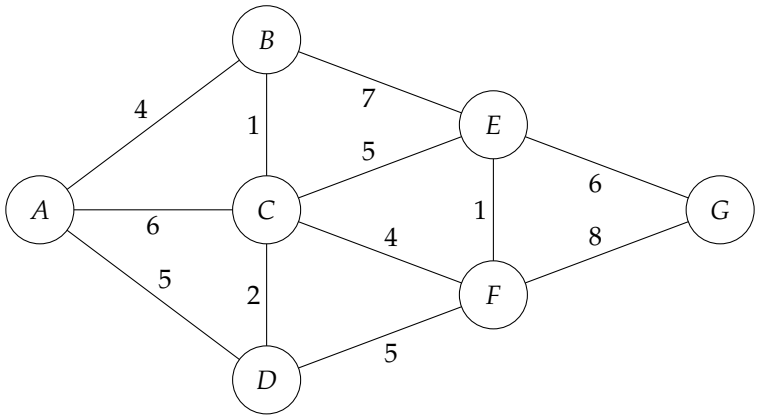
CSM 61B Spring 2017

MSTs & Graph Algorithms

Week 12: April 11, 2017

1 Networking

1.1 Suppose we need to design a telephone network connecting all the residents, labeled A through G, in a neighborhood. How can we create a network that guarantees connectivity between all subscribers at the least possible cost?



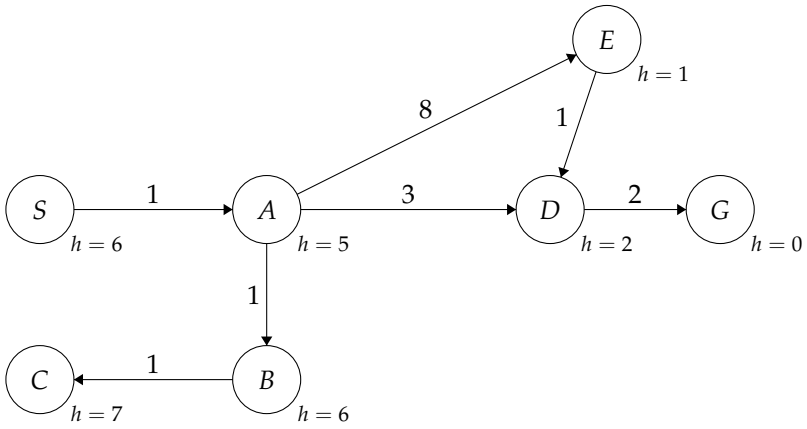
(a) In a graph with N vertices and M edges, how many edges form a minimum spanning tree?

(b) Will the new graph contain any cycles? Describe the structure of the graph.

(c) Run Kruskal's Algorithm to find the minimum spanning tree.

2 A* Search

2.1 Find the path from the start, S, to the goal, G, when running each of the following algorithms.



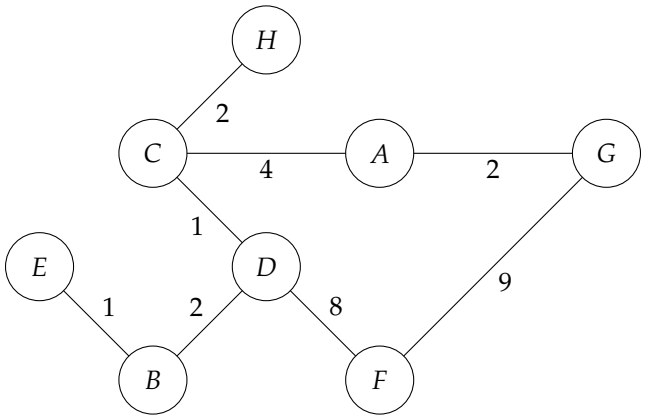
(a) Which path does uniform cost search return?

(b) Which path does greedy search return?

(c) Which path does A* search return?

3 Searches

3.1 For the graph below, write the order in which vertices are visited using the specified algorithm starting from A. Break ties by alphabetical order.



(a) DFS

(b) BFS

(c) Dijkstra's

4 Shortest Paths Algorithms *Extra for Experts*

4.1 Given a weighted, directed graph G where the weights of every edge in G are all integers between 1 and 10, and a starting vertex s in G, find the distance from s to every other vertex in the graph where the distance between two vertices is defined as the weight of the shortest path connecting them, or infinity if no such path exists.

(a) Design an algorithm for solving the problem that runs faster than Dijkstra's.

(b) Give the runtime of your algorithm.