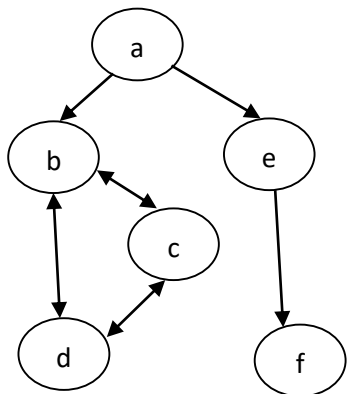


**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)**School of Computer Science and Engineering****Winter Semester 2023-24****Continuous Assessment Test – I****SLOT: B2+TB2****Programme Name & Branch: B.Tech & SCOPE****Course Name & Code: Artificial Intelligence & BCSE306L****Class Number (s): Common to all batches****Faculty Name (s): All****Exam Duration: 90 Min.****Maximum Marks: 50**

Q. No.	Question					Max Marks	CO	BL
1.	Design PEAS for the following artificial intelligent agents. i) Taxi driver agent ii) Automated robot in a manufacturing plant. iii) Playing soccer iv) Bidding an item on an auction v) Shopping for used AI books on the Internet					10	CO1	BL2
Answer	Agent	Performance measure	Environment	Actuators	Sensors			
	Playing soccer	Scoring goals, defending, winning, injuries and teamwork	Soccer playground, Players, ball, goals, referee	Player`s legs, head and hands	Camera, orientation sensor, players locator			
	Shopping for used AI books on the Internet	Price, authors, book review, interested books, cost minimization	Websites, vendors, shippers	Keyboard, mouse (hands)	Camera, price monitor			
	Bidding an item on auction	The winning bid amount	Auctioneer Bidders BiddersItems which are to be bid	Speakers Microphones Display items Budget	Camera Price monitor, where prices are being displayed.			
	Taxi driver agent	Safe Fast Legal	Roads, Traffic, Pedestrians	Steering, Accelerator, Brake,	Cameras, Sonar, Speedometer,			

		Comfortable trip Maximize profits		signal, horn,	GPS, odometer, engine sensors, keyboard			
	Automated robot in a manufacturing plant.	Percentage of parts correctly manufactured	Conveyor	Jointed arm hand	Camera, joint angle sensors			
2.	Consider the project developed by Google, codenamed Waymo. Waymo has successfully deployed self-driving cars with advanced sensors and implemented AI-based model algorithms in their decision-making process. These autonomous vehicles navigate the roads, making decisions based on percept history and real-time sensory input — the ability to make informed decisions based on historical data and real-time perceptual input received from the environments. Identify the most suitable model and explain how it fits this scenario where a decision has been made based on the perception of events that happened.					10	CO1	BL3
Answer	A Learning based Agent model may be used and justification for model needed.							
3.	<p>Consider the directed graph below, where a is the start node, and f is the goal node.</p>  <pre> graph TD a((a)) --> b((b)) a((a)) --> e((e)) b((b)) --> c((c)) b((b)) --> d((d)) c((c)) --> b((b)) c((c)) --> d((d)) d((d)) --> c((c)) e((e)) --> f((f)) </pre> <p>Which sequences of paths are explored by BFS and DFS in this problem? Show the complete intermediate state space for DFS and BFS with a neat sketch. Would you prefer DFS or BFS for this problem? Justify? <i>Note: Nodes are revisited as per the direction mentioned.</i></p>					10	CO2	BL3

Answer

DFS
 explores $a \rightarrow b \rightarrow d \rightarrow b \rightarrow d$ means oscillating b/w the two nodes
 b & d.

BFS

for this problem
 prefer BFS
 DFS get stuck in an
 infinite loop.
 If it explores to the last point
 it will get stuck in the loop.

a
 $abac$
 $abte$
 $abce$
 $abd|abc$
 ae
 $abd|abc|aef$
 $abc|aef|abdb|abcd$
 $aef|abdb|abcd|abcd|abcb$
 aef selected reached the goal node.

a
b
c
d
e

b
e

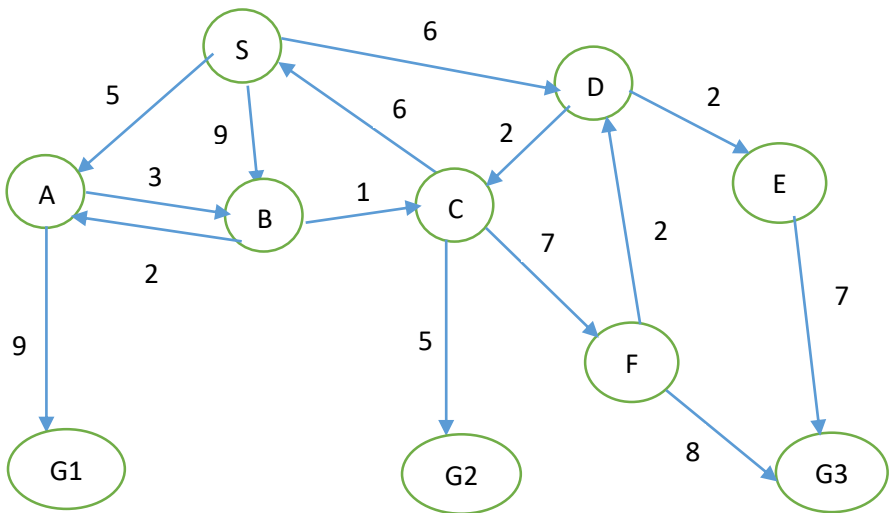
c
d
e

b
d
e

c
a
e

↳ keeps oscillating.

4. For the given directed graph (start node is S), perform the Uniform Cost Search (UCS). Expand the node based on the alphabetic order if the nodes have the same cumulative cost.
- Show the priority queue and visited nodes for each step (4M)
 - Draw the tree for each step (3M)
 - Path and cost to reach the goal states (G1, G2, G3) (2M)
 - Find the goal node which has the minimum cost. (1M)



10 CO2 BL3

Ans
wer

All questions: UCS

For the given tree below prepare uniform cost search algorithm and find the following

- Show the priority queue of visited nodes for each step
- Draw the tree for each step
- path and cost to reach the goal state (G1, G2, G3)
- Find the goal node with the minimum cost

Step 1:- start with node S.

(S)

Step 2: expand the node S.

SA	9B	6D
----	----	----

visited nodes

S

from this the minimum cumulative cost is node A

Step 2: expand the node A

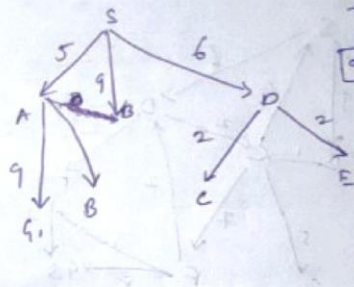
9B	6D	8B	4G1
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visited nodes

S	A
---	---

from this minimum cumulative cost is 6D.
∴ expand the node D

Step 3: expand the node b.



PO

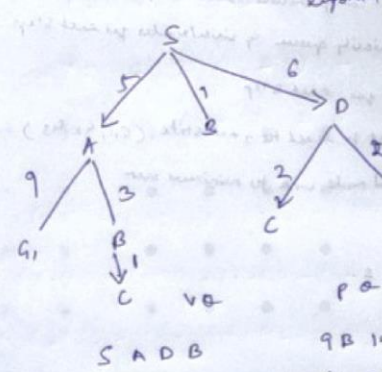
9B	9B	14A1	9C	8E
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VO

S	A	B
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The nodes B & E are the same cost
 ∴ select the node based on the alphabetic order.
 ∴ select node B.

Step 4: expand the node b.



Expand the nodes with the cost of which comes through the node A.

No node to expand from nodes through node A.

S A D B

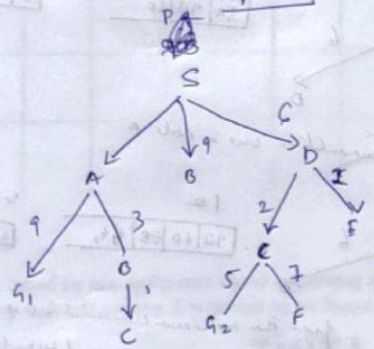
PO

9B	14A1	8C	8E	9C
----	------	----	----	----

VO

minimum is 8C. ∴ expand C.

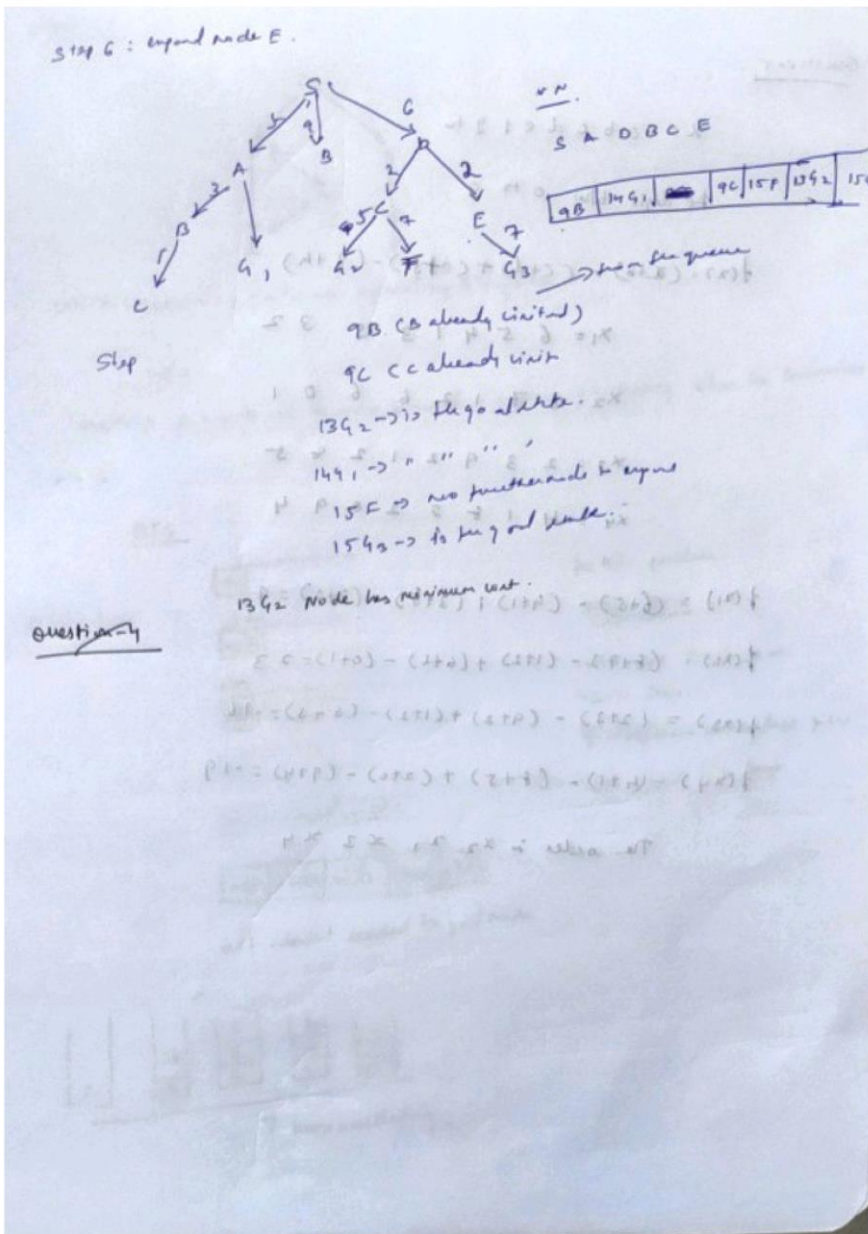
Step 5: expand the node c.



S A D B C

PO

9B	14A1	8E	9C	15F	13C1
----	------	----	----	-----	------



5. a) Suppose a genetic algorithm uses chromosomes of the form $x = abcdefgh$ with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as:

$$f(x) = (a + b) - (c + d) + (e + f) - (g + h)$$

and let the initial population consist of four individuals with the following chromosomes:

- $x_1 = 65413532$
- $x_2 = 87126601$
- $x_3 = 23921285$
- $x_4 = 41852094$

Evaluate each individual's fitness, showing all your workings and arrange them in order with the fittest first and the least fit last. (4 M)

10

CO2

BL3

b) With a neat sketch of the hill-climbing algorithm's state-space landscape, explain why the hill-climbing search gets stuck. List the variants of the hill climbing algorithm and describe how they overcome this problem. (6 M)

Answer

Question 5:

$x = abcde + gh$
 If digit b/w 0 to 9

$f(x) = (a+b) - (c+d) + (e+f) - (g+h)$

$x_1 = 6\ 5\ 4\ 1\ 3\ 5\ 3\ 2$

$x_2 = 8\ 7\ 1\ 2\ 6\ 6\ 0\ 1$

$x_3 = 2\ 3\ 9\ 2\ 1\ 2\ 4\ 5$

$x_4 = 4\ 1\ 8\ 5\ 2\ 0\ 9\ 4$

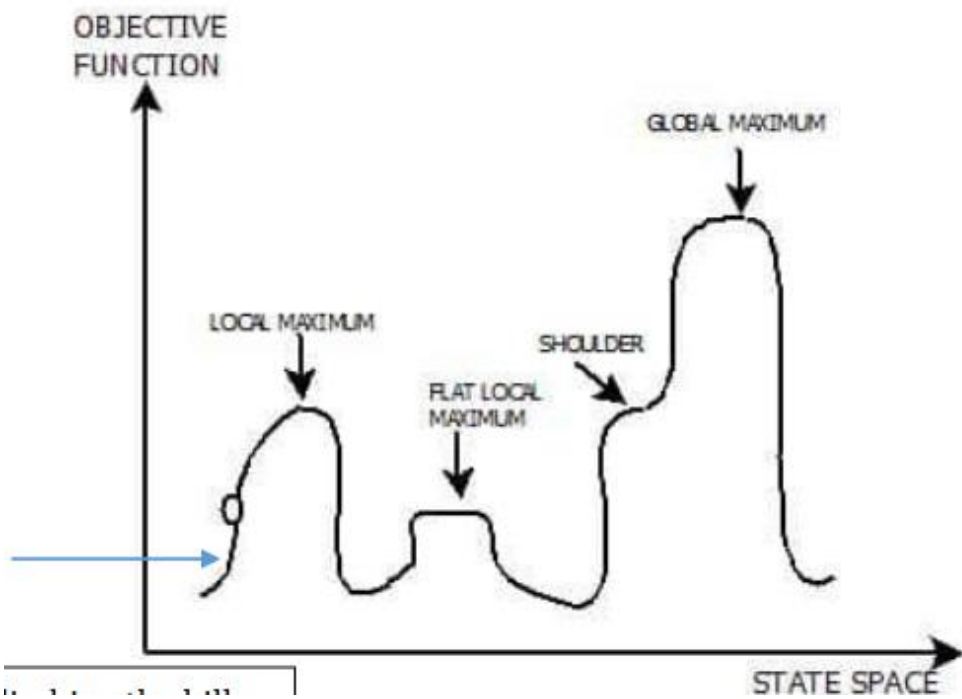
$f(x_1) = (6+5) - (4+1) + (3+5) - (3+2) = 9$

$f(x_2) = (8+7) - (1+2) + (6+6) - (0+1) = 23$

$f(x_3) = (2+3) - (9+2) + (1+2) - (4+5) = -16$

$f(x_4) = (4+1) - (8+5) + (2+0) - (9+4) = -19$

The order is $x_2 > x_1 > x_3 > x_4$



hill-climbing search gets stuck

- 1) Local maximum
- 2) Plateau/ flat maximum
- 3) Ridge

variants of the hill climbing algorithm

Simple hill Climbing:

Steepest-Ascent hill-climbing:

Stochastic hill Climbing:

Problem can be solved using simulated annealing