CS619 Advanced Data Structures and Algorithms Laboratory
Autumn 2024
Assignment 1
Not for evaluation

Objective

The objective of this assignment is to appreciate the difference between a tractable problem and an intractable problem

Hamiltonian cycle

A Hamiltonian cycle of a simple undirected graph G is a simple cycle containing all vertices of G. It is known that the problem is NP-Complete, so we cannot expect to solve it in polynomial time. A simple algorithm for the Hamiltonian Cycle problem is to generate all permutations of vertices and check whether it forms a Hamiltonian cycle or not.

Euler tour

An Euler tour of a simple undirected graph G is a cycle containing each edge of G exactly once. Note that a vertex can appear multiple times in an Euler tour. It is known that a connected graph has an Euler tour if and only if every vertex has an even degree.

There is a simple efficient algorithm to find an Euler tour in a graph. Compute a cycle (one can use depth first search for this) C in G. Remove the edges of C from G to obtain G'. Recursively compute an Euler tour in each component of G'. Then merge the Euler tour in each component of G' with C to obtain an Euler tour of G.

Input

You are given with a file "graphs.txt" which contains details of many graphs. The first line of description of a graph contains two integers - the number of vertices n and the number of edges m respectively separated by a white space. Each of the next m lines gives an edge in the graph. The numbering of vertices is from 0 to n-1. Blank lines should be ignored.

Tasks

Write two programs - one for finding an Euler tour and one for finding a Hamiltonian Cycle.Your programs should read graphs from the input file and find an Euler tour (if exists) and a Hamiltonian cycle (if exists) respectively. Run your Hamiltonian cycle program on the input file and wait for 10 minutes to see how many instances are solved. Run your Euler tour program on the input file and wait for 10 minutes to see how many instances are solved.