

U C L A Computer Science Department**CS 180****Algorithms & Complexity**

ID (4 digit): _____

Midterm**Total Time: 1.5 hours****November 1, 2010**

- 1 a. Describe Prim's MST algorithm (in English – bullet by bullet; no pseudo-code). b. Analyze its time complexity (using a heap).

- 2 . 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). b. **Analyze** the time complexity of your algorithm.

3. 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.

- 4 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.

5. 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.