CSE 312 Midterm

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I. Question (25 points)

A contiguous subsequence of a list S of **non-negative numbers** is a subsequence made up of consecutive elements of S. For instance, if S is

$$5, 15, 0, 10, 5, 40, 0, 12$$

then 15, 0, 10 is a contiguous subsequence but 5, 15, 40 is not. Give a linear time algorithm that finds the contiguous subsequence of maximum product. For the preceding example, the answer would be 10, 5, 40, with a product of 2000.

II. Question (24 points)

There are n people who need to be assigned to execute n jobs, one person per job. (That is, each person is assigned to exactly one job and each job is assigned to exactly one person.) The cost that would occur if the i'th person is assigned to the j'th job is known quantity C[i, j] for each pair $i, j = 1, 2, \ldots, n$. The problem is to find an assignment with the minimum cost.

A small instance of this problem follows, with the table entries representing the assignment costs C[i, j]:

	Job 1	Job 2	Job 3	Job 4
Person 1	9	2	7	8
Person 2	6	4	3	7
Person 3	5	8	1	8
Person 4	7	6	9	4

- Design a greedy algorithm for the assignment problem.
- Does your greedy algorithm always yield an optimal solution?

III. Question (30 points)

Explain what adjustments, if any, need to be made in Dijkstra's algorithm to solve the following problems.

- Find a shortest path between two given vertices of a weighted graph.
- Find the shortest paths to a given vertex from each other vertex of a weighted graph
- Solve the single-source shortest-paths problem in a graph with nonnegative numbers assigned to its vertices (and the length of a path defined as the sum of the vertex numbers on the path)

IV. Question (21 points)

Consider the following linear programming problem

$$\begin{aligned} &\mathit{minimize}\ c_1x + c_2y \\ x + y &\geq 4 \\ x + 3y &\geq 6 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

where c_1 and c_2 are some real numbers not both equal to zero. Draw the feasible region and

- Give an example of coefficient values c_1 and c_2 for which the problem has a unique optimal solution.
- Give an example of coefficient values c_1 and c_2 for which the problem has infinitely many optimal solutions.
- Give an example of coefficient values c_1 and c_2 for which the solution is unbounded.