CS345: Design and Analysis of Algorithms

Assignment 2

Due Date: 6th September

Total Number of Pages: 1 Total Points 20

Instructions-

1. For submission typeset the solution to each problem and compile them in a single pdf file. Hand-written solutions will not be accepted. You can use LaTeX or Word for typesetting.
2. Start each problem from a new page. Write down your Name, Roll number and problem number clearly for each problem.
3. For each question, give the pseudo-code of the algorithm with a clear description of the algorithm. Unclear description will receive less marks. Less optimal solutions will receive only partial marks.
4. Assume that sorting would have $O(n \log n)$ complexity.

Question 1. (10 points) A photocopy shop has a single large machine. Each morning the shop receives a set of jobs from customers. The shopkeeper wants to do the jobs on the single photocopying machine in an order that keeps their customers happiest. Customer i's job will take t_i time to complete. Given a schedule (ordering of the jobs), let C_i denote the finishing time of job i. For example, if job i is the first to be done, we would have $C_i = t_i$; and if job j is done right after job i, we would have $C_j = C_i + t_j$. Each customer has a given weight w_i that represents his or her importance to the business. The happiness of customer i is expected to be dependent on the finishing time of i's job. So the company decides that they want to order the jobs to minimize the weighted sum of the completion time, $\sum_{i=1}^{n} w_i C_i$.

Design an efficient algorithm to solve this problem. That is, you are given a set of n jobs: job i has a processing time t_i and a weight w_i. You want to order the jobs so as to minimize the weighted sum of the completion time, $\sum_{i=1}^{n} w_i C_i$.

Question 2. (10 points) You are given a directed acyclic graph $G = (V, E)$ in which each node $u \in V$ has an associated price, denoted by $price(u)$, which is a positive integer. The cost of a node u, denoted by $cost(u)$,is defined to be the price of the cheapest node reachable from u (including u itself). Design an algorithm that computes $cost(u)$ for all $u \in V$.