

Name (last, first): _____

UCLA Computer Science Department

CS 180
Midterm

Algorithms & Complexity
Total Time: 1.5 hours

ID (4 digits): _ _ _ _
November 1, 2010

Question:	1	2	3	4	5	Total
Points:	20	20	20	20	20	100
Score:						

- (20 points) Prims MST algorithm
 - Describe Prims MST algorithm (in English—bullet by bullet; no pseudo-code).
 - Analyze its time complexity (using a heap).
- (20 points) (a) We are given a set of activities $I_1 \dots I_n$: each activity I_i is represented by its left-point L_i and its right-point R_i . Design a very efficient algorithm that finds the maximum number of mutually overlapping subset of activities (write your solution on English, bullet by bullet).
 - Analyze** the time complexity of your algorithm.
- (20 points) Majority in a voting system is a candidate who gets more than half the votes (example: if there are 8 votes the majority must get 5 votes or more). Given a list of n votes, each vote holding a candidate name design an efficient algorithm for finding a majority among n votes. (**Note:** You do not know, in advance, how many candidates there are or what their names are: so bucket sorting or counting does not work).

Design an efficient algorithm for finding a majority among n votes.
- (20 points) A Hamiltonian path in a graph is a path that has no repeated vertices and covers all vertices. Design an efficient algorithm for finding a Hamiltonian path in a directed acyclic graph (DAG). Describe your algorithm in English, bullet by bullet.
- (20 points) Consider a sorted sequence a_1, \dots, a_n of distinct integers. Design an efficient algorithm that decide whether there is an integer a_i such that $a_i = i$. For example, if the sequence is -1, 3, 4, 5, 7, 9 then the answer is NO. If the sequence is 1,2,4,5,7,8 the answer is yes for $i = 2$.

Note that an $O(n)$ time algorithm would be trivial.

Describe your algorithm in English bullet-by-bullet.