CSE 222 (ADA) Homework Assignment 3 (Theory)

Deadline : April 21 (Friday) 11.59pm.

The theory assignment has to be done in a team of at most two members, as already selected by you. The solutions are to be typed either as a word document or latex-ed and uploaded as pdf on GC. We shall strictly not accept solutions written in any other form. Remember that both team members need to upload the HW solution on GC. Collaboration across teams or seeking help from any sources other than the lectures, notes and texts mentioned on the homepage will be considered an act of plagiarism

Problem 1. (10 points) (Greedy Algorithms) Suppose you are given n tasks $J = \{j_1, j_2, \cdots j_n\}$. Each task j_ℓ has two parts - a preprocessing phase which takes p_ℓ units and a main phase which takes f_ℓ units of time. There are n machines that can execute the main phases of the jobs *in parallel*. However, the preprocessing phases need to be executed sequentially on a special machine. The completion time of any schedule is the earliest time when *all tasks* have finished execution. Design a greedy algorithm which produces a schedule that minimizes the completion time. Here, you need to give formal proof of correctness. Your proof should not exceed one side of an A4 sheet. Anything more than that will not be considered by the evaluator.

Problem 2. (10 marks for each part) Solve problem 22 Part(a). You can find it here (this is a clickable link). We want linear time, that is $\mathcal{O}(m+n)$ algorithms for both the parts. For part(b), you will get 50% credit for solving in $\mathcal{O}(n(m+n))$ time and no credit for anything that is slower.

Hint 1: The distance array D has nothing to do with the edges in the graph. *Hint 2* : DP !

Follow the usual template for DP solutions. Any non-DP solution will require a formal proof of correctness which is less than one side of an A4 sheet. An algorithm without proof fetches a zero. Moral of the story : Use DP.

Problem 3. (5 points) You are given a graph $G = (V, E)$ where the weights of the edges can have only three possible values - 2, 5 and 7. Design a linear time , that is $\mathcal{O}(E+V)$ time algorithm to find the minimum spanning tree of G. *Hint:* Modify a known algorithm. No proof of correctness required. But argue runtime for credit.