15-122: Principles of Imperative Computation

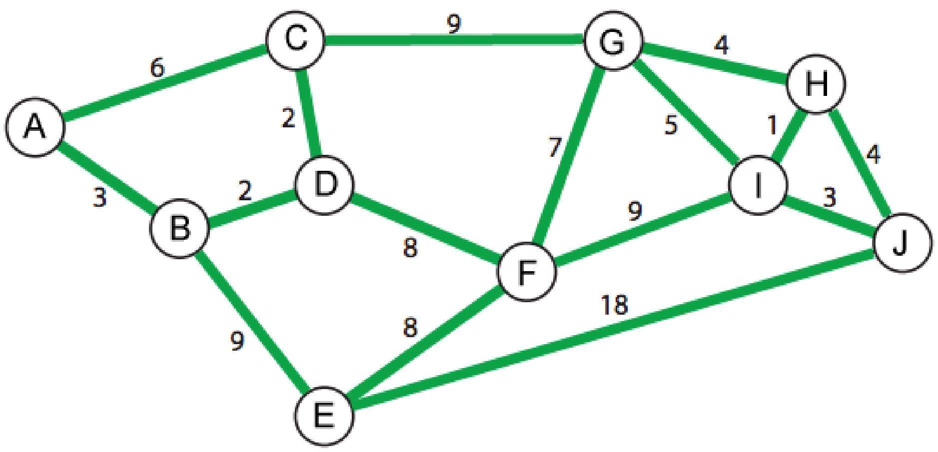
QuickCheck 6 May 3, 2013

Today, we'll do the QuickCheck at the beginning of recitation. You will have twenty minutes to do this. Your TA will go over answers at the end. Then hand in this QuickCheck to your TA.

Name (all caps)																

AndrewID (all caps)								

Section (all caps)	



Compute the edges in the MST of the above graph in the order they would be added (lowest to highest weight) under Kruskal's algorithm. The first edge has been done for you. There might be more boxes than edges you should fill in.

Edge #1 (all caps)	H	I

Edge #2 (all caps)		

Edge #3 (all caps)		

Edge #4 (all caps)		

Edge #5 (all caps)		

Edge #6 (all caps)		

Edge #7 (all caps)		

Edge #8 (all caps)		

Edge #9 (all caps)		

Edge #10 (all caps)		

Edge #11 (all caps)		

Edge #12 (all caps)		

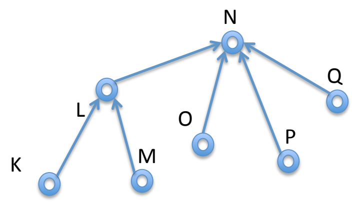
After running Kruskal's algorithm on the graph above, using a union find structure, how many unique equivalence classes would remain?

Answer (all caps)		

If we keep track of the height of a union-find data structure and use that information to always point smaller trees to larger ones, what is the runtime complexity of performing a single union on a union-find structure with n vertices?

Answer (all caps)	$\mathcal{O}(\quad\quad)$

The following is a representation of a union find data structure as a graph (left) and as an array (right), where index 0 corresponds to K, index 1 corresponds to L, and so on.

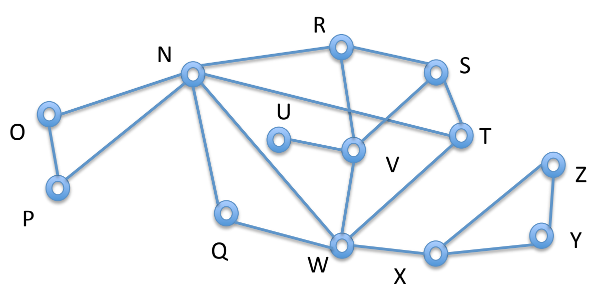


K 0	L 1	M 2	N 3	O 4	P 5	Q 6
1	3	1	-3	3	3	3

If the union operation only ever points smaller trees to bigger ones but may connect trees of the same size in either direction, describe a series of operations that could result in the following tree. Use each letter exactly once. (The answer may not be unique.)

Union #1 (all caps)	K	
Union #2 (all caps)	L	
Union #3 (all caps)	Q	
Union #4 (all caps)	N	
Union #5 (all caps)	N	
Union #6 (all caps)		

Consider the following graph:



Starting from Q, write out the longest sequence of nodes that we might mark in *depth-first search* before successfully finding N?

Answer (all caps)													