

Algorithms for Minimum Spanning Trees

Lecture 20

Thursday, November 5, 2020

20.1

Minimum Spanning Tree

20.1.1

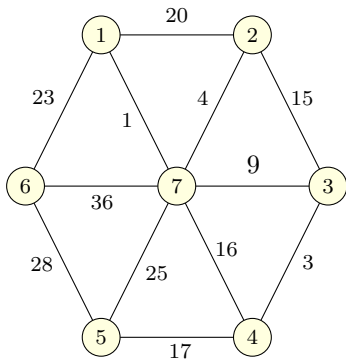
The Problem

Minimum Spanning Tree

Input Connected graph $G = (V, E)$ with edge costs

Goal Find $T \subseteq E$ such that (V, T) is connected and total cost of all edges in T is smallest

① T is the **minimum spanning tree (MST)** of G

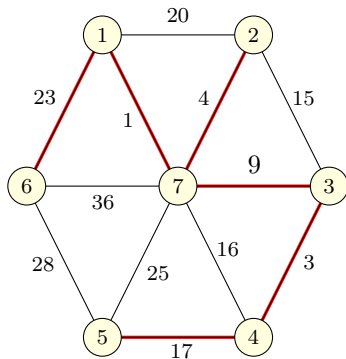


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Applications

- ① Network Design
 - ① Designing networks with minimum cost but maximum connectivity
- ② Approximation algorithms
 - ① Can be used to bound the optimality of algorithms to approximate Traveling Salesman Problem, Steiner Trees, etc.
- ③ Cluster Analysis

Some history

The first algorithm for **MST** was first published in 1926 by Otakar Borůvka as a method of constructing an efficient electricity network for Moravia. From his memoirs:

My studies at poly-technical schools made me feel very close to engineering sciences and made me fully appreciate technical and other applications of mathematics. Soon after the end of World War I, at the beginning of the 1920s, the Electric Power Company of Western Moravia, Brno, was engaged in rural electrification of Southern Moravia. In the framework of my friendly relations with some of their employees, I was asked to solve, from a mathematical standpoint, the question of the most economical construction of an electric power network. I succeeded in finding a construction-as it would be expressed today-of a maximal connected subgraph of minimum length, which I published in 1926 (i.e., at a time when the theory of graphs did not exist).

There is some work in 1909 by a Polish anthropologist Jan Czekanowski on clustering, which is a precursor to MST.

THE END

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(for now)