Let's begin at 9:05 PM

L93
Minimum Spanning Trees: Prim's and Kruskal's

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RECAP

Why MST? What MST?

N cities, M possible roads ⇒ cost of construction for each is known.

1) N-1 roads will be constructed

2) The resultant network will be a tree

3) Sum of road costs min. possible

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An MST is a subset of edges of a connected undirected graph s.t.:

1) It connects all the nodes.

2) No cycles

3) Total sum of edge weights is minimum possible.

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Let’s begin with Kruskal’s Algorithm

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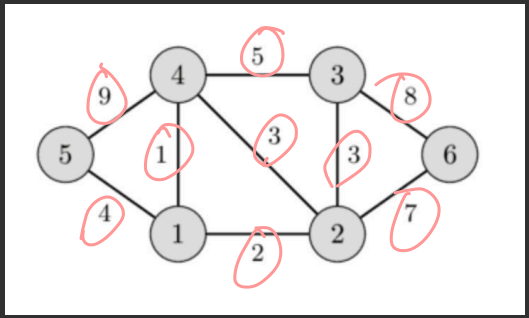
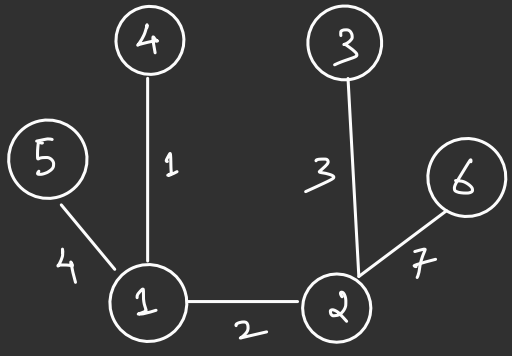
Introduction to the Algorithm





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Proof

"If K is the set of edges chosen by the algo at any given time, then there exists at least 1 MST with this set of edges." (Will try to prove using induction)

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K is the set of edges chosen so far (it's correct).

In the next step, we're about to choose e. (not creating a cycle)

O is a set of optimal edges of an actual MST. (not edges)

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Pass 1 :

e is part of D.

V. Good!

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Pass 2 :

e is not a part of O.

O + e will create a cycle.

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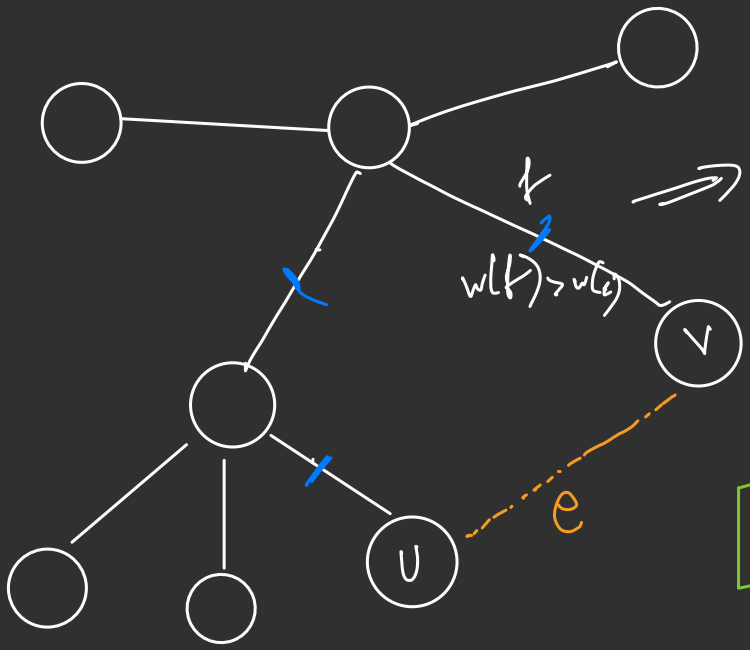

At least 1 edge of 3 that is not chosen yet.

(f)

$w(f) \geq w(e)$

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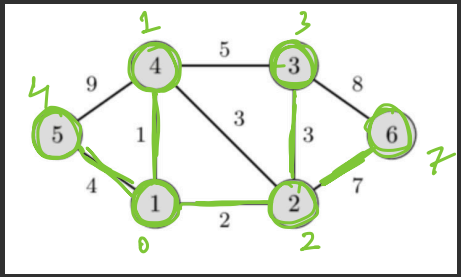
Let’s implement

Prim’s Algorithm

Introduction to the Algorithm



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Let’s implement

A few properties

1. Not only the sum of edge weights is minimized in MST, but the product is also minimized.
2. In any valid MST, the maximum edge weight is also minimized.
3. The set of weights of the edges in an MST is unique:
    a. So, if all the edge weights in the graph are distinct, then MST will be unique.
    b. Otherwise, it may or may not be unique.
4. Similar to Minimum Spanning Tree, maximum spanning tree can also be found using Prim's or Kruskal's algorithms.

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Thank You!

Reminder: Going to the gym & observing the trainer work out can help you know the right technique, but you'll muscle up only if you lift some weights yourself.

So, PRACTICE, PRACTICE, PRACTICE!