

Gabriel Emerson

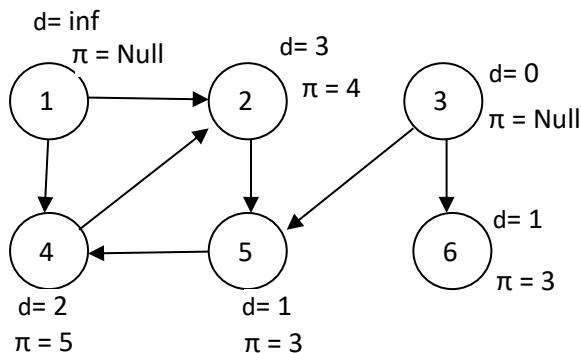
COMP 3270 Assignment 4 (100 points)

Due by 11:59PM on Thursday, April 22nd, 2021

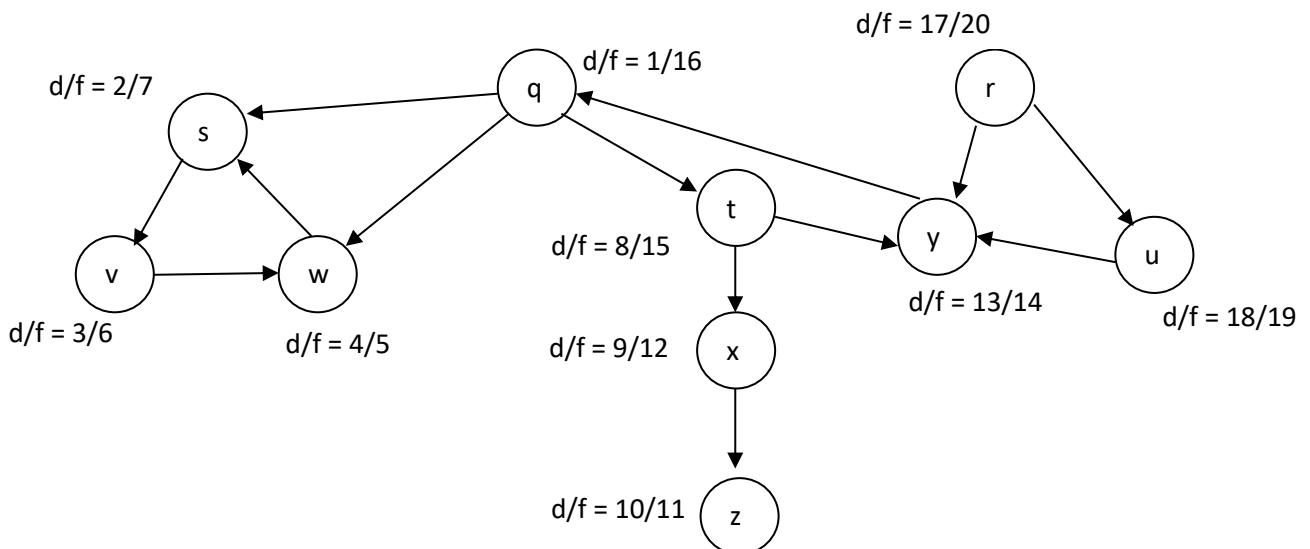
Instructions:

1. Late submissions **will not** be accepted unless prior permission has been granted or there is a valid and verifiable excuse.
2. Think carefully; formulate your answers, and then write them out concisely using English, logic, mathematics and pseudocode (no programming language syntax).
3. Type your final answers in this Word document.
4. Don't turn in handwritten answers with scribbling, cross-outs, erasures, etc. If an answer is unreadable, it will earn zero points. **Neatly and cleanly handwritten submissions are acceptable.**

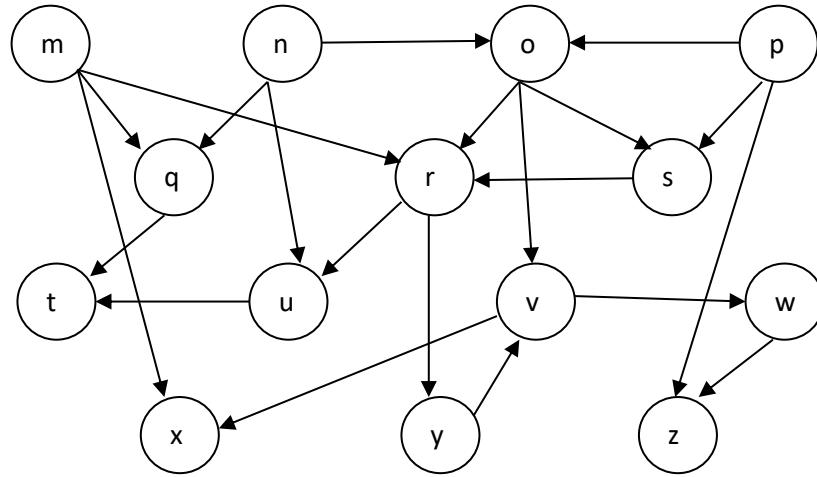
1. (15 points) Show d and π values that result from running Breadth First Search on the directed graph below using vertex 3 as the start node.



2. (10 points) Show how Depth First Search works on the graph below by marking on the graph the discovery and finishing times (d and f) for each vertex and the classification of each edge. Assume that the for loops in DFS and DFS-VISIT consider vertices alphabetically.



3. (15 points) List the vertices of the graph below in Topological Order, as produced by the Topological Sort algorithm. Assume that the for loops in DFS and DFS-VISIT consider vertices alphabetically.



From Left → Right [n, p, o, m, s, r, y, v, q, u, w, t, x, z]

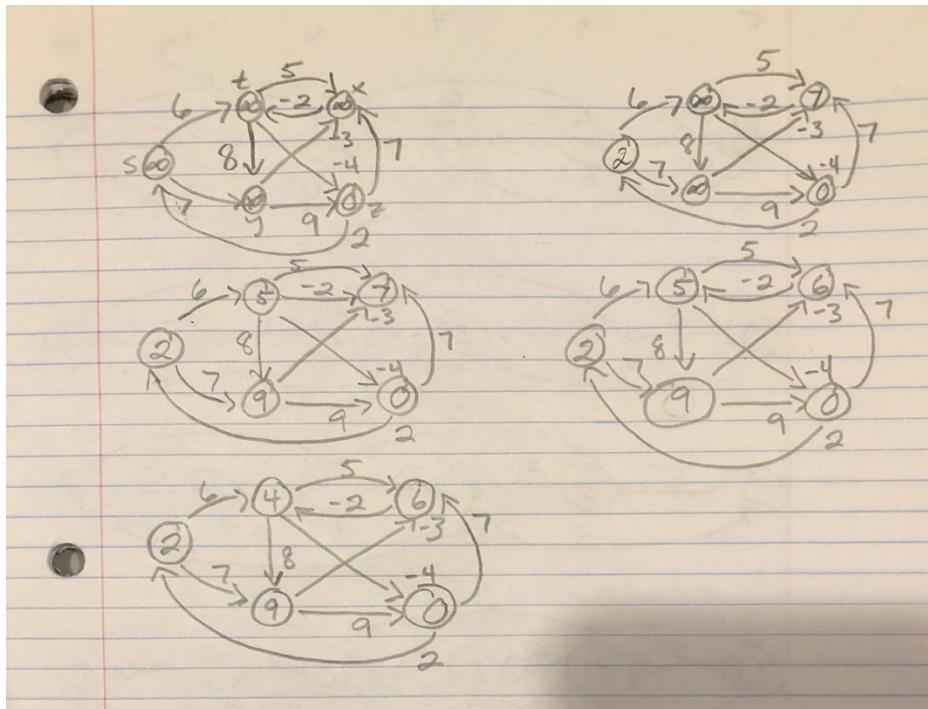
4. (15 points) Do Problem 24.1-1 (p. 654) (you do not have to do the last part, i.e., running the algorithm again after changing an edge weight).

D VALUES

s	t	x	y	z
infinity	infinity	infinity	infinity	0
2	infinity	7	infinity	0
2	5	7	9	0
2	5	6	9	0
2	4	6	9	0

π VALUES

s	t	x	y	z
NIL	NIL	NIL	NIL	NIL
Z	NIL	Z	NIL	NIL
Z	X	Z	S	NIL
Z	X	Y	S	NIL
Z	x	Y	S	NIL



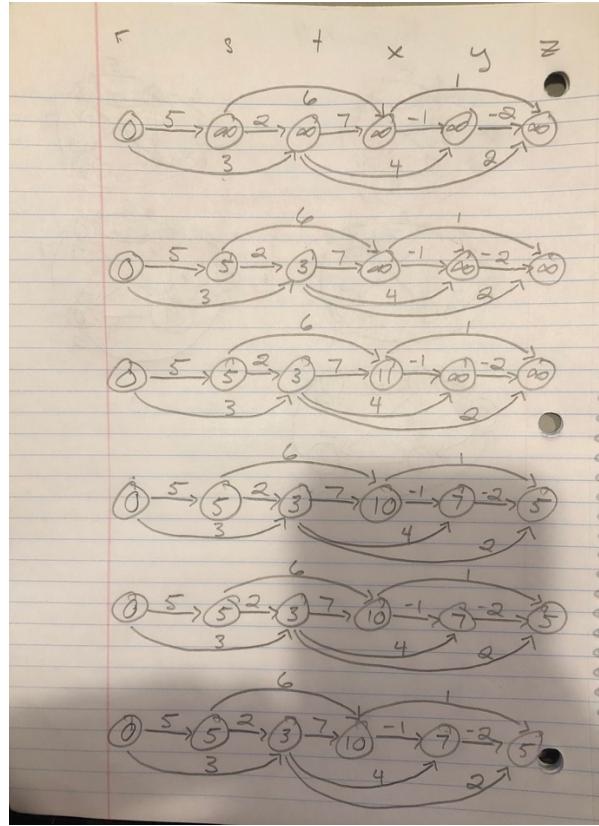
5. (15 points) Do Problem 24.2-1 (p. 657). Show the results similar to Fig. 24.5.

D VALUES

r	s	t	x	y	z
0	infinity	infinity	infinity	infinity	infinity
0	5	3	infinity	infinity	infinity
0	5	3	11	infinity	infinity
0	5	3	10	7	5
0	5	3	10	7	5
0	5	3	10	7	5

π VALUES

r	s	t	x	y	z
NIL	NIL	NIL	NIL	NIL	NIL
NIL	R	R	NIL	NIL	NIL
NIL	R	R	S	NIL	NIL
NIL	R	R	T	T	T
NIL	R	R	T	T	T
NIL	R	R	T	T	T



6. (20 points) Do Problem 24.3-1 (p. 662).

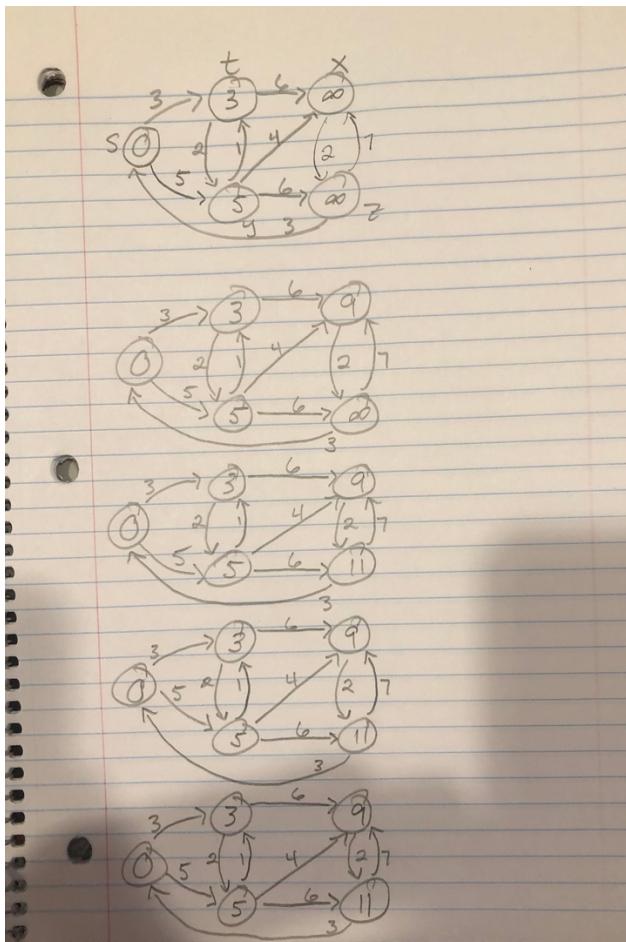
S as Source

D VALUES

s	t	x	y	z
0	3	infinity	5	infinity
0	3	9	5	infinity
0	3	9	5	11
0	3	9	5	11
0	3	9	5	11

π VALUES

s	t	x	y	z
NIL	s	NIL	NIL	NIL
NIL	S	t	S	NIL
NIL	S	t	S	Y
NIL	S	t	S	Y
NIL	s	t	S	Y



**Z as Source
D VALUES**

s	t	x	y	z
3	infinity	7	infinity	0
3	6	7	8	0
3	6	7	8	0
3	6	7	8	0
3	6	7	8	0

π VALUES

s	t	x	y	z
Z	NIL	Z	NIL	NIL
Z	S	Z	S	NIL
Z	S	Z	S	NIL

Z	S	Z	S	NIL
Z	S	Z	S	NIL

(7) (10 points) Suppose that a graph G has a Minimum Spanning Tree (MST) computed. How quickly can we update the MST if we add a new vertex and incident edges to G. Propose and outline a strategy and present an algorithm (you can reuse graph algorithms covered in class as building blocks as part of your solution) and evaluate its asymptotic complexity.

If the edge being added is only one edge, then just add the edge.

If the amount of edges being added are $k(k>1)$ then we need to remove $k-1$ edges. We can find these cycles with Union find and remove the highest weight edge in a union.

(I also read in section 23.2 that there is such an algorithm that accomplishes this very well called “Prim’s algorithm”. All that’s needed is to take into account the previous and new edges. This works because the new graph made by Prim’s is only made of the old MST or any new edges.