CSE 412A Spring 2022 — Introduction to Artificial Intelligence — Exercise 3

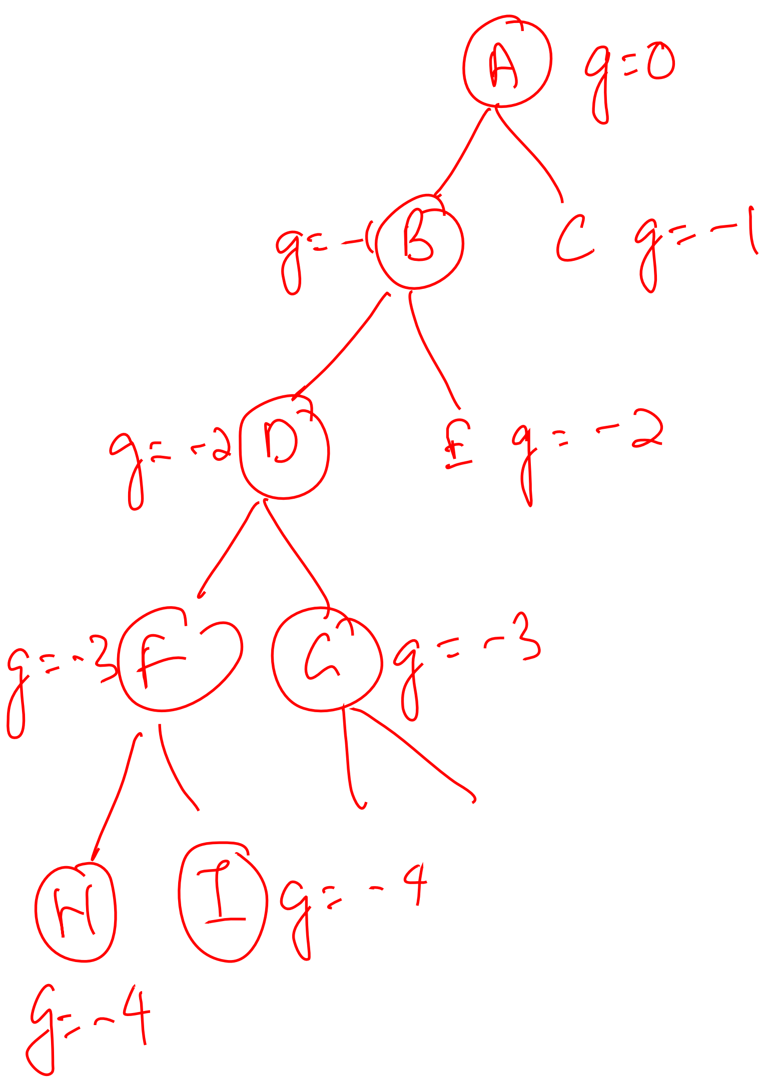
- You have approximately as many minutes as there are points.
- Mark your answers ON THE EXERCISE ITSELF. If you are not sure of your answer you may wish to provide a *brief* explanation. All short answer sections can be successfully answered in a few sentences AT MOST.
- For True/False questions, please *circle* your answer.

First name	
Last name	
WUSTL ID	

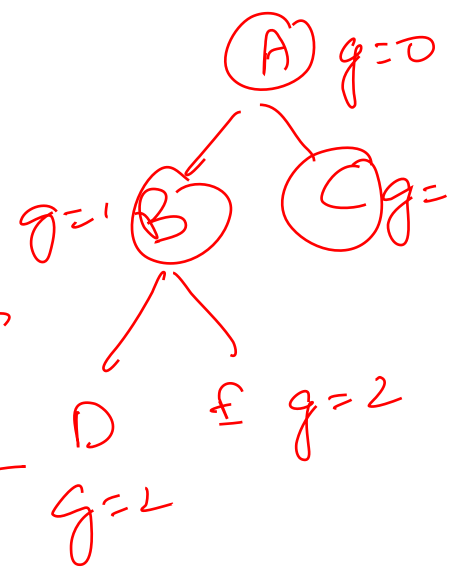
For staff use only:

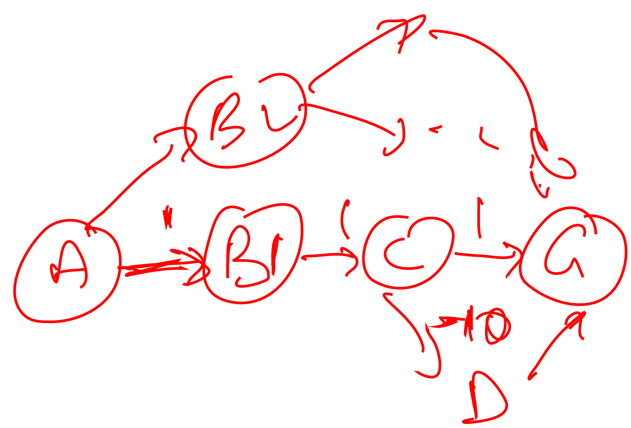
Q1.	Search	/17
	Total	/17

THIS PAGE IS INTENTIONALLY LEFT BLANK



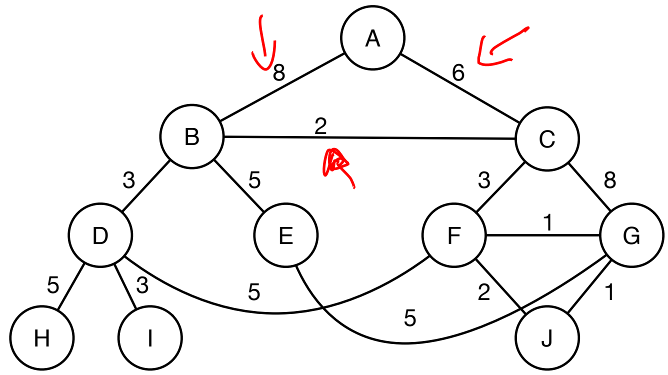
DFS





0

Q1. [17 pts] Search



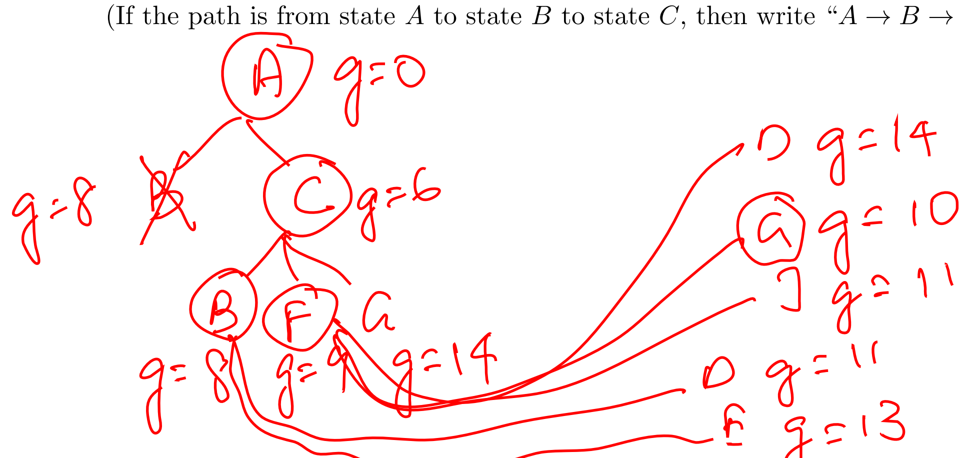
The questions on this page refer to the graph above, where the start state is A and the goal state is G. The number on an edge corresponds to the cost of traversing that edge. Additionally, assume that we have the following heuristic values:

State	A	B	C	D	E	F	G	H	I	J
Heuristic value	5	3	2	3	2	0	0	5	4	0

Assume that each algorithm re-generates states that are not yet expanded, does not re-expand states, breaks ties in lexicographical ordering, and terminates after expanding the goal state.
Note: These assumptions may differ with the operations of some of the algorithms in the textbook.

(a) [5 pts] What is the order of state expansions if you used used Uniform-Cost Search?
(If state A is expanded before state B, which is expanded before state C, then write "A, B, C".)

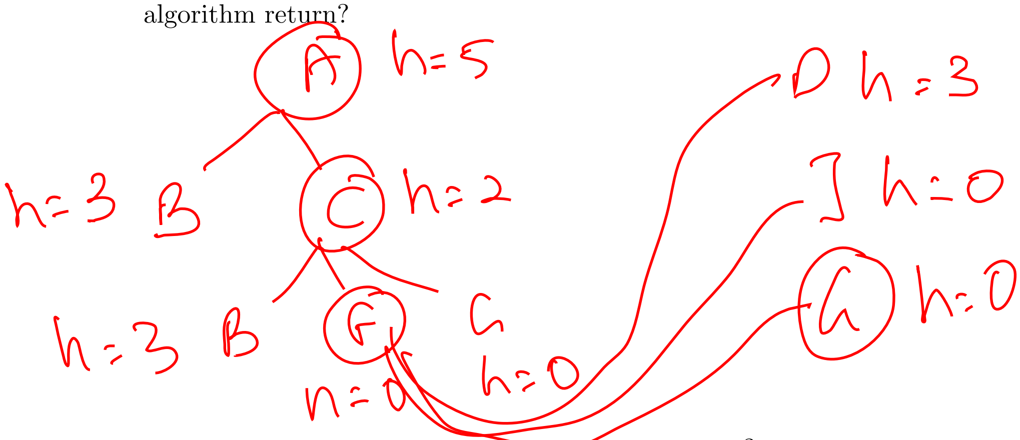
What path would the algorithm return?
(If the path is from state A to state B to state C, then write "$A \to B \to C$".)



A, C, B, F, G

A → C → F → G

(b) [5 pts] What is the order of state expansions if you used Greedy Best-First Search? What path would the algorithm return?



A, C, F, G

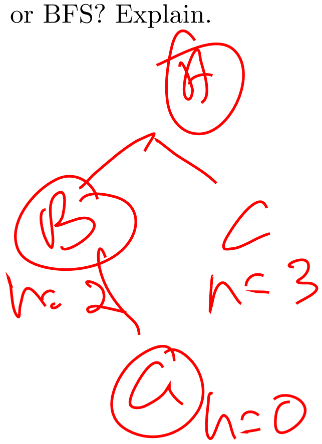
A → C → F → G

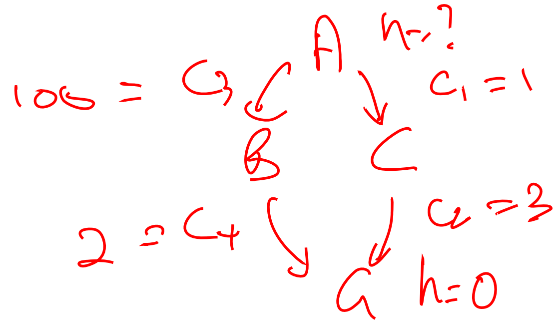
(c) Each question is worth 1 point. Leaving a question blank is worth 0 points. **Answering a question incorrectly is worth −1 point.** This gives you an expected value of 0 for random guessing.

(i) [1 pt] [*true* or *false*] Uniform-cost search is guaranteed to find a shortest path in finite graphs with uniform edge costs.

(ii) [1 pt] [*true* or *false*] Greedy best-first search, using a perfect heuristic $h(n) = h^*(n)$ that always returns the true cost to the goal, is optimal.

(d) [5 pts] How would UCS operate in tree-structured graphs with uniform negative edge costs (e.g., all edges have cost -1), where the root is the start state and a different arbitrary node of the graph is the goal state? Is its behavior more similar to DFS or BFS? Explain.





greedy: A B G

true opt: A C G

$C_1 + C_2 < C_3 + C_4$

$h(A) = C_1 + C_2$

$h(B) = C_4$

$h(C) = C_2$