

HW1

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For all Questions, since Goal starts with 'G', it will alphabetically come before 'P' and 'Q'

1. [3 pts.] Show the order of nodes visited using Breadth First Search (BFS), and the final path selected. Is this optimal? Why or why not?

Solution

- [Start]
-> [K,L]
-> [L, L, N]
-> [L, N, M, O]
-> [N, M, O, M, O]
-> Goal
- Final path selected:
Start -> K -> N -> Goal
- This is **not optimal**.
 - Because the cost of this path is $14 + 9 + 5 = 28$ while there is a path with less cost that is *Start -> L -> K -> N -> Goal* with cost = $8 + 3 + 9 + 5 = 25$.
 - This happens because BFS tries to find the shortest path with minimum edges and not a path with minimum cost.

2. [3 pts.] Show the order of nodes visited using Iterative Deepening (initial depth of 2, increasing depth by 1), and the final path selected. Is this optimal? Why or why not?

Solution

- Depth = 2
Start -> K -> L -> fail
-> N -> fail
Start -> L -> K -> fail
-> M -> fail
-> O -> fail
- Depth = 3
Start -> K -> L -> M -> fail
-> O -> fail
-> N -> Goal

- Final path selected:
Start -> K -> N -> Goal
 - This is **not optimal**.
 - Because the cost of this path is $14 + 9 + 5 = 28$ while there is a path with less cost that is *Start -> L -> K -> N -> Goal* with cost = $8 + 3 + 9 + 5 = 25$.
 - This happens because Iterative Deepening tries to find the path with minimum depth and not a path with minimum cost. The path with most effective cost, as mentioned in last point, i.e. *Start -> L -> K -> N -> Goal* has Depth = 4 but the selected path is at Depth = 3 and lower depth is preferred in ID, so selected path is **not optimal**.
3. [4 pts.] Using the above h-function, show the order of nodes visited using A*, and the final path selected. Is this optimal? Why or why not?

Solution

Let Start = S and Goal = G

- [SK(14+9), SL(8+21)]

Expanding smaller SK(14+9)

[SKN(23+3), SL(29), SKL(17+21)]

Expanding smaller SKN(23+3)

[SKNG(28+0), SL(29), SKNP(27+3), SKL(17+21), SKNQ(34+12)]

- Final path selected:
Start -> K -> N -> Goal
- This is **not optimal**.
 - Because the cost of this path is $14 + 9 + 5 = 28$ while there is a path with less cost that is *Start -> L -> K -> N -> Goal* with cost = $8 + 3 + 9 + 5 = 25$.
 - I think this happened because the heuristic function values are not accurate. For example,
 1. $h(L) > h(M)$, it should be the other way around
 2. $h(K) = 9$, it should be more than 9