* Experiment-7 (Postlab)

Q.1) What are the advantages and disadvantages of state space search?

Ans :- Advantages :-

i) Completeness : If the solution exists and the algorithm is appropriately designed (with avoidance of revisiting states), a state space search will find it.

ii) Flexibility :- Can be applied to a variety of problems from different domains such as puzzles, planning problems, and optimization tasks.

iii) Simplicity :- Conceptually simple and straightforward, making it easy to understand and implement.

Disadvantages :-

i) Memory Consumption :- Can require a significant amount of memory to store all generated states and transitions, especially in problems with large scale state spaces.

ii) Time Consumption :- Searching through large state spaces can be computationally expensive and slow.

iii) Optimality:- Not all state space search methods guarantee ~~that~~ the optimal solution unless they are specifically designed for it, such as A* search with an appropriate heuristic.

Q.2) What are the advantages and disadvantages of the Hill Climbing approach?

Ans: Advantages:-

i) Simplicity:- Easy to implement and understand.
ii) Speed:- Can quickly find a local maximum, which may be sufficient for some applications.
iii) Low Memory Usage:- Requires minimal memory as it generally keeps track of only the current state and compares it to it's neighbors.

Disadvantages:-

i) Local Maximum:- Can get stuck at a local maximum and fail to find the global maximum.
ii) Plateaus:- A flat region can cause the algorithm to halt prematurely because no better neighbouring states are found.

iii) No backtracking:- Once a path is chosen, there is no mechanism to go back and explore other paths which might lead to a better solution.

Q3) Describe variations of Hill Climbing approach.

Ans:- i) Simple Hill Climbing :- Examines the neighbouring nodes of the current state and moves to the neighbour that is closest to the goal state, in terms of heuristic measure.

ii) Steepest - Ascent Hill Climbing :- Similar to simple hill climbing but instead examines all neighbours and selects the one that most increases (or decreases, depending on the problem) the value of the objective function.

iii) Random - Restart Hill Climbing : Combats the problem of local maxima by performing repeated hill climbing from randomly generated initial states.

iv) Simulated Annealing :- Introduces randomness as a part of the search process to escape local maxima by allowing moves to worse states under controlled conditions.

Q4) Solve the Block World problem by using the STRIPS method.

Ans:- Suppose there are three blocks A, B and C initially on the table. The goal is to stack them in a specific order on the table.

STRIPS (Stanford Research Institute Problem Solver) Outline:-

Initial State: 'OnTable(A) ∧ OnTable(B) ∧ OnTable(C) ∧ Clear(A) ∧ Clear(B) ∧ Clear(C) ∧ HandEmpty.

Goal State:- 'On(A,B) ∧ On(B,C) ∧ OnTable(C)'

Operators:-

1. Stack(X,Y):-

Preconditions: 'Clear(Y) ∧ Holding(X)'
Add: 'On(X,Y) ∧ Clear(X) ∧ HandEmpty'
Delete: 'Clear(Y) ∧ Holding(X)'

2. Unstack(X,Y):-

Preconditions: 'On(X,Y) ∧ Clear(X) ∧ HandEmpty'
Add: 'Clear(Y) ∧ Holding(X)'
Delete: 'On(X,Y) ∧ Clear(X) ∧ HandEmpty'

3. PickUp (X):-

Preconditions:- 'OnTable (X) ∧ Clear (X) ∧ HandEmpty'
Add: 'Holding (X)'
Delete: 'OnTable (X) ∧ Clear (X) ∧ HandEmpty.

4. PutDown (X):

Preconditions: 'Holding(X)'
Add: 'OnTable (X) ∧ Clear (X) ∧ HandEmpty'
Delete: 'Holding (X)'

Solution Example:-

1. PickUp (C): Moves C from the table to the hand.
2. PickUp (B): Moves B from the table to the hand.
3. Stack (B, C): Places B on C
4. PickUp (A): Moves A from the table to the hand.
5. Stack (A, B): Places A on B.

This sequence will lead from the initial state to the goal state using the defined operators, adhering to STRIPS formalism, which requires specifying what each action's preconditions and effects (additions and deletions to the state) are.