CS 6300, Spring 2017 *Due: 24 January 2017*

HW01: Search

Please use LaTeX to produce your writeups. See the Homework Assignments page on the class website for details.

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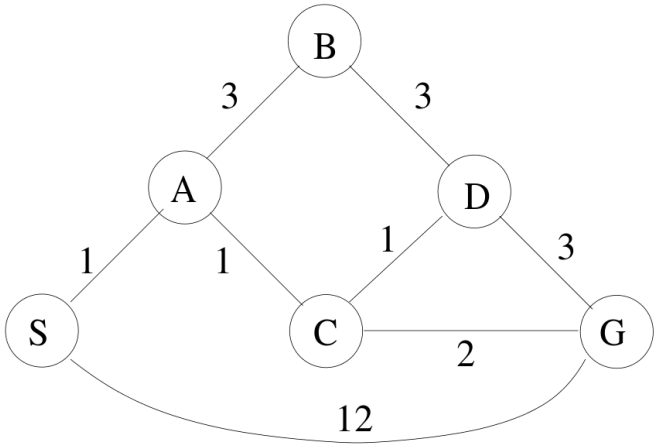
1 Search

Execute the following search algorithms on the graph below using priority queues, by filling in the search table for each part. (Not all steps will necessarily be used.) The arcs are bi-directional.



1 Breadth First Graph Search

Step	Priority Queue	Expand
1	S	S
2	S-A, S-G	S-A
3	S-G, S-A-B, S-A-C	Found G
4		
5		
6		
7		
8		

2 Depth First Graph Search

Step	Priority Queue	Expand
1	S	S
2	S-A, S-G	S-A
3	S-A-B, S-A-C, S-G	S-A-B
4	S-A-B-D, S-A-C, S-G	S-A-B-D
5	**S-A-B-D-G**, S-A-B-D-C, S-A-C, S-G	Found G
6		
7		
8		

3 Uniform Cost Graph Search

Step	Priority Queue	Expand
1	S	S
2	S-A, S-G	S-A
3	S-A-C, S-A-B, S-G	S-A-C
4	S-A-C-D, S-A-C-G, S-A-B, S-G	S-A-C-D
5	**S-A-C-G**, S-A-C-D-B, S-A-C-D-G, S-A-B, S-G	Found G
6		
7		
8		

4 Consider the heuristics for this problem shown in the table below.

State	h_1	h_2
S	5	4
A	3	2
B	6	6
C	2	1
D	3	3
G	0	0

1. Is h_1 admissible? If not, why?

   Not admissible as $h_1(S) = 5$, while the actual "optimal cost" from $S \to G$ is 4. It must be less than or equal to the actual cost to be admissible.

2. Is h_1 consistent? If not, why?

   To be consistent, $h(n) \leq c(n, a, n') + h(n')$, where a is any action and n' is every successor of n. Therefore, the estimated cost of reaching the goal from n is no greater than the step cost of getting to n' plus the estimated cost of reaching the goal from n'.
   Yes, it is consistent as we have

   $$\begin{aligned} h(S) &\leq c(S \to A) + c(A \to C \to G) + h(A) \\ 5 &\leq 1 + 1 + 2 + 2 \\ 5 &\leq 6 \checkmark \end{aligned}$$

   This also holds true for all other nodes.

3. Is h_2 admissible? If not, why?

   Not admissible as $h_2(A) = 2$, while the actual "optimal cost" from $A \to G$ is 3. It must be less than or equal to the actual cost to be admissible.

4. Is h_2 consistent? If not, why?

   Yes, it is consistent. An example node is as follows:

   $$\begin{aligned} h(S) &\leq c(S \to A) + c(A \to C \to G) + h(A) \\ 4 &\leq 1 + 1 + 2 + 2 \\ 4 &\leq 6 \checkmark \end{aligned}$$

   The rest of the nodes are left as an exercise to the reader.