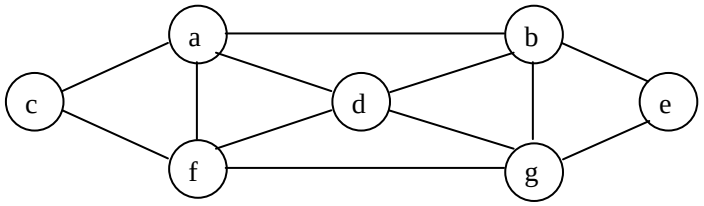
Spring 2017

CS3230 Tutorial (Backtracking & Branch-and-Bound, week of 3 April)

1. Consider the 4-queens and 5-queens problems and a backtracking and a brute-force algorithm to solve it. Write down the number of nodes in the state space tree needed to find:
    a. the first solution with backtracking
    b. all solutions with backtracking
    c. all solutions with a (simple) brute force algorithm

2. Backtracking (textbook page 423).
   Apply backtracking to the problem of finding a Hamiltonian circuit in the following graph.



3. Write a program implementing a backtracking algorithm for the Hamiltonian circuit problem.

4. Degree-Constrained Spanning Tree (DCST):
   Given a graph G with n vertices. Does G have a spanning tree in which no vertex has degree greater than k, $k \leq n$?
    a. What is the complexity class of the DCST problem?
    b. Describe an algorithmic strategy to solve this problem.
    c. What are possible applications of this algorithm?

5. Graph coloring (backtracking):
   Backtracking can be used to decide whether a graph can be colored using n colors. Describe an algorithm to do the graph coloring.

6. Bucket Problem:
   You are given one empty 5-unit water bucket and one empty 3-unit water bucket. Your goal is to measure 4 units of liquid. You are allowed to completely fill or empty the 1st and 2nd buckets. You can also pour the contents of one bucket to the other until the source is empty or the recipient is full.
    a. Find a backtracking algorithm that will achieve the goal and produce the sequence of actions required.
    b. Give a valid sequence of actions (a solution).