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**

<table>
<tr><th>Q. No.</th><th>Question</th><th>Max Marks</th><th>CO</th><th>BL</th></tr>
<tr><td>1.</td><td>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</td><td>10</td><td>CO1</td><td>BL2</td></tr>
<tr><td>Answer</td><td>
<table>
<tr><td>Agent</td><td>Performance measure</td><td>Environment</td><td>Actuators</td><td>Sensors</td></tr>
<tr><td>Playing soccer</td><td>Scoring goals, defending, winning, injuries and teamwork</td><td>Soccer playground, Players, ball, goals, referee</td><td>Player`s legs, head and hands</td><td>Camera, orientation sensor, players locator</td></tr>
<tr><td>Shopping for used AI books on the Internet</td><td>Price, authors, book review, interested books, cost minimization</td><td>Websites, vendors, shippers</td><td>Keyboard, mouse (hands</td><td>Camera, price monitor</td></tr>
<tr><td>Bidding an item on auction</td><td>The winning bid amount</td><td>Auctioneer Bidders BiddersItems which are to be bid</td><td>Speakers Microphones Display items Budget</td><td>Camera Price monitor, where prices are being displayed. .</td></tr>
<tr><td>Taxi driver agent</td><td>Safe Fast Legal</td><td>Roads, Traffic, Pedestrians</td><td>Steering, Accelerator, Brake,</td><td>Cameras, Sonar, Speedometer,</td></tr>
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</td><td></td><td></td><td></td></tr>
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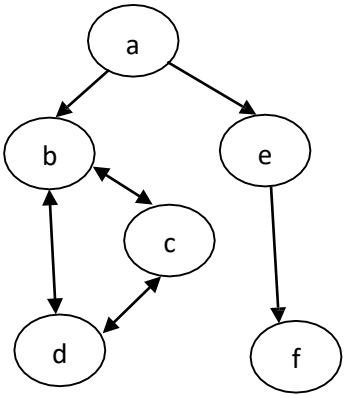
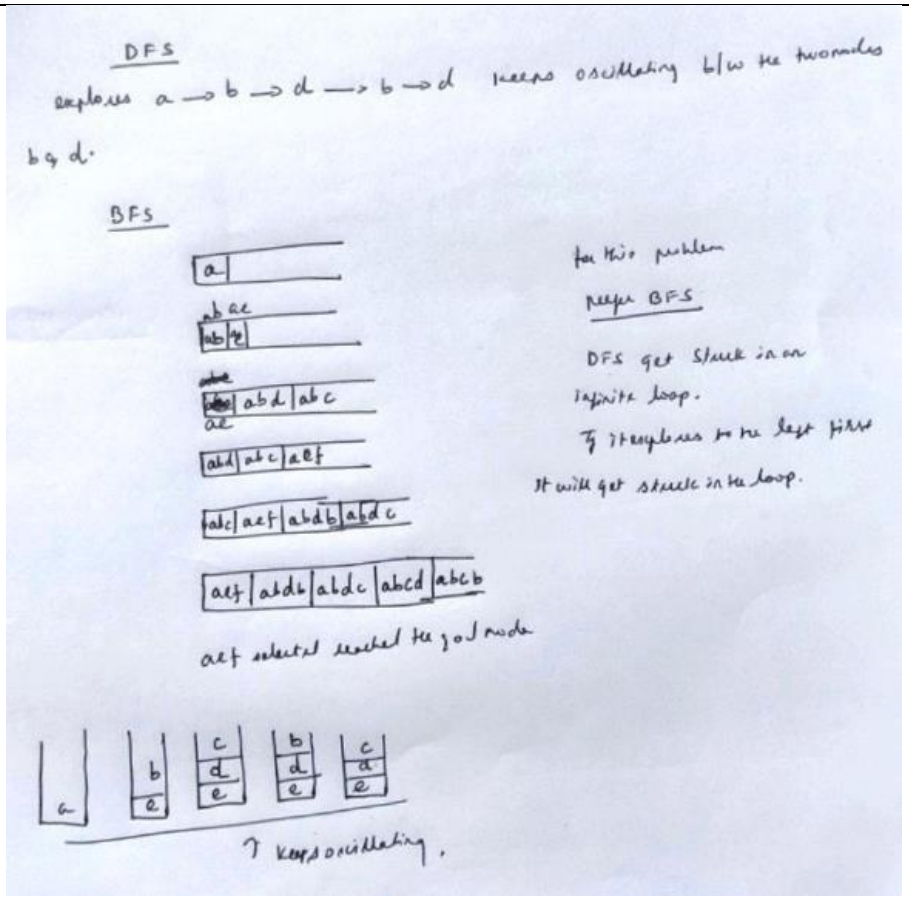
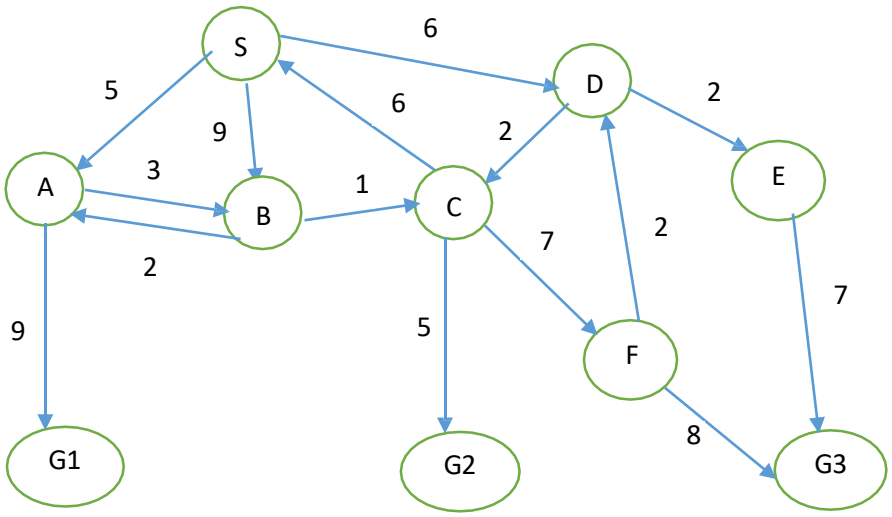
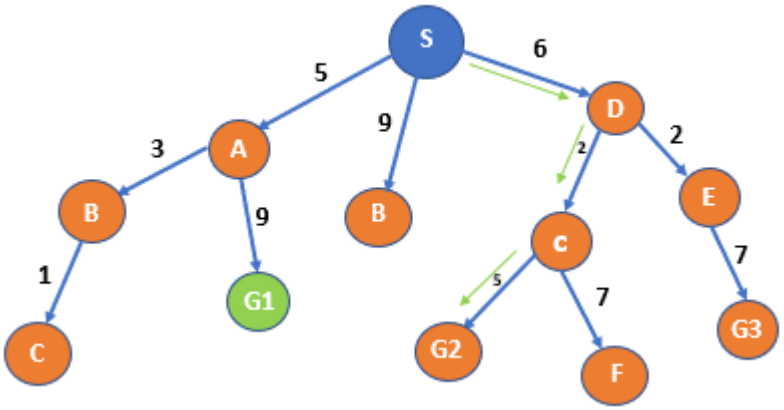
		Comfortable trip Maximize profits		signal, horn,	GPS, odometer, engine sensors, keyboard			
	Automated robot in a manufacturing plant.	Percentage of parts correctly manufactured	Conveyor	Jointed arm hand	Camera, joint angle sensors			
2.	Consider the project developed by Google, codenamed Waymo. Waymo 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. **Architecture -4 marks** To make the overall design more concrete, let us return to the automated taxi example. The performance element consists of whatever collection of knowledge and procedures the taxi has for selecting its driving actions. The taxi goes out on the road and drives, using this performance element. The critic observes the world and passes information along to the learning element. Forexample, afterthe taximakes aquick leftturn across three lanes oftraffic, the critic observes the shocking language used by other drivers. From this experience, the learning element is able to formulate a rule saying this was a bad action, and the performance element is modified by installation of the new rule. The problem generator might identify certain areas of behavior in need of improvement and suggest experiments, such as trying out the brakes on different road surfaces under different conditions. **Not Model based agent and others:** model-based agent is that it does not have to describe "what the world is like now" in a literal sense. For example, the taxi may be driving back home, and it may have a rule telling it to fill up with gas on the way home unless it has at least half a tank. Although "driving back home" may seem to an aspect of the world state, the fact of the taxi's destination is actually an aspect of the agent's internal state. If you find this puzzling, consider that the taxi could be in exactly the same place at the same time, but intending to reach a different destination.								

3.	Consider the directed graph below, where a is the start node, and f is the goal node.  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? *Note: Nodes are revisited as per the direction mentioned.* *If we were just running vanilla DFS(nopruningor loopchecking) then we would prefer BFS,because DFS could get stuck in an* ***infiniteloop.*** *Note that DFS is sensitive to the ordering of the nodes. If it explores to the left first it will get stuck in the loop, whereas if it explores to the right first it will find the goal very quickly.* ***DFS explores a−−>b−−>d−−>b−−>d*** ***BFS first adds a−−>b and a−−>e to the frontier.*** *It expands ab and adds abd and abc to the frontier. Path ae is then expanded, adding aef to the frontier. Path abd is selected and removed from the frontier,and expanded so that abdb and abdc are added to the frontier. Path abc is selected and expanded,adding abcb and abcd to the frontier.*	10	CO2	BL3

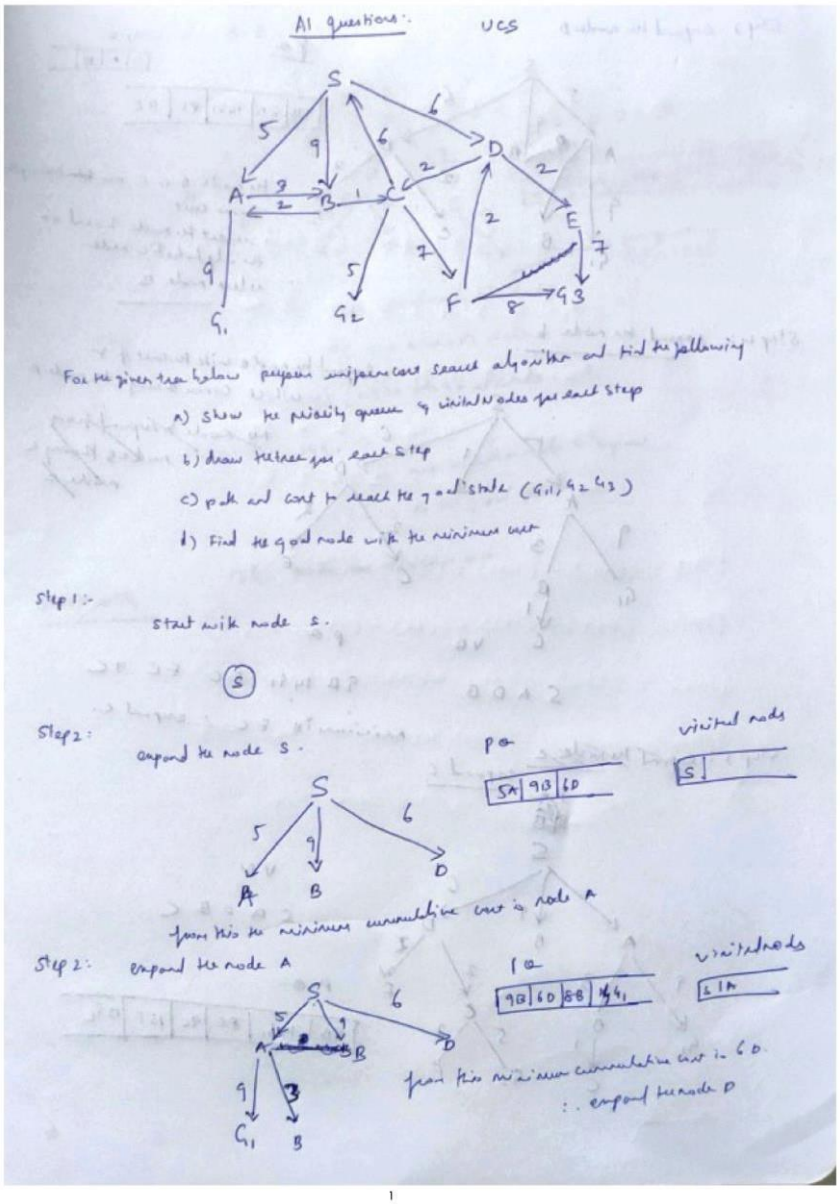
Ans wer				
4.	For the given directed graph (start node is S), perform the Uniform Cost Search (UCS). Expand the node based on the alphabetic order if the nodes have the same cumulative cost. 1. Show the priority queue and visited nodes for each step (4M) 2. Draw the tree for each step (3M) 3. Path and cost to reach the goal states (G1, G2, G3) (2M) 4. Find the goal node which has the minimum cost. (1M) 	10	CO2	BL3

Answer

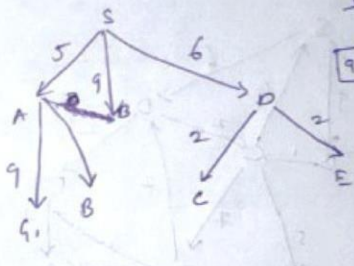
Step by step solution is required



Closed list :S,A,D,B,C,E



Step 3: expand the node D.



PQ

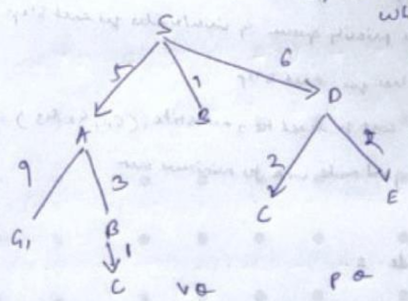
9B	8D	14G1	8C	8E

VQ

S	A	D

the node B & E are having 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 9 & which comes through the node A.

~~no node to expand from nodes through node A~~

VQ

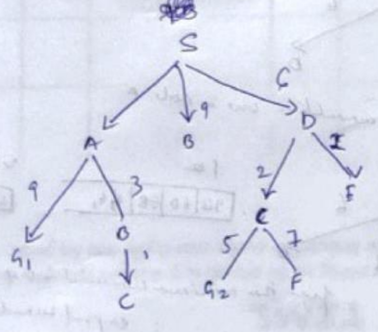
S A D B

PQ

9B 14G1 8C 8E 9C

minimum is 8C ∴ expand C.

Step 5: ~~expand the node~~ expand C.

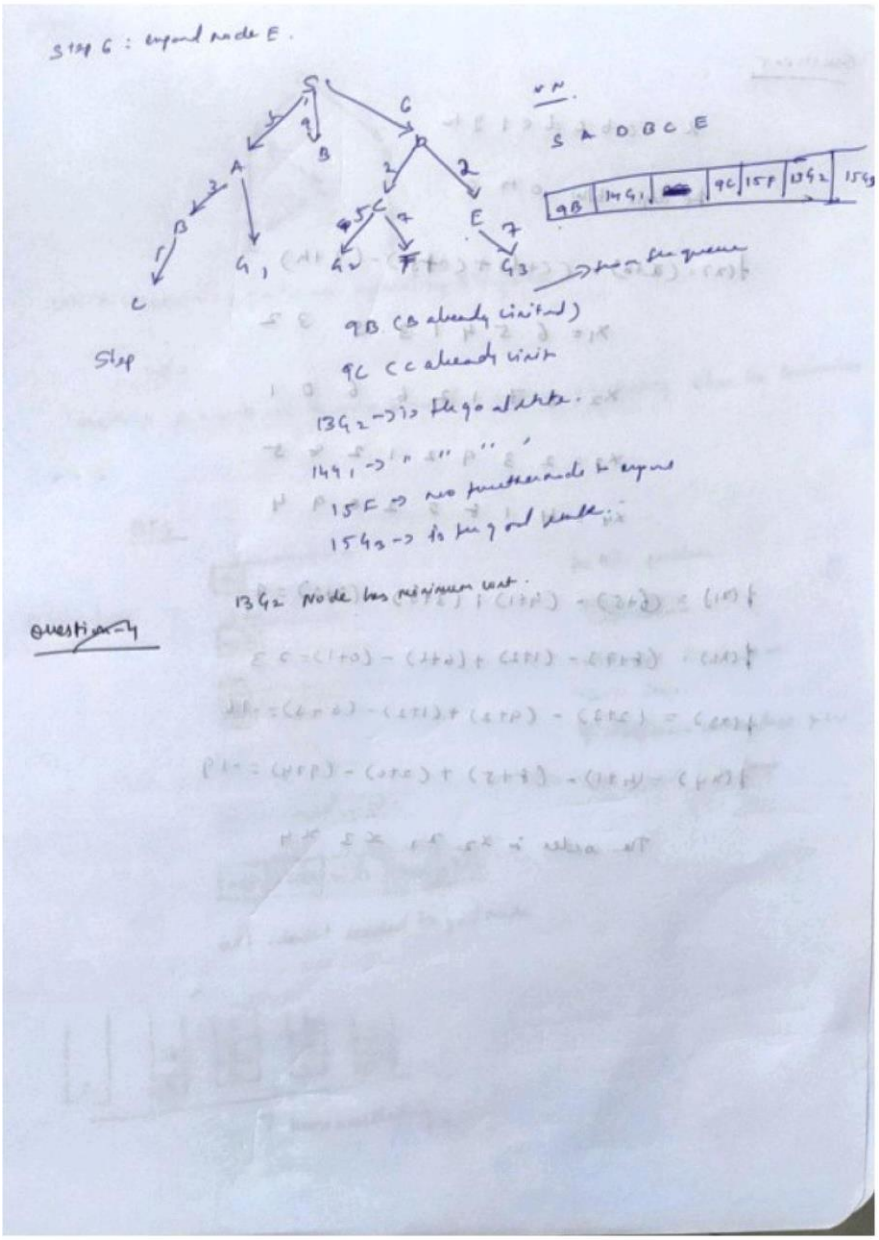


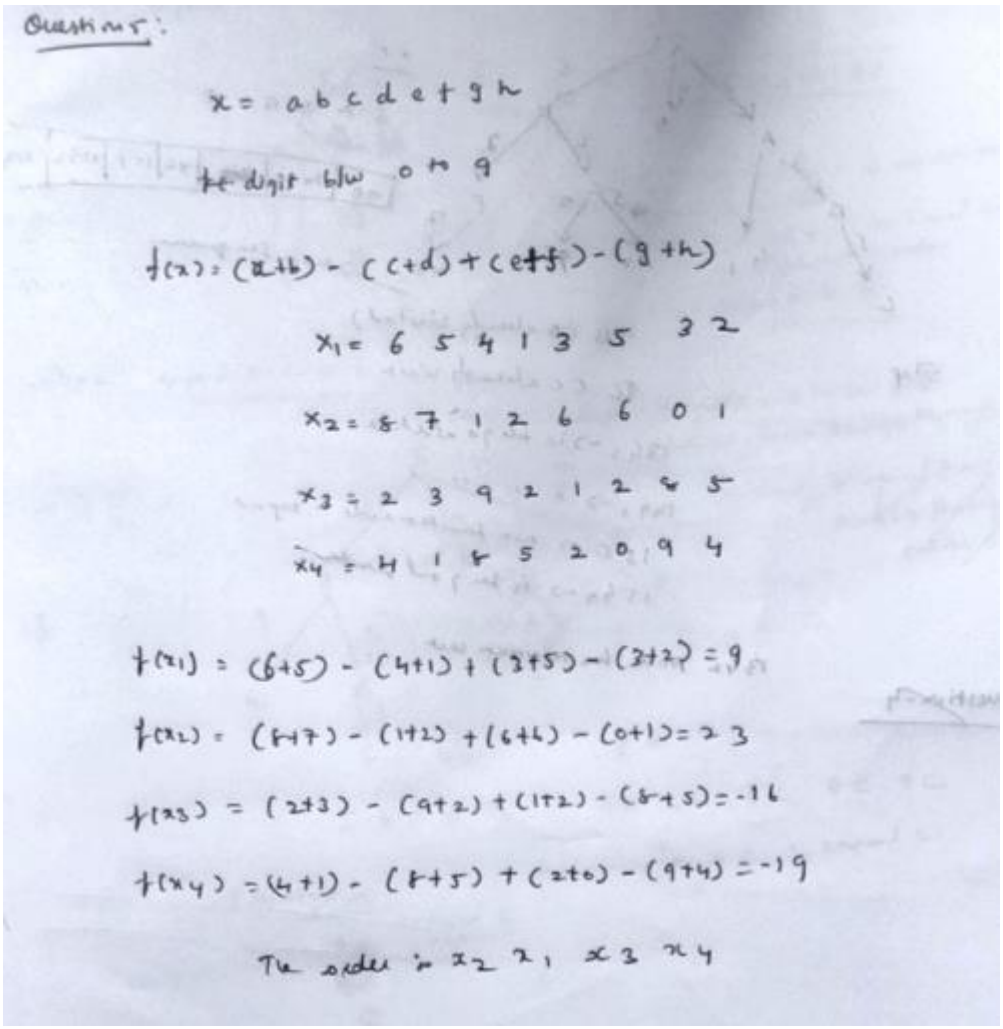
VQ

S A D B C

PQ

9B	14G1	8E	9C	15F	13G2

				
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: x1 = 6 5 4 1 3 5 3 2 x2 = 8 7 1 2 6 6 0 1 x3 = 2 3 9 2 1 2 8 5 x4 = 4 1 8 5 2 0 9 4 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 struck. List the variants of the hill climbing algorithm and describe how they overcome this problem. (6 M)			
Answer				

Question 5:

x = a b c d e f g h

the 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 8 5

x_4 = 4 1 8 5 2 0 9 4

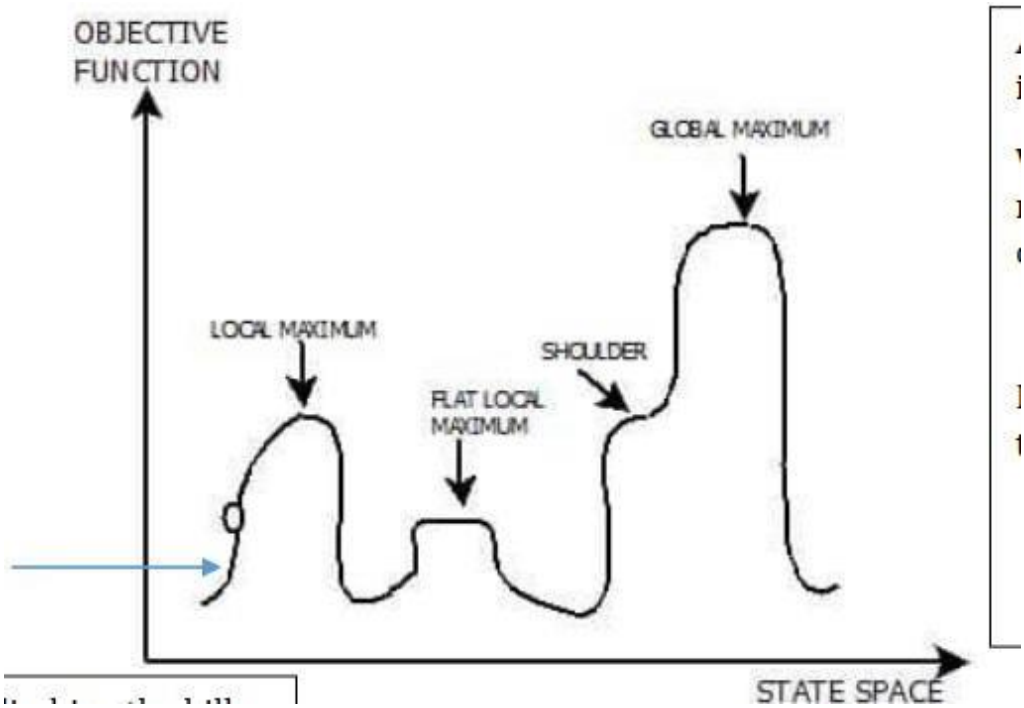
f(x1) = (6+5) - (4+1) + (3+5) - (3+2) = 9

f(x2) = (8+7) - (1+2) + (6+6) - (0+1) = 23

f(x3) = (2+3) - (9+2) + (1+2) - (8+5) = -16

f(x4) = (4+1) - (8+5) + (2+0) - (9+4) = -19

The order is x2 x1 x3 x4



hill-climbing search gets struck

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