

# HW 1 - CSE 473 Spring 2021

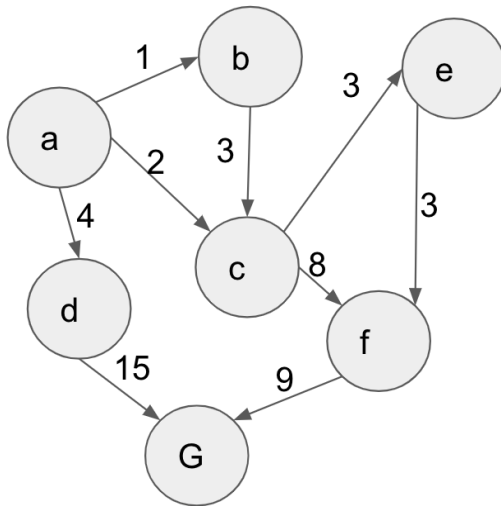
**Due Date:** Friday, April 9th, 2021 at 6:00 pm PDT

**Total Points:** 20 points

## Problem 1. Search (8 Points)

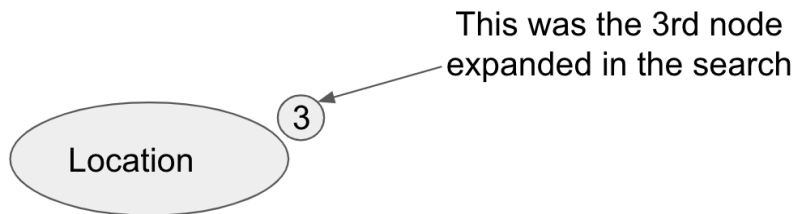
In the following state graph, the agent wants to move from the start state (a) to the goal state (G). The agent can move in the direction indicated by the edges.

At every node, the agent observes a list of the next possible destinations (children of the current node) in alphabetical order and adds them to the fringe, in that order.



Node	H
a	17
b	19
c	14
d	12
e	10
f	8

In the following questions, number the nodes in your search tree corresponding to the expansion order (see below for an example) -- break ties alphabetically.



- What is the path returned by Depth First Search (DFS) (ignoring costs on edges)? Show your search tree. (2 points)
- What is the path returned by Breadth-first search (BFS) (ignoring costs on edges)? Show the expanded search tree. (2 points)

- C) What is the path returned by Uniform Cost Search (UCS) given the costs of the edges in the figure? Show the expanded search tree. (2 points)
- D) What is the path returned by greedy search using heuristic  $H$  ? Show the expanded tree. (2 points)

## Problem 2. Short Questions (12 Points)

- A) Let's define the procedure of hill-climbing. You start at a random location on a hill, your goal is to get to the highest point on the hill. At each time step, you will take a step toward the location next to you that is higher than your current location.

Is hill-climbing complete? Why? If not, is there any way to improve the performance in the discrete problem space? (2 points)

- B) Pac-Man wants to get to the goal location from some initial position in a 2D grid.

a. If Pac-Man wants to get to the goal location with the shortest path, what is the simplest state representation? (1 point)

b. If Pac-Man instead wants to first get to all four corners, then go to the goal location, should the state representation above change? If so, how? (1 point)

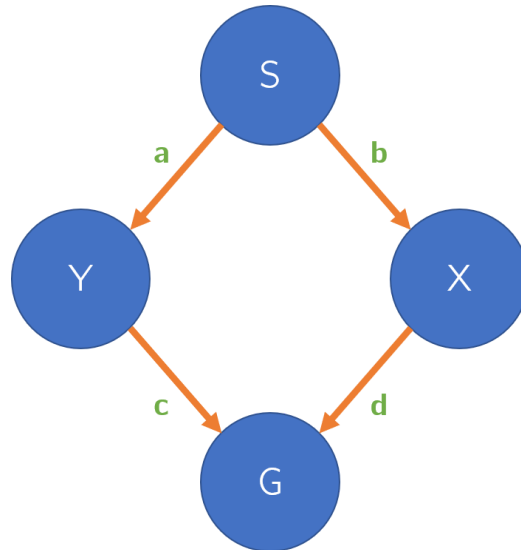
- C) Search algorithm comparisons:

a. In what circumstances is Depth-first Search preferred over Breadth-first Search? Write down two circumstances. (2 points)

b. In what circumstances is Greedy Search preferred over Uniform Cost search? Write down two circumstances. (2 points)

D) You are given the graph shown below, and the heuristics functions  $H(X)$  and  $H(Y)$ . Your start from State S, and your goal is to go to State G.

Find non-negative edge weights, a, b, c, and d, such that it satisfies each of the scenarios:



Heuristic

$$H(S) = 12$$

$$H(Y) = 10$$

$$H(X) = 1$$

**a. Scenario 1:** (2 point)

Both greedy search and A\* find the optimal solution.

a:

b:

c:

d:

**b. Scenario 2:** (2 point)

A\* search finds the optimal solution, but greedy search doesn't.

a:

b:

c:

d: