Algorithms I

Tutorial 6

October 21, 2016

Problem 1

CLRS 23.1-1

Problem 2

CLRS 23.1-3

Problem 3

CLRS 23.1-6

Problem 4

CLRS 22.4-3

Note: Model the following problems as graph problems and solve them assuming both adjacency list and adjacency matrix

Problem 5

There are N cities in Magicland. Some of the cities are connected by some roads. A road connects two cities and is bi-directional i.e we can go either way through a road. There is a path from a city i to every other city j and there is no cycle among the cities. You need to find a pair of cities (i, j) such that the length of the path between i and j is maximum among all such pairs. The length of a path is the number of edges on the path.

Problem 6

You are given a DAG (Directed Acyclic Graph) $G(V, E)$. You need to find the longest path in G. The length of a path is the number of edges on the path. Your algorithm should run in $O(V^2)$ time for adjacency matrix representation and $O(V + E)$ time for adjacency list representation.

Problem 7

Let us consider an undirected connected graph $G(V, E)$. A vertex v is called a *cut vertex* or *articulation point* if after removing v and all the edges incident on v, the graph becomes disconnected. You need to find all the articulation points in G in $\Theta(V^3)$ time for adjacency matrix representation and $\Theta(V(V+E))$ time for adjacency list representation. Can you improve it to $O(V^2)$ for adjacency matrix representation and $O(V+E)$ for adjacency list representation.

Problem 8

There are N variables $x_1, x_2, \ldots x_N$ and M relations of the form $x_i < x_j$ where $i \neq j$. A subset S of relations is called inconsistent if there does not exist any assignment of variables that satisfies all the relations in S. e.g $\{x_1 < x_2,\ x_2 < x_1\}$ is inconsistent. You need to find if there's an inconsistent subset of M.