Assignment 9

Design and Analysis of Algorithms

The[1] CLRS-textbook notation is used in the following problems.

Problem 1: (10 points) Consider a directed graph $G = (V, E)$, where V is the set of vertices, and E is the set of edges. Also $|V| = n$, and $|E| = m$. How long does it take to compute the out-degree of each vertex? How long does it take to compute the in-degree of each vertex?

That is, using the big-Θ notation, determine a tight bound for the timing in terms of m and n.

Problem 2: (20 points) The following problems are from *Introduction to Algorithms*, by CLRS. If the solution of a problem is posted publicly, then understand it and copy.

Points	Second Edition	Third Edition
15	Page 531: 22.1-7	Page 593: 22.1-7

Hint: Try some toy examples, to get insight.

Problem 3: (20 points) You are given an undirected graph $G = (V, E)$, where elements of the vertex set V are $1, 2, 3, 4$, and 5. The graph is fully connected. The adjacency matrix, and the cost matrices are:

$$A = \begin{bmatrix} 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 & 0 \end{bmatrix}, \quad C = \begin{bmatrix} \infty & 3 & 4 & 5 & 6 \\ 3 & \infty & 1 & 4 & 2 \\ 4 & 1 & \infty & 5 & 7 \\ 5 & 4 & 5 & \infty & 3 \\ 6 & 2 & 7 & 3 & \infty \end{bmatrix}$$

(a) (10 points) Use Prim's algorithm to determine MST.

(b) (10 points) Use Kruskal's algorithm to determine MST.

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