

INSTRUCTIONS:

Write or type your answers on paper. Hand in your answers in class on the due date shown above. Attempt all problems. The maximum grade on this assignment is 20.

Problem 1: [5 pts] (Exercise 8, Sect. 5.2) A graph is bipartite if all its vertices can be partitioned in two subsets X and Y so that every edge connects a vertex in X with a vertex in Y . Design a DFS algorithm to check whether the graph is bipartite or not. Write pseudocode and explain your algorithm.

Problem 2: [5 pts] (Exercise 3, Sect. 5.1) Design a decrease-by-one algorithm for generating all subsets of a set S of n elements. For example, if $S = \{a, b\}$, then the subsets are \emptyset , $\{a\}$, $\{b\}$, and $\{a, b\}$. Write your algorithm in pseudocode and explain.

Problem 3: [10 pts] The following sequence of keys (1, 2, 3, 4, 8, 7, 6, 5, 9, 10) is inserted in an empty dictionary. Trace the shape of the dictionary if:

- a) The dictionary is implemented by an AVL tree.
- b) The dictionary is implemented by a 2-3 tree.

For every insertion draw: (i) The shape of the tree with the new node inserted, before any balancing operation on the tree. (ii) The shape of the tree after balancing, if balancing was required.