Spring 2017

CS3230 Tutorial (Decrease and Conquer Alg., week of 27 February)

1. In insertion sort, if binary search is used to locate the correct insert position, what is the worst case efficiency class of such an insertion sort algorithm?

2. Consider the unit cube graph $G = (V,E)$ in which

   $$V = \{v_0, v_1, \cdots, v_7\}$$

   is the set comprising the eight vertices of the unit cube, and

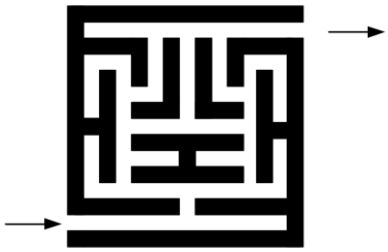
   $$E = \{\{v_a, v_b\} : v_a, v_b \in V \text{ ; the binary rep. of } a, b \text{ differ by exactly 1 bit}\}$$

   is the set comprising the twelve edges of the unit cube. What is the tree produced by `dfs`(v_0)? Assume the graph is described by adjacency lists and in an adjacency list vertices are ordered by their indices increasingly.

3. Repeat the above question but with `bfs`(v_0).

4. Give a topological sort of the unit cube graph given in the above questions. The graph is made directional by having the edges that are parallel to the axes to take the corresponding positive axis direction.

5. Model the following maze with a graph. Use both depth first search and breadth first search to produce a path between the in-arrow and out-arrow points.



6. A celebrity is a person who knows nobody but is known by everybody. By asking only the question "Do you know him/her?" design an algorithm to identify a celebrity, if any, among n persons. How many times is the question asked in your algorithm?

7. Give an algorithm to generate the k combinations of the set $\{1, 2, \cdots, n\}$. For example, the 2 combinations of {1, 2, 3, 4} are

   12, 13, 14, 23, 24, 34