Basic Graph Algorithms

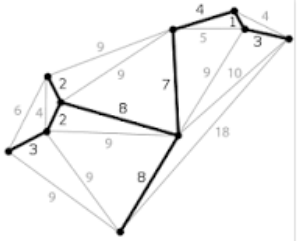
Thursday, September 28, 2017 5:03 PM

Problem A: Arctic Network

Problem B: Island Hopping

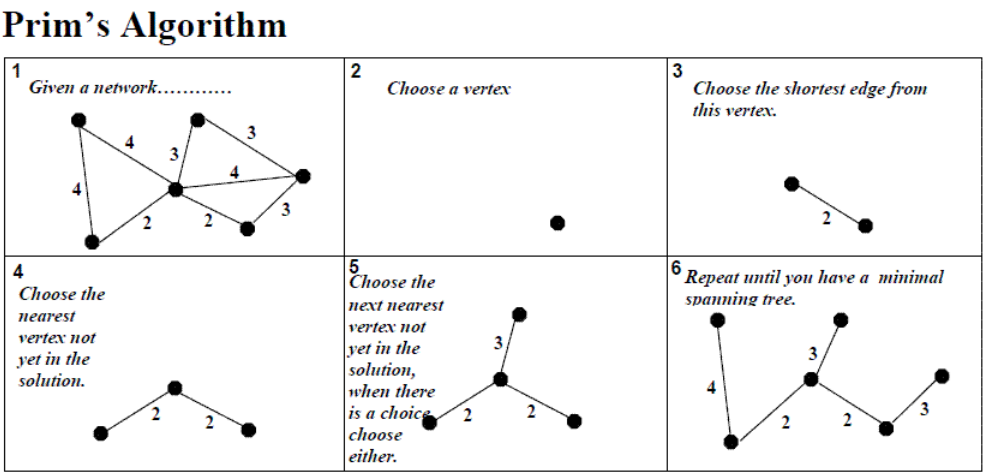
- Minimum Spanning Tree

A **minimum spanning tree** (MST) or **minimum** weight **spanning tree** is a subset of the edges of a connected, edge-weighted undirected graph that connects all the vertices together, without any cycles and with the **minimum** possible total edge weight.

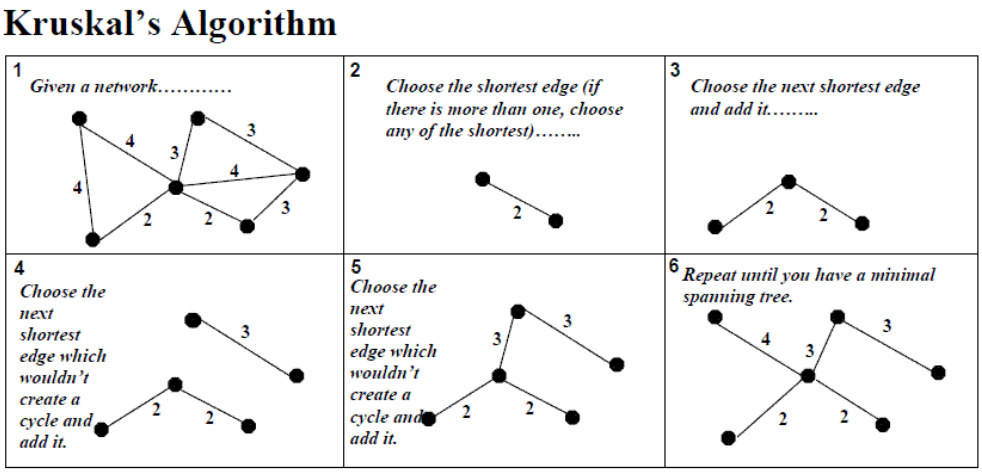


Minimum spanning tree - Wikipedia
https://en.wikipedia.org/wiki/Minimum_spanning_tree

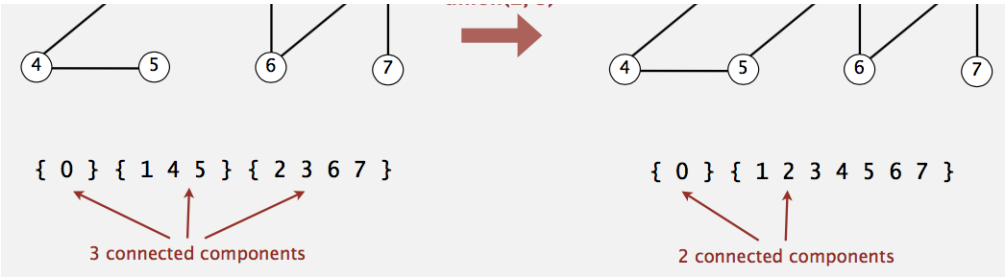
- Prim's Algorithm

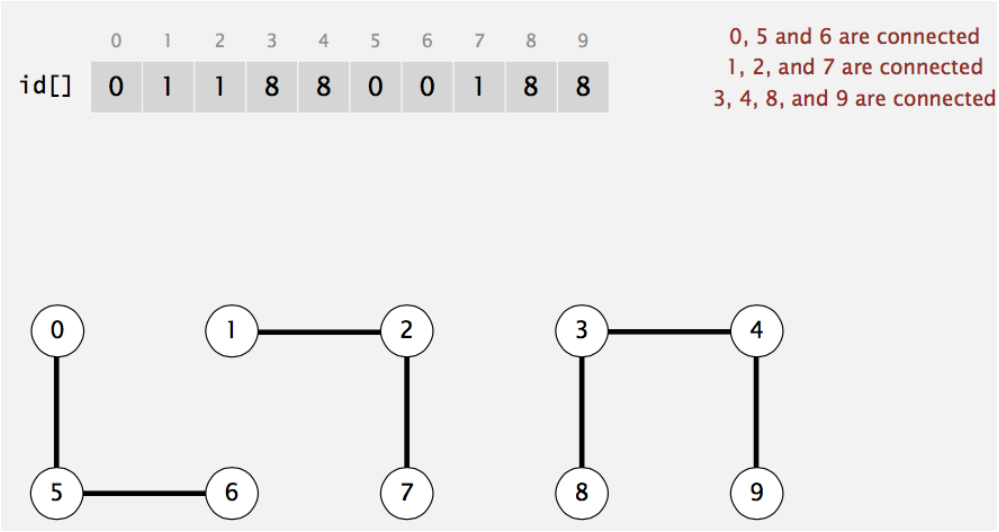


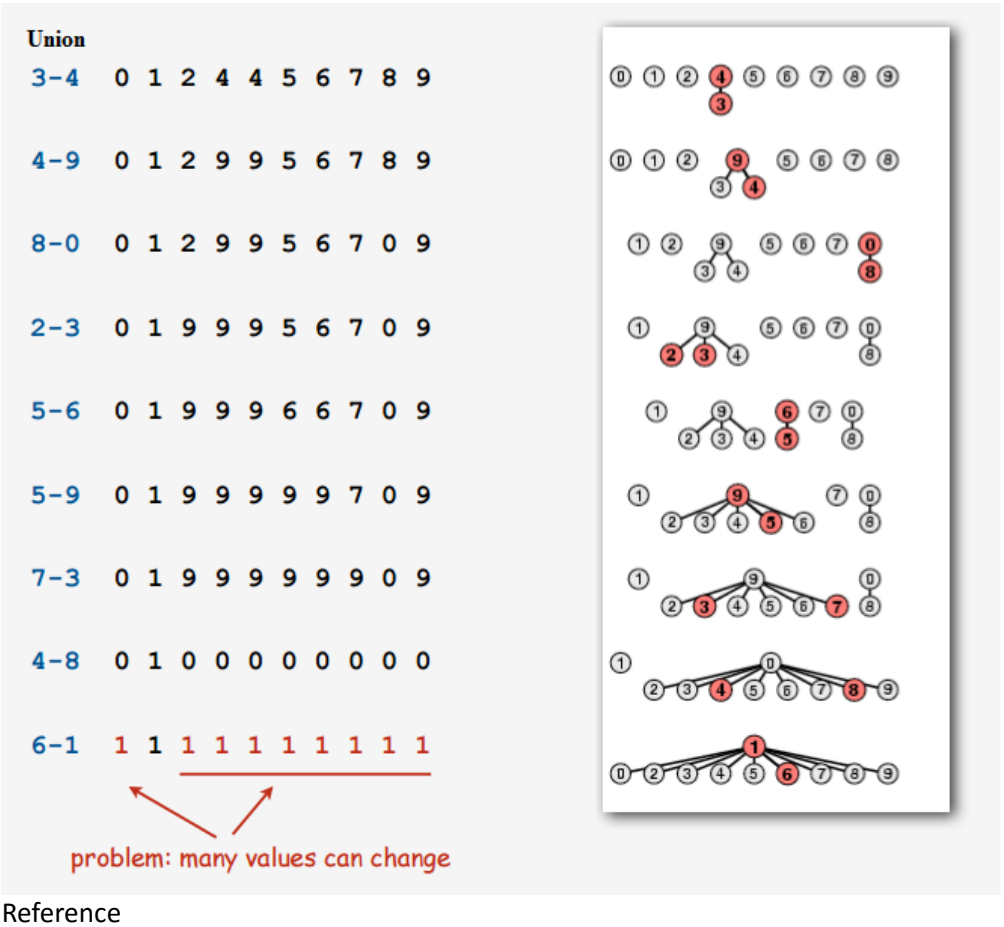
- Kruskal's Algorithm



- Disjoint-set data structure / Union–find data structure







- Reference
  - https://en.wikipedia.org/wiki/Minimum_spanning_tree
  - https://www.hackerearth.com/practice/algorithms/graphs/minimum-spanning-tree/tutorial/

- http://www.geeksforgeeks.org/greedy-algorithms-set-2-kruskals-minimum-spanning-tree-mst/
- https://en.wikipedia.org/wiki/Prim%27s_algorithm
- https://en.wikipedia.org/wiki/Kruskal%27s_algorithm
- https://en.wikipedia.org/wiki/Disjoint-set_data_structure
- http://vancexu.github.io/2015/07/13/intro-to-union-find-data-structure.html

Problem C: Nikola

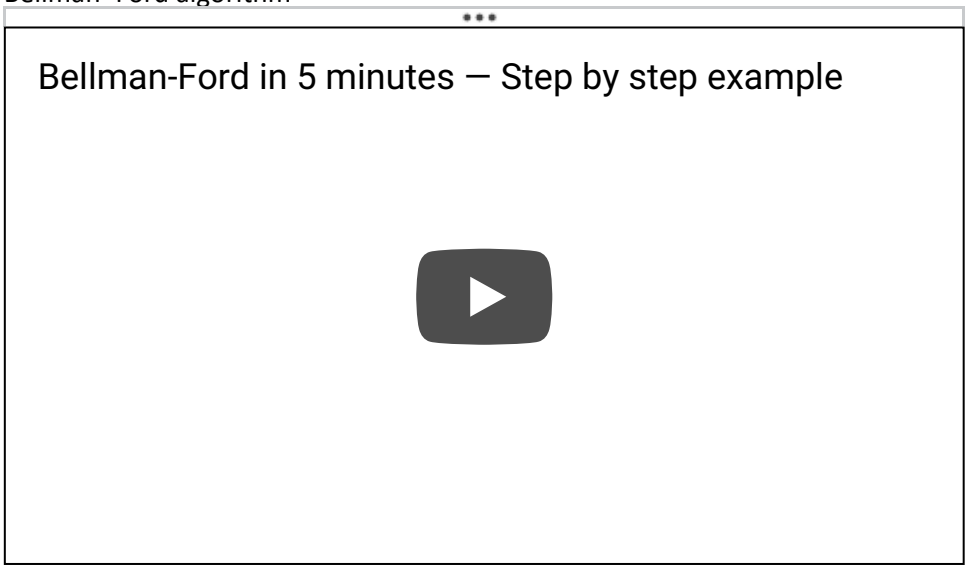
- Solved by Ziyi Zhang 🖐🖐🖐
- `| | | |from| | |…| | |i| | |…| | |to| | | |`
- `Where from = i-(stepLength-1), to = i+stepLength`
- `mincost[i][j] = min(mincost[i+stepLength][stepLength],mincost[i-(stepLength-1)][stepLength])`
- Time complexity: $\Theta\left(n^2\right)$

Problem D: Reachable Roads

- See "Disjoint-set data structure / Union–find data structure"

Problem E: Single source shortest path, negative weights

- Bellman–Ford algorithm



- Reference
  - https://en.wikipedia.org/wiki/Bellman%E2%80%93Ford_algorithm
  - https://www-m9.ma.tum.de/graph-algorithms/spp-bellman-ford/index_en.html (Highly recommended)
- Our Github repository:
  - https://github.com/atmorgan/ICPC2014/blob/master/BellmanFord.cc