Q1-1: What are disadvantages of IDA* search?

- IDA* has no disadvantages
- 2. IDA* sometimes returns a suboptimal solution
- IDA* can visit the same state multiple times during the same iteration
- 4. When IDA* restarts, it discards all information except the next threshold
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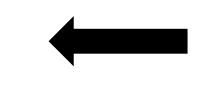


Q1-2: Consider the Beam search example with k = 2 and what would happen if we increased k to 3. Under what conditions will Beam search return the optimal solution?

- When no states are evicted from OPEN because the capacity k has been reached
- 2. When the same solution is returned for *k* and *k*+1
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Q1-3: Consider proof that A* is optimal. Why can we not use this proof by contradiction to prove that Beam search is optimal?

- 1. Beam search may not find any path to the goal
- 2. If Beam search finds a suboptimal path to the goal, it may not have stored unexpanded node *n* on the optimal path
- Beam search no longer guarantees f(n)=g(n)+h(n)
- 4. 1 and 2
- 5. 2 and 3

- Suppose A* finds a suboptimal path ending in goal G', where f(G') > f* = cost of optimal path
- Let's look at the first unexpanded node *n* on the optimal path (*n* exists, otherwise the optimal goal would have been found)
- f(n) ≥ f(G'), otherwise we would have expanded n
- f(n) = g(n) + h(n)

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- f^{*} ≥ f(n) ≥ f(G^{*}), contradicting the assumption at top

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Q2-1: Which of these is <u>NOT</u> a reason to prefer optimization instead of search for the 3-SAT optimization problem with a very large number of Boolean variables and clauses.

- Path cost is not relevant for 3-SAT
- 2. The state space is very large
- We need to guarantee we find the Boolean assignments that satisfy the most clauses possible

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Q2-2: You are building a computer that requires *k* parts. You must purchase them from *k* stores because each store has a limit of 1 part per customer. Finding the least expensive way to buy the parts is a:

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Q2-3: You are buying *k* computer parts from *k* stores, as in question 2-2. A state is a mapping of which parts you buy from which stores. What is a good choice of neighbor?

- 1. Select the most expensive part; enumerate the *k*-1 ways to buy that part from the other stores by swapping parts mapped to those stores
- 2. For each set of 3 parts and their 3 stores, enumerate all the different ways to buy those parts from the 3 stores
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Q3-1: In the 3-SAT example we started from the all T state. Consider what would happen if we instead started in the all F state.

- 1. Hill climbing would still find the global optimum with f = 2
- 2. Hill climbing would find the global optimum if it visited neighbors in the right order
- 3. Hill climbing would get stuck in a local optimum

$$\begin{array}{l} A \lor \neg B \lor C \\ \neg A \lor C \lor D \\ B \lor D \lor \neg E \\ \neg C \lor \neg D \lor \neg E \\ \neg A \lor \neg C \lor E \end{array}$$

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Q3-2: In the 3-SAT example we reached a local optimum in the state (A=T, B=F, C=T, D=T, E=T). How can we modify hill climbing to escape this local optimum?

- 1. In "IF $f(t) \le f(s)$ THEN stop" change \le to <
- 2. We cannot fix hill climbing to escape this local optimum
- 3. Pick the neighbor t with the smallest f(t) instead of the largest f(t)

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Q3-3: What is a disadvantage of modifying hill climbing to explore a plateau?

- 1. Unlike the original hill climbing, it will now be sensitive to the initial state
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