CS 473: Fundamental Algorithms, Spring 2011

HW 6

Question 1 is due by **Sunday, 23:59:59, March 13** Questions 2-4 are due by **Monday, 23:59:59, March 14**

This homework contains four problems. **Read the instructions for submitting homework on the course webpage**.

Collaboration Policy: For this homework, Problems 2–4 can be worked in groups of up to three students.

Problem 1 should be answered in Compass as part of the assessment HW6-Online and should be done individually.

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1. HW6-Online. (20 pts.)

2. MST Stuff. (30 pts.)

   You are given an undirected weighted graph $G = (V, E)$ with n vertices and m edges. Assume the weights of the edges are all distinct.

   (A) (10 pts.) Let $E' \subseteq E$ be the set of those edges of G with weight less than or equal to the median of edge weights. Give an $O(n+m)$ time algorithm to determine whether the MST of G uses only edges in E' or not.

   (B) (20 pts.) Give an $O(n+m)$ time algorithm that outputs the heaviest edge in the (unique) MST of G.

3. Palindrome II. (30 pts.)

   A sequence is ***palindromic*** if it is the same whether read left to right or right to left. An example is $m, a, l, a, y, a, l, a, m$ (*Malyalam* is a Southern Indian language). Given a sequence $a_1, a_2, \ldots, a_n$ describe an algorithm to compute a *shortest* palindromic *supersequence* of the given sequence. For example, the sequence below

   `blab`

   has the palindrome `blalb` as the shortest supersequence.

   What is the running time of your algorithm?

4. Serving time. (20 pts.)

   A server has n customers waiting to be served. The service time required by each customer is known in advance: it is t_i minutes for customer i. So if, for example, the customers are served in order of increasing i, then the ith customer has to wait $\sum_{j=1}^{i} t_j$ minutes. We wish to minimize the total waiting time

   $$T = \sum_{i=1}^{n} (\text{time spent waiting by customer } i).$$

Give an efcient algorithm for computing the optimal order in which to process the customers. How fast is your algorithm