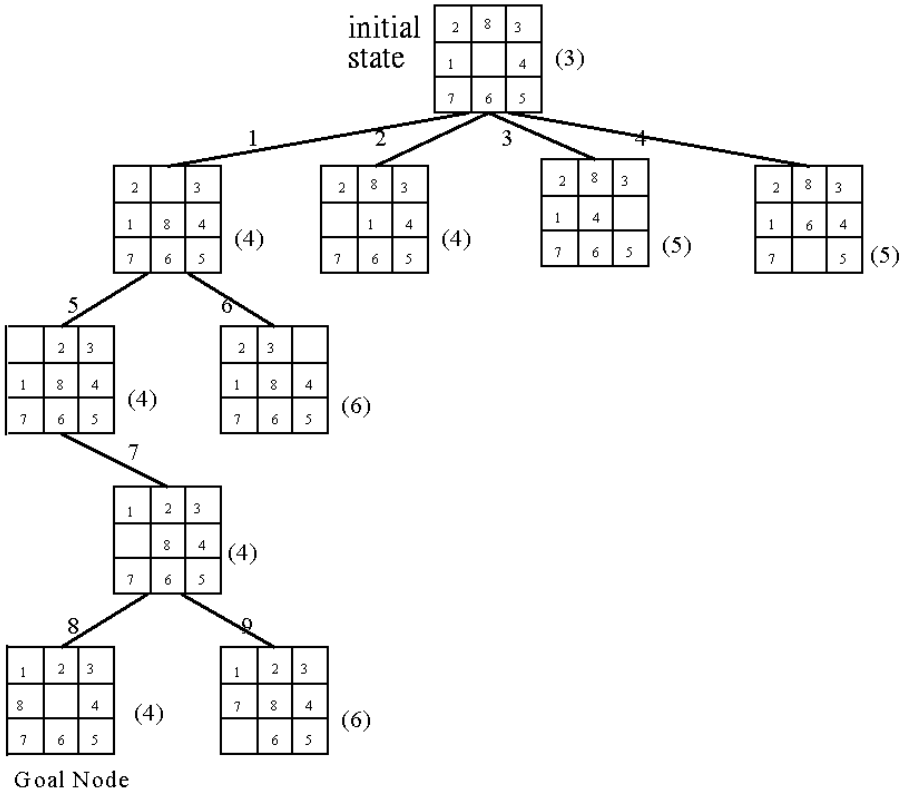
Start State

2	8	3
1		4
7	6	5

Goal State

1	2	3
8		4
7	6	5

Soln:



14

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? [14] CO3 L2,L3

Write State space search representation for the above water jug problem and give state transitions for any one possible solution.

Soln:
State: (x,y) x: Amount of water in Jug 1y: Amount of water in Jug 2 — 2
Space: 0<=x<=5 0<=y<=3 — 2
Search: Rules allowed based on filling of jug and pouring water on to the ground or to the other jug. — 4

Soln: Any one way of applying rules which takes initial state (0,0) to Goal state(4,n). — 6