Quiz 11

CSCE 580

April 11, 2017

This exercise is very similar to the one in Quiz 6 of 2017-03-28. There is a new part in which I ask you to explicitly draw a search tree. According to Edelkamp and Schroedl (p.48; S. Edelkamp and S. Schroedl. *Heuristic Search: Theory and Applications*. Morgan-Kaufmann, 2012.),

The set of all explicitly generated paths rooted at the start node and of which the leaves are the open nodes constitutes the *search tree* of the underlying [state-space] problem graph. Note that while the [state-space] *problem graph* is defined solely by the problem domain description, the search tree characterizes the part explored by a search algorithm at some snapshot during its execution time.

Consider the state-space search problem graph in the figure below, where heuristic estimates are shown in parenthesis for each node, the start node is *a*, and the goal node is *g*.



Recall that a heuristic h(.) is admissible if h(*n*) does not overestimate the actual cost of the shortest path from *n* to the goal node, for every node *n*. Is h admissible?

**Answer**: yes.

A heuristic is monotone if abs(h(n’) – h(n)) <= c(n’,n) for any two adjacent nodes. (Your book has a different, but equivalent, definition.) Is h in the figure above monotone?

**Answer**: yes.

Run A\* by hand by filling out the table below. The values in parenthesis are: g, f (=g+h), and parent:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | Selection | OPEN | CLOSED |  |
| 1 | {} | {*a*(0,11,nil)} | {} |  |
| 2 | *a* | {(*c*(6,14,*a*),*b*(2,15,*a*),d(10,15,*a*)} | {*a*} |  |
| 3 |  |  |  | Update *d* (includes changing its parent to *c*) |
| 4 |  |  |  |  |
| 5 |  |  |  |  |

Draw the search tree built by A\*. For each node in the search tree, indicate the order of node generation, the g value, and the f value.

**Answer to the last two questions**:



Search tree:



Note that this tree lists the order of node generation, not node expansion. Note that a(6/dup) is not placed in Open but is still indicated in the search tree. Either the definition by Edelkamp and Schroedl should be modified or Figure 2.14 is incorrect!