CMRIT
CELEBRATING 25 YEARS
* CMR INSTITUTE OF TECHNOLOGY, BENGALURU.
ACCREDITED WITH A+ GRADE BY NAAC

Internal Assessment Test 1 – Nov 2021

Sub:	Introduction to Artificial Intelligence					Sub Code:	18CS753	Branch:	ECE/EEE/ME/CIV	
Date:	13/11/21	Duration:	90 mins	Max Marks:	50	Sem/Sec:		VII		OBE

	Answer any FIVE FULL Questions	MARKS	CO	RBT
1.	What is Artificial Intelligence? Discuss the task domains of AI.	[10]	CO1	L2
2.	Explain the requirements of a good control strategy.	[10]	CO1	L2
3	The water jug problem is defined as follows: You are given two jugs, a 4 litre one and a 2 liter one. Neither have any measuring marks on it. Assume that there is an infinite supply of water to fill the jugs. There is also a facility to drain the entire water in the jugs as well. How can you get exactly 2 litre of water in a 4-liter jug? Express the problem as a state space representation, provide a set of production rules and any one solution to the problem	[10]	CO2	L3
4 (a)	Explain the Depth First Search with example	[05]	CO2	L2
(b)	Compare the advantages Depth First Search and Breadth First Search	[05]	C02	L2
5	What are the characteristics of the problem with respect to Heuristic search?	[10]	CO2	L2
6 (a)	What is Heuristic search? How can it be applied to Travelling salesman problem	[05]	CO2	L2
(b)	Write a note on Heuristic functions	[05]	CO2	L2

Scheme & Solution

What is Artificial Intelligence? Discuss the task domains of AI. [Def: 2M + Domains of AI =8 m]

Artificial Intelligence: Artificial intelligence is the study of how make computers to do things which people do better at the moment. It refers to the intelligence controlled by a computer machine.

Some of the task domains of AI are:
- Mundane Tasks
  - Perception
    - Vision
    - Speech
  - Naltural language processing (NLP)
  - Common sense reasoning
  - Robot control
- Formal Tasks
  - Games: Chess, Checkers
- Proving properties of programs
  - Expert Tasks
  - Engineering: Design, Fault finding, planning
  - Scientific Analysis
  - Medical Diagnosis
- Financial Analysis

2. Explain the requirements of a good control strategy. Explaining 2 requirement: 2*5=10M
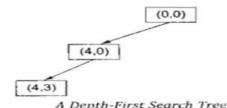
Requirements of a good search strategy:
 1. It causes motion. It must reduce the difference between current state and goal state. Otherwise, it will never lead to a solution.
 2. It is systematic. Otherwise, it may use more steps than necessary.
3. It is efficient. Find a good, but not necessarily the best, answer

3. Listing the Production rules: **6M One solution to Water Jug Problem : 4m**

Production Rules:

#	Rule		Result	Description
1	(x, y) if $x < 4$	$\rightarrow$	$(4, y)$	Fill the 4-gallon jug
2	(x, y) if $y < 3$	$\rightarrow$	$(x, 3)$	Fill the 3-gallon jug
3	(x, y) if $x > 0$	$\rightarrow$	$(x - d, y)$	Pour some water out of the 4-gallon jug
4	(x, y) if $y > 0$	$\rightarrow$	$(x, y - d)$	Pour some water out of the 3-gallon jug
5	(x, y) if $x > 0$	$\rightarrow$	$(0, y)$	Empty the 4-gallon jug on the ground
6	(x, y) if $y > 0$	$\rightarrow$	$(x, 0)$	Empty the 3-gallon jug on the ground
7	(x, y) if $x + y \geq 4$ and $y > 0$	$\rightarrow$	$(4, y - (4 - x))$	Pour water from the 3-gallon jug into the 4-gallon jug until the 4-gallon jug is full
8	(x, y) if $x + y \geq 3$ and $x > 0$	$\rightarrow$	$(x - (3 - y), 3)$	Pour water from the 4-gallon jug into the 3-gallon jug until the 3-gallon jug is full
9	(x, y) if $x + y \leq 4$ and $y > 0$	$\rightarrow$	$(x + y, 0)$	Pour all the water from the 3-gallon jug into the 4-gallon jug
10	(x, y) if $x + y \leq 3$ and $x > 0$	$\rightarrow$	$(0, x + y)$	Pour all the water from the 4-gallon jug into the 3-gallon jug

Gallons in the 4-Gallon Jug	Gallons in the 3-Gallon Jug	Rule Applied
0	0	
		2
0	3	
		9
3	0	
		2
3	3	
		7
4	2	
		5 or 12
0	2	
		9 or 11
2	0	

One Solution to the Water Jug Problem

4a. Algorithm: dfs **(5m)**
 1) If the initial state is the goal state, quit return success
2) Otherwise, do the following until success or failure is signaled
a. Generate a successor E of the initial state, if there are no more successors, signal failure
b. Call Depth-First Search with E as the initial state
 c. If success is returned, signal success. Otherwise continue in this loop.

A Depth-First Search Tree

4b. Advantages of Breadth-First Search •**(5m)**
 BFS will not get trapped exploring a blind alley. – In case of DFS, it may follow a single path for a very long time until it has no successor.
• If there is a solution for particular problem, the BFS is generated to find it.
can find minimal path if there are multiple solutions for the problem.

Advantages of Depth –First Search
 • DFS requires less memory since only the nodes on the current path are stored.
 • Sometimes we may find the solution without examining much.

5. **Listing the Issues = 4m Explaining any 2:6=2*3**
    In order to choose the most appropriate method (or a combination of methods) for a particular
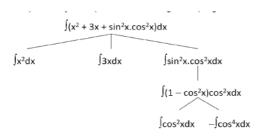   problem, it is necessary to analyze the problem
    Is the problem decomposable?
 • Can solution steps be ignored or undone?
 • Is the universe predictable?
 • Is a good solution absolute or relative?
 • Is the solution a state or a path?
What is the role of knowledge?
• Does the task require human-interaction?
• Problem Classification

Decomposable problem can be solved easily. Suppose we want to solve the problem of computing the expression. We can solve this problem by breaking it down into these smaller problems, each of which we can then solve by using a small collection of specific rules the following figure shows problem tree that as it can be exploited by a simple recursive integration program that works as follows.

Can solution steps be ignored or undone?
Suppose we are trying to prove a mathematical theorem. We proceed by first proving a lemma that we think will be useful. A lemma that has been proved can be ignored for next steps as eventually we realize the lemma is no help at all.

Is the universe predictable?
 There are certain outcomes every time we make a move we will know what exactly happen. This means it is possible to plan entire sequence of moves and be confident that we know what the resulting state will be.

Is the solution a state or a path?
Consider the problem of finding a consistent interpretation for the sentence The bank president ate a dish of pasta salad with the fork There are several components of this sentence, each of which may have more than one interpretation. Some of the sources of ambiguity in this sentence are the following: The word "Bank" may refer either to a financed institution or to a side of river. But only¬ one of these may have a President. The word "dish" is the object of the word "eat". It is possible that a dish was eaten.¬ But it is more likely that the pasta salad in the dish was eaten.¬ Because of the interaction among the interpretations of the constituents of the sentence some search may be required to find a complete interpreter for the sentence. But to solve the problem of finding the interpretation we need to produce only the interpretation itself. No record of the processing by which the interpretation was found is necessary.

6a. **Heuristic search=2 m Travelling salesman problem using heuristics=3m**
Heuristic:
– It is a "rule of thumb" used to help guide search
– It is a technique that improves the efficiency of search process, possibly by sacrificing claims of completeness.
– It is involving or serving as an aid to learning, discovery, or problem-solving by experimental and especially trial-and-error methods.

We can find the TSM problem in less exponential items. On the average Heuristic improve the quality of the paths that are explored. Following procedure is to solve TRS problem
– Select a Arbitrary City as a starting city
– To select the next city, look at all cities not yet visited, and select one closest to the current city
 – Repeat steps until all cities have been visited

6b.
. Heuristic Function:
– It is a function applied to a state in a search space to indicate a likelihood of success if that state is selected
– It is a function that maps from problem state descriptions to measures of desirability usually represented by numbers
– Heuristic function is problem specific. The purpose of heuristic function is to guide the search process in the most profitable direction by suggesting which path to follow first when more than one is available (best promising way).