CSCI 6470 Quiz #5 Questions Answers

October 24, 2023 (12:45am-1:15pm EST)

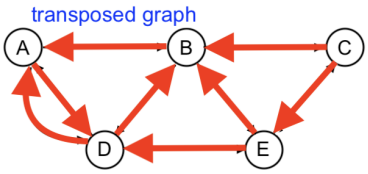
Student Name _____ **Student ID**_____

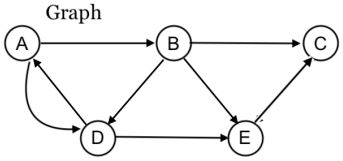
Rules. Violation will result in **zero credit** for the exam and possibly the final grade.
1. Closed book/note/electronics/neighborhood.
2. Surrender your cell phone to the podium before using the restroom.

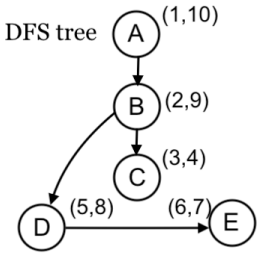
There are 4 questions and 60 points in total. Good luck!

1. (**15 points**) Finding strongly connected components (SCCs) consists of 3 steps. The first step is done as the shown DFS tree on the given graph. Complete the rest o

   (1) Draw the transposed graph in the following space: *3 points*

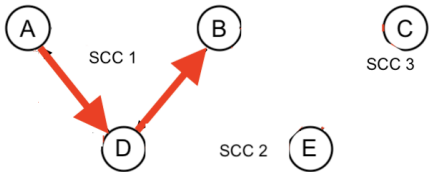






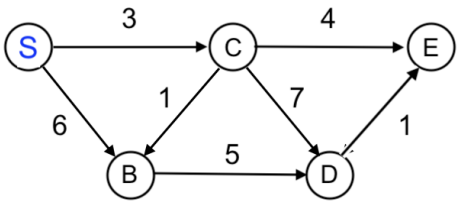
   (2) Draw the 2nd DFS forest, and based upon which, to identify all SCCs.

   SCC1 : 8 points *SCC2 : 2 points* *SCC3 : 2 points*



2. (**15 points**) Run algorithm `shortest-paths-DAG` on the given DAG; show `dist` values for all vertices **after** every edge relaxation in a topological order including their initial `dist` values.

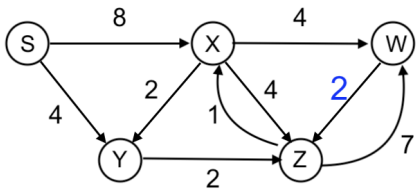
Vertex	S	B	C	D	E	relaxed edge
`dist`	0	∞	∞	∞	∞	
`dist`	0	∞	③	∞	∞	(S,C)
`dist`	0	⑥	3	∞	∞	(S,B)
`dist`	0	④	3	∞	∞	(C,B)
`dist`	0	4	3	⑩	∞	(C,D)
`dist`	0	4	3	10	⑦	(C,E)
`dist`	0	4	3	⑨	7	(B,D)
`dist`	0	4	3	9	7	(D,E)



- Each row is for ONE EDGE; order of relaxation may be different in (C,B), (C,D), (C,E).
- *3 points* for a correct topological order; S, C, B, D, E
- *2 points* for every updated number that is circled.

3. (**15 points**) Run `Dijkstra` algorithm on the following graph; show `dist` values for all vertices **after** every vertex is dequeued and relevant edges are relaxed, including their initial `dist` values.

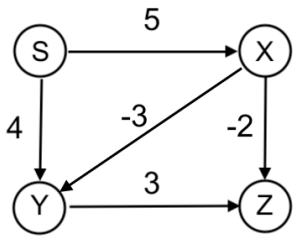
Vertex	S	X	Y	Z	W	dequeued vertex
`dist`	0	∞	∞	∞	∞	
`dist`	0	⑧	④	∞	∞	S
`dist`	0	8	4	⑥	∞	Y
`dist`	0	⑦	4	6	⑬	Z
`dist`	0	7	4	6	⑪	X
`dist`	0	7	4	6	11	W



- 3 *points* for the order of vertices picked dequeuec
- 2 *points* for every updated number that is circlec

4. (**15 points**) Run `Bellman-Ford` algorithm on the following directed graph contains negative-weight edges. Assume at each round of relaxation, the edges are relaxed in the order of `(X,Z)`, `(Y,Z)`, `(S,X)`, `(S,Y)`, `(X,Y)`. Show `dist` values for all vertices **after** every round of relaxation, including their initial `dist` values.

Vertex	S	X	Y	Z	round of relaxation
`dist`	0	∞	∞	∞	
`dist`	0	⑤	②	∞	1^{st}
`dist`	0	5	2	③	2^{nd}
`dist`	0	5	2	3	3^{rd}
`dist`	0	5	2	3	4^{th}



- 3 *points* following the order of the edges relaxed at each round of relaxation;
- 4 *points* for every updated number that is circled.

[The following space will not be graded.]