Name: _____ **100 points total**

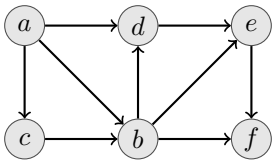
CS 2123 Homework 2 Fall 2019

Assignment is due at 11:59pm on October 2. Submit a digital copy of the assignment on Harvey. Submit the file as a single PDF named HW2LastNameFirstName.pdf. If you are working with a partner, turn in one assignment.

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. **NOTE: students who worked in pairs on HW1 must work with a different partner on HW2.**

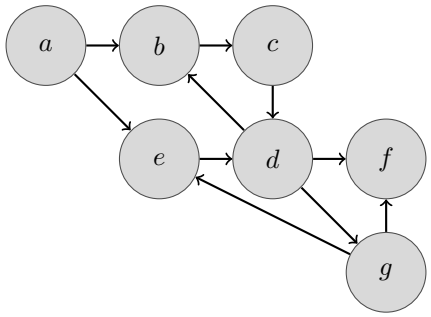
Q1 (18)	_____
Q2 (28)	_____
Q3 (18)	_____
Q4 (18)	_____
Q5 (18)	_____
Total (100)	_____

Q1. (18 points)
Consider the following directed acyclic graph:



Identify a topological sorting of vertices of the above graph using an inductive algorithm. Show your work, similar to what was done in class (e.g., cross out the vertices and number each step).

Q2. (28 points)
Consider the following directed graph:



a. Construct a depth-first search tree starting at node a. Break all ties by picking the vertex that comes first alphabetically. Show your work (include the order in which vertices are discovered, the order in which vertices are processed, numbering the edges, plus any forward, back and cross edges in the DFS tree).

b. Construct a breadth-first search tree starting at node a. Break all ties by picking the vertex that comes first alphabetically. Show your work (include the order in which vertices are discovered, the order in which vertices are processed, numbering the edges, plus any forward, back and cross edges in the BFS tree).

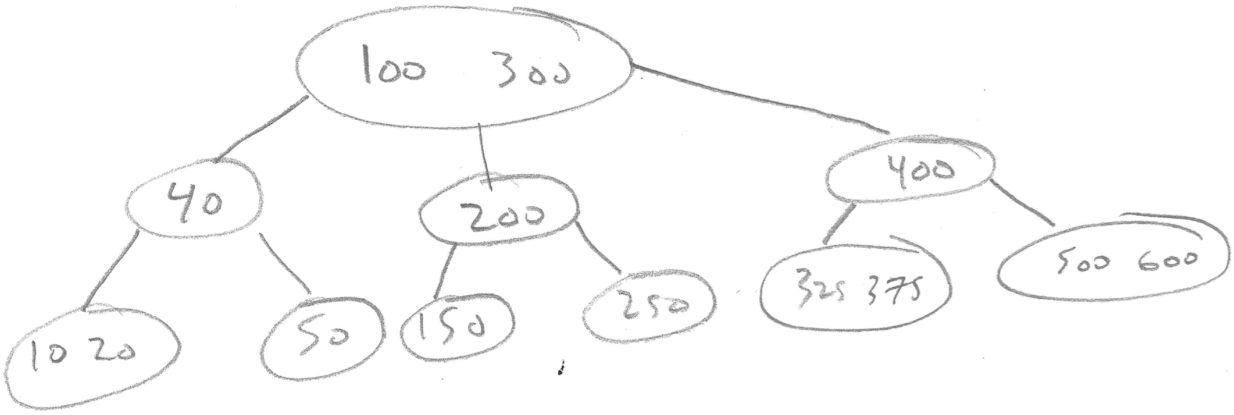
Q3. (18 points)

Insert the following nodes into an initially empty AVL tree: 20, 100, 15, 35, 50, 110, 105.

Show your work by re-drawing the tree whenever a rotation is required, include the newly added node that triggers the rotation with a dotted line on the unbalanced tree, recalculate balance factors where necessary, and identify pivot nodes with a box drawn around the node on the unbalanced tree. In other words, follow the notation used in class.

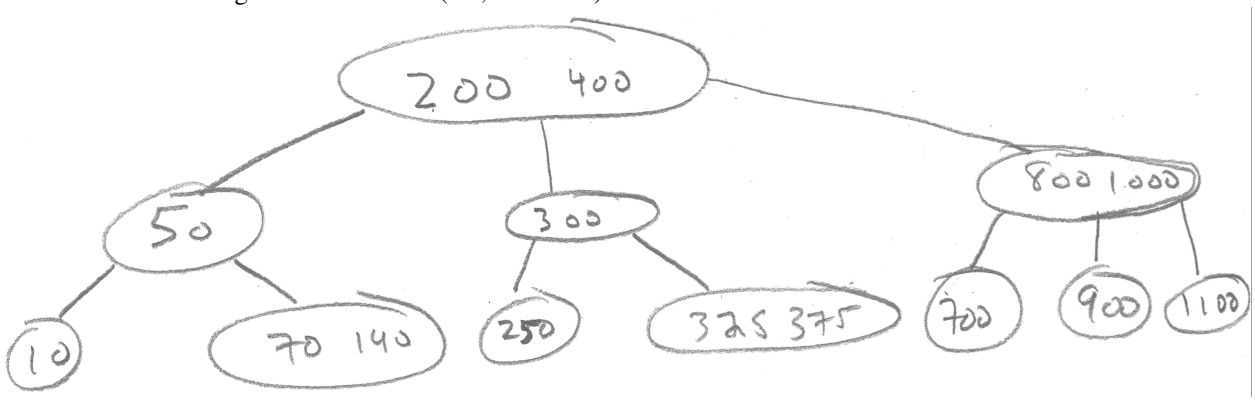
Q4. (18 points)

Consider the following B-tree of order 3 (i.e., a 2-3 tree):



Insert the following nodes in order: 30, 60, 15, 70, 5. Redraw the tree whenever edges have to be reordered or significant node relabeling is required.

Q5. (18 points)
Consider the following B-tree of order 3 (i.e., a 2-3 tree):



Delete the following nodes in order: 10, 300, 325.
Redraw the tree whenever edges have to be reordered or significant node relabeling is required.