

Introduction To AI (67842)| EX 4

11 ביולי 2024

Question 13

Optimality

(1)

- It is sufficient to show that the graph is a tree because the graph without nutexes is a tree, hence it is enough to show that the heuristics are admissible in order to show optimality.
- max_level:
 - The max_level function is admissible, because it calculates the number of expansions left to reach the goal.
 - This means that the function is optimal.
- sum_level:
 - This function isn't necessarily optimal.
 - The function calculates the current heuristic value, and adds to it the value of the level if a sub-goal is in it.
 - This leads to an option that the function may overestimate the cost to the goal, which means it isn't optimal.
 - The heuristic adds each sub-goal simultaneously which could lead to overestimating the cost to goal.

(2)

Heuristic	Number Of Actions To Goal
Null Heuristic	6
Max Level	6
Level Sum	6

- The optimal solution for the DWR problem would consist these 6 actions:

- r picks a from room 1
 - r moves a to room 2
 - r drops a in room 2
 - q picks b from room 2
 - q moves b to room 1
 - q drops b in room 1
- This is an optimal solution because each action is separate.
 - This leads that in this case the null heuristic, max_level, and level_sum are also optimal.

(3)

- Theoretically, max_level is optimal, and as we can see, empirically it gives an optimal solution.
- Theoretically, The level_sum isn't necessarily optimal, but in this empirical case it is.

Running Time

(1)

- We expect the sum_level to expand less or equal nodes to max_level.
- The max_level tries to expand the graph as fast as it could, while the level_sum expands the graph in order to get the goal as fast as possible.
- This means that max_level will expand a node that consists a sub-goal and other nodes in each level.
- The level_sum will expand to nodes that have a sub-goal. If there are none it will expand the whole level.
- As we showed level_sum will expand less or equal to max_level.

(2)

Heuristic	Expanded Nodes
max_sum	28
sum_level	9

- The sum_level is more efficient in this case.

Question 14

(1)

- The set-level heuristic is optimal.
- The heuristic will never overestimate the goal.
- If it will find an earlier goal with mutexes, than the level of this goal will be smaller than the level of the real goal, and if it wont it will return the level of the real goal.
- This means the heuristic is addmisible which leads to optimality.

(2)

- The heuristic is a private case of the max_level heuristic.
- This means that the nodes expanded in this heuristic will be smaller or equal to the nodes expanded by max_level.

(3)

- The heurostic isn't perfect.
- For example if there is a state which consists of the goal propositions with mutexes in level m , the heuristic will return m .
- The real goal might be in $n > m$. This leads the the heuristic returns a level where the goal isn't real.