

CS122 Algorithms and Data Structures

MW 11:00 am - 12:15 pm, MSEC 101

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Lecture 16: Graphs (3)

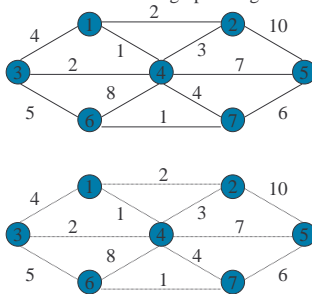
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Kruskal's algorithm

- n select edge with smallest weight as accept the edge if it does not cause a cycle
- n determining if it causes a cycle: essentially the equivalence class (union/find) problem
- n two vertices belong to the same set iff they are connected in the current spanning forest

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Construct MST for this graph using Kruskal's algorithm



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Prim's algorithm

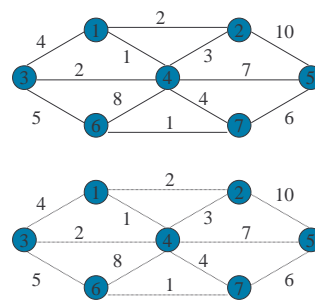
- n grow the tree in successive stages
- n in each stage, one node is picked as the root, we add an edge, and thus a vertex is added to the tree
- n have a set on vertices in the tree and a set that is not in the tree

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- n at each stage, a new vertex to add to the tree is selected by choosing edge (u, v) such that the cost of (u, v) is the smallest among all edges where u is in the tree and v is not
- n Build spanning tree starting from v_1
- n Virtually identical to Dijkstra's, but note that it is for undirected graphs

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Construct MST from v_1 for this graph using Prim's algorithm



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Connectivity

- n Find a path in a graph from one vertex to any other vertex
- n Undirected graphs: No separate subgraphs
- n Directed graphs: There are some places to which we can get from some directions

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Definitions

- n Connected undirected graph
- n n-connected graphs
- n Biconnected graphs
- n Cut vertices
- n Bridges
- n Blocks

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Detect Cut Vertices

- n Create a tree using the depth-first search algorithm
- n Determine **Forward edges**
- n Determine **Back edges**
- n A vertex v is a cut vertex if v has at **least one subtree unconnected** with any of v 's predecessors by back edges

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Detect Cut Vertices (cont.)

- n **A special case:** If v is a root with more than one descendant in the tree, then v is a cut vertex

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Connectivity in Directed Graphs

- n Weakly connected: A corresponding undirected graph is connected.
- n Strongly connected: Each pair, there is a path between them in both directions.
- n Strongly connected components

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