

Tutorial 10 (Week 11)

1. Define hill climbing algorithm.

Hill climbing derived from the analogy of a person climbing a hill. It is an algorithm that moves in the direction of improvement value that is uphill.

2. Describe the Hill Climbing algorithm.

Hill Climbing is a technique to solve certain optimization problems. In this technique, we start with a sub-optimal solution and the solution is improved repeatedly until some condition is maximized.

The idea of starting with a sub-optimal solution is compared to starting from the base of the hill, improving the solution is compared to walking up the hill, and finally maximizing some condition is compared to reaching the top of the hill.

3. What are the features of hill climbing algorithm?

Some of the features include greedy approach, unable to perform backtracking and similar with generate and test strategy, less time consuming and solution is often sub-optimal.

4. What is the algorithm procedure for hill climbing?

Step 1: Evaluate the initial state, if it is goal state then return success and Stop.

Step 2: Loop Until a solution is found or there is no new operator left to apply.

- a. If it is goal state, then return success and quit.
- b. If it is better than the current state then assign new state as a current state.
- c. Else if not better than the current state, then return to step 2.

5. What are the advantages of Hill Climbing?

The advantages of hill climbing algorithm are using less memory and effective in finding solution in infinite space.

6. What are the limitations of Hill Climbing?

Hill Climbing is a short sighted technique as it evaluates only immediate possibilities. So it may end up in few situations from which it can not pick any further states.

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- a. **Local maximum:** It's a state which is better than all neighbors, but there exists a better state which is far from the current state; if local maximum occurs within sight of the solution, it is known as "foothills"
- b. **Plateau:** In this state, all neighboring states have same heuristic values, so it's unclear to choose the next state by making local comparisons
- c. **Ridge:** It's an area which is higher than surrounding states, but it can not be reached in a single move; for example, we have four possible directions to explore (N, E, W, S) and an area exists in NE direction

7. List three types of hill climbing algorithm.

- a. Simple hill climbing
- b. Steepest-ascent hill climbing
- c. Stochastic hill climbing

8. Describe the following state space in hill climbing – **local optimum**.

Local optimum is a state which is better than its neighbor states, but there is also another state which is much better than it.

9. Describe the following state space in hill climbing – **global optimum**.

Global optimum is the best possible state of state space landscape. It has the highest or lowest value of objective function depending on maximization or minimization.

10. Describe the following state space in hill climbing – **current state**.

It is a state in a landscape diagram where an agent is currently present.

11. Describe the following state space in hill climbing – **plateau**.

It is a flat space in the landscape where all the neighbor states of current states have the same value.

12. Describe the following state space in hill climbing – **shoulder**.

It is a plateau region which has an uphill edge.

13. Describe about min-max algorithm.

Min-max algorithm commonly used for game playing in AI. The algorithm consists of two players which are MAX and MIN whereby the objective of MAX is to