Lecture 32: Graphs: Minimum Spanning Trees
11:00 AM, Apr 23, 2020

Contents

Objectives

By the end of this lecture, you will know:

• What a minimum spanning tree is

By the end of this lecture, you will be able to:

• Use Jarnik/Prim’s algorithm to construct a minimum spanning tree
• Use Kruskal’s algorithm to construct a minimum spanning tree

1 Minimum Spanning Trees

We’ve been talking about how to find shortest paths between two nodes in a graph. What if instead we needed to connect all nodes using the minimum total edge weight?

A typical motivating example for this is laying electrical wires among towns: given an undirected connected graph in which nodes are towns and weighted edges show the distance between pairs of towns, we need to select a subset of the edges such that (a) every town is included, (b) the subset of edges forms a connected graph, and (c) the total weight of the selected edges is minimal (relative to other sets of edges we might choose). Such a subset of edges is called a minimum spanning tree.

As an example, consider the following graph (using a collection of towns in rural Texas – the edge weights are only approximate). The upper figure shows the original graph. The lower figure shows two spanning trees for the graph: the orange has weight 220 and the green has weight 160. The green one is minimal.
For the rest of today’s notes, we refer to section 19.8 of a textbook called Programming and Programming Languages (written by Brown CS Professor Shriram Krishnamurthi)


We covered through 19.8.4 in this lecture, and will cover 19.8.5 in the next lecture.

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