Name: _____ **100 points total**

CS 2123 Homework 3 Fall 2019

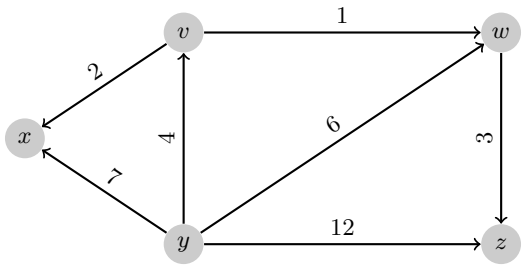
Assignment is due at 11:59pm on October 24. Submit a digital copy of the assignment on Harve as a SINGLE PDF file. The easiest way to scan your work is to use an app on your phone that saves a single PDF (e.g., the Google Drive app for Android phones (see
https://support.google.com/drive/answer/3145835?co=GENIE.Platform%3DAndroid&oco=1) or apps such as Scanner Pro. You can see a list of choices here: https://www.pcmag.com/roundup/349681/the-best-mobile-scanning-apps

NOTE: As a reminder, students who worked in pairs on HW2 must work with a different partner on HW3.

You may submit a lateness coupon request BEFORE the assignment is due by sending an email to cs2123f19@googlegroups.com with Subject "CS2123 Lateness Coupon". All other late work will receive a 10 percentage point deduction per day (including weekends), No late work is accepted beyond five days after the assignment is due.

Q1 (24)	_____
Q2 (24)	_____
Q3 (24)	_____
Q4 (24)	_____
Q5 (4)	_____
Total (100)	_____

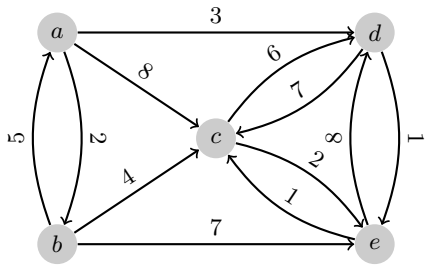
Q1. (24 points)
Consider the following weighted, directed, acyclic graph:



Find the weight of the shortest path from y to all nodes in the graph using the *shortest path on DAGs algorithm*. Complete the table that indicates intermediate values of the upper bound `d` of the distance from y after each iteration of the outermost for loop. Fill in the column heading with the node that is considered at each iteration. The topological sort of the graph is (y,v,x,w,z).

	`d[Node]`: distance from y to Node after each iteration of the loop						
Node	init.	1 ( )	2 ( )	3 ( )	4 ( )	5 ( )	
v	∞						
w	∞						
x	∞						
y	0						
z	∞						

Q2. (24 points)
Consider the following weighted directed graph:



Find the weight of the shortest path from a to all nodes in the graph using Dijkstra's algorithm. Complete the table that indicates intermediate values of the upper bound `d` of the distance from a after each iteration of the while loop. Fill in the column heading with the node that is considered at each iteration. Show your work by including the contents of the priority queue.

	`d[Node]`: distance from a to Node after each iteration of the while loop					
Node	init.	1 ( )	2 ( )	3 ( )	4 ( )	5 ( )
a	0					
b	∞					
c	∞					
d	∞					
e	∞					

Q3. (24 points)

Devise an encoding for the following symbols and associated probabilities using the Shannon-Fano algorithm. Fill out the following table (including codewords, length, average, and average weighted code length) and draw the trie below (showing your work).

Symbol	Frequency	Codeword	Length	Average
a	0.03			
b	0.24			
c	0.12			
d	0.36			
e	0.08			
f	0.02			
g	0.15			
	Average weighted code length:			

Q4. (24 points)

Devise an encoding for the following symbols and associated probabilities using the Huffman algorithm. Fill out the following table (including codewords, length, average, and average weighted code length) and draw the trie below (showing your work).

Symbol	Frequency	Codeword	Length	Average
a	0.03			
b	0.24			
c	0.12			
d	0.36			
e	0.08			
f	0.02			
g	0.15			
	Average weighted code length:			

Q5. (4 points) How long (in hours) did you spend on this assignment?