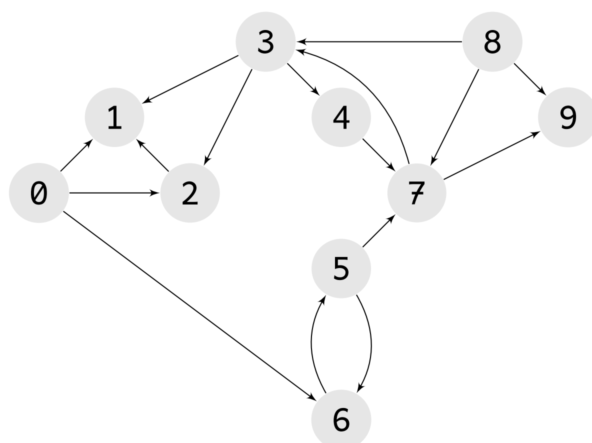
Midterm 4 practice test

CS 133

December 9, 2019

1 Graphs

The next few problems will use the following directed graph:



▶ Is this graph

- Strongly connected? No
- Weakly connected? Yes
- Acyclic No
- Has a sink? (if so, which node(s)) Yes, 9, 1.
- Has a source? (if so, which node(s)) Yes, 0, 8

▶ Perform a *breadth-first traversal* of this graph, starting at node 0, and labeling each node with its distance from the starting node.

Node	Distance
0	0
1	1
2	1
3	4
4	5
5	2
6	1
7	3
8	$+\infty$
9	4

▶ Perform a *depth-first traversal* of this graph, starting at node 0, and labeling each node with its starting and ending times.

You'll get varying answers depending on the path you take through the graph, but node 0 should be labeled with times 0/17.

▶ Draw the adjacency list representation of this graph.

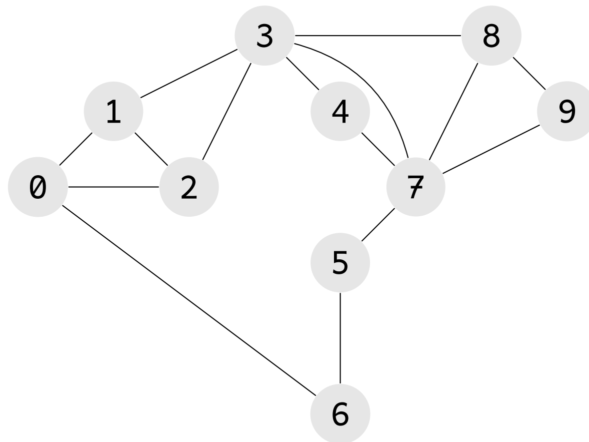
0	1,2,6
1	
2	1
3	1,2,4
4	7
5	6,7
6	5
7	3,9
8	3,7,9
9	

▶ Draw the adj. matrix representation of this graph.

	0	1	2	3	4	5	6	7	8	9
0	.	T	T				T			
1		.								
2		T	.							
3		T	T	.	T					
4					.			T		
5						.	T	T		
6						T	.			
7				T				.		T
8				T				T	.	T
9										.

I've put dots along the diagonal where the implicit self-connections would be.

The following undirected graph will be used in the next two problems:



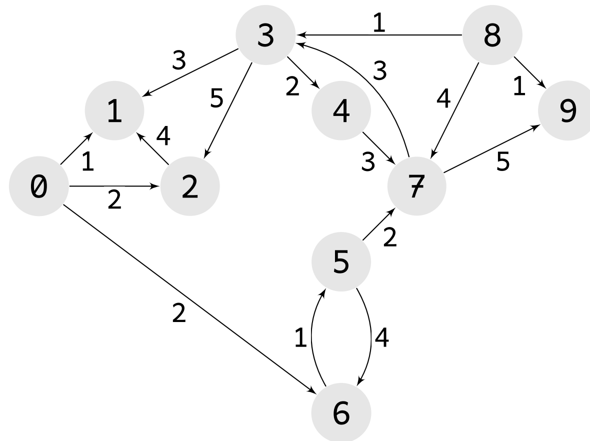
▶ Perform a breadth-first traversal, starting at node 3, labeling nodes with distances.

Node	Distance
0	2
1	1
2	1
3	0
4	1
5	2
6	3
7	1
8	1
9	2

▶ Perform a depth-first traversal, starting at 3, labeling nodes with starting and ending times.

Again, you'll get different answers but you should end up with a final time at node 3 of 0/19.

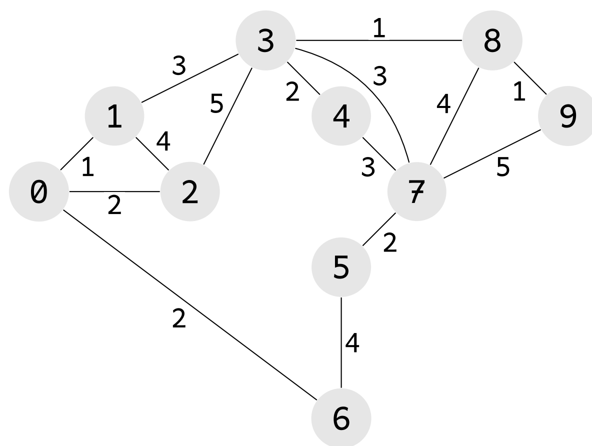
The following weighted, directed graph will be used for the next two problems.

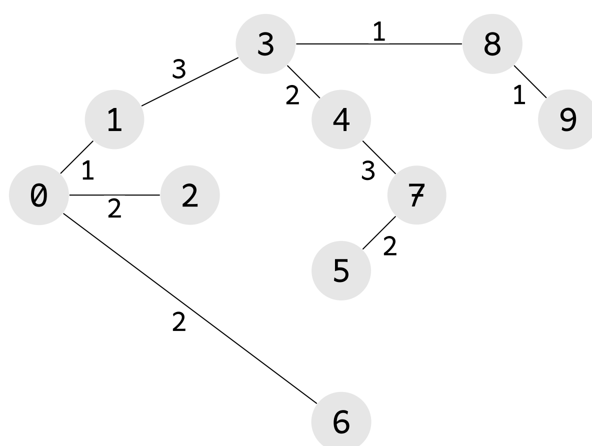

0
1
2
3
4
5
6
7
8
9

- ► Use Dijkstra's algorithm to find the shortest-weight paths from a starting node of 3.

The only nodes reachable from 3 are 1, 2, 4, 7, and 9. These will have distance-weights of 3, 5, 2, 5, and 10, respectively.

- ► Find a minimum spanning tree for the following graph:





Is the minimum spanning tree unique?

I think you can make another MST.