I have read and agree to the collaboration policy. Lynne Diep.

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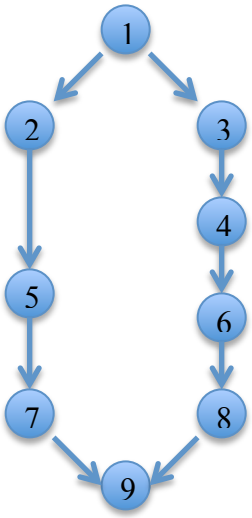
Homework Heavy Grading
Collaborators: Sabrina

Homework 3-3
Due: May 22, 2017

a.



There is a left and right side of the graph. On the left, if we choose the path by longest length, we only travel 5 states from top to bottom (1,2,5,7,9). However, on the right side of the graph we travel 6 states from top to bottom (1,3,4,6,8,9). By the algorithm presented, we take the right side of 5 states, which is not the longest path from 1 to 9. Thus this algorithm does not return the correct answer.

The algorithm above finds a path from v_1 to v_n with the next smallest v_j but doesn't compare if different paths have the longest length. As seen in the counterexample, the algorithm does not have a guarantee chance of v_j being state 3. V_j could be state 2, which is not the longest length, and hence returns the incorrect length. Ultimately the algorithm returns *a* path, which is not necessarily the longest path possible from the source to v_n.

b. Algorithm –

start at v_1 → look at v_i to v_n (i = 2) basically every node from v_1
for all unfinished nodes
take all connected nodes from v_1: look at all edges from that v
every time edge is discovered, if current parent + 1 >A[i]
update A[i] to current parent + 1
once you finish leaf go back to *unfinished node
*v_i is finished when all possible leaves from v_i have been reached
stops when all nodes have been finished

return A[n]

Time: $O(n^2)$
Space: O(n)

Proof of Correctness:
The algorithm considers all of the paths from the source, $p_1 \ldots p_n$

Starting with p_1 as the "longest path" we compare all other possible paths and the longest path is updated when the new node has a longer path from the source than what we have assured what was the longest path before. For example, p_1 is currently our longest path with length 3. We compare p_1 with p_2, where p_2 has a path length of 5. Since p_2 has a longer path than p_1, p_2 is updated to our new longest path. This process continues of comparing the undiscovered paths with our current longest path until there are no more paths to be considered. By the end of this search, we have searched through all possible paths and are guaranteed the longest path possible.