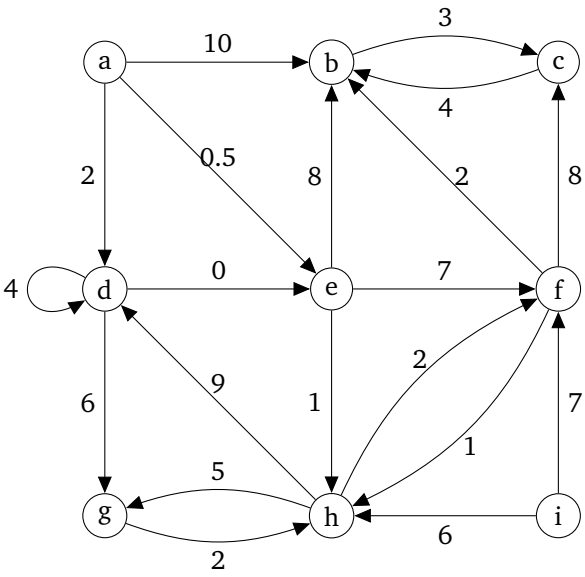
EX3: BFS, DFS, & Dijkstra's

Due date: Friday May 14, 2021 at 11:59 pm

Instructions: Submit your responses to the "EX3: BFS, DFS, & Dijkstra's" assignment on Gradescope here: https://www.gradescope.com/courses/259163/assignments/1154089. Make sure to log in to your Gradescope account using your UW email to access our course.

1. Dijkstra's Algorithm

Consider the following graph:



Run Dijkstra's algorithm on this graph to compute the shortest path tree for this graph starting on node a. For each vertex in the graph (a - i), you should give the final result and show your work for data that gets stored by filling the following table. Make sure to **show the intermediate values** you had during the algorithm. You'll list out all the proposed distances / predecessor edges as a list in chronological order as they occur during the algorithm, where the last item in the list is the actual best distance / predecessor edge.

Vertex	Distance	Predecessor	Processed
a			
b			
c			
d			
e			
f			
g			
h			
i			

2. Amazon Delivery

When you buy something from Amazon, the package almost never goes directly from the warehouse to your house. Instead, shipments are usually consolidated and routed through major shipping hubs to take advantage of cheaper travel.

For example, a package from a warehouse in Chicago might have to go through multiple shipping hubs, through a routing of Chicago→Los Angeles→Portland→Seattle, rather than traveling there directly. For every route within the network, there will always be some mode of transportation in the opposite direction with the same cost.

Bezos always looks to cut costs, so as an Amazon employee you are tasked with writing a program that finds optimal shipping hub routings for packages in order to conserve costs. You decide to model the current delivery network with a graph.

Please answer the following questions:

(a) What do your vertices represent?

(b) What do your edges represent? Your answer may be a real-world object or an abstract description of what edges will exist.

(c) Is your graph directed or undirected? Briefly explain why in less than three sentences.

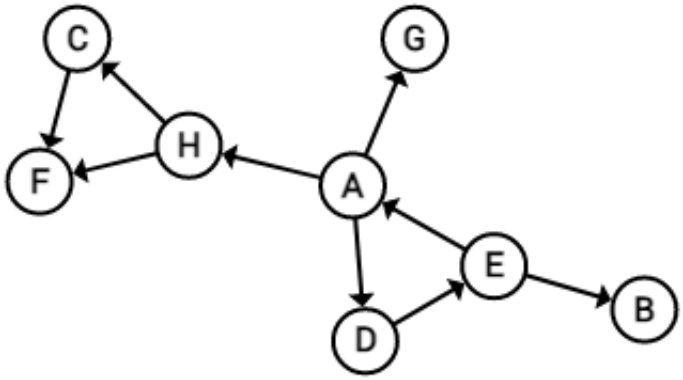
(d) Is your graph weighted or unweighted? Briefly explain whyin less than three sentences.

(e) Amazon Delivery needs to route a package from a warehouse in DC to Seattle. Since the buyer selected the standard delivery option, you want to find the cheapest routing for the package, even if it means there will be detours. Describe, in no more than three sentences, how you can use an algorithm from lecture to accomplish this task. If you use extra information, state where to store it in the graph.

(f) Amazon Delivery is tasked with relocating a goose from IntelliJ Island, FL to Seattle. Since the animal is sensitive and shy, you want to find a route for the goose through the minimum number of stops, so as to minimize the number of loadings/unloadings. Describe, in no more than three sentences, how you can use an algorithm from lecture to accomplish this task. If you use extra information, state where to store it in the graph.

3. Graph Question

Please look at the following graph and answer questions. For part (c) and (d), if a node has more than one neighbor, visit the neighbors in alphabetical order. For example, when you iterate over the neighbors {A, F, D, Z} of some node, it visits A, D, F, Z in order.



(a) Please draw an adjacency list representation of the graph above.

(b) Please draw an adjacency matrix representation of the graph above.

(c) Starting at node A, in which order will the nodes in the graph be visited by depth-first search?

(d) Starting at node A, in which order will the nodes in the graph be visited by breadth-first search?