CSCI 570 Fall 2016 Discussion 11

1. Professor Jones has determined that *x* priceless artifacts (which belong in a museum) are located in a labyrinth. The labyrinth can be thought of as a graph, with each edge representing a path and each node an intersection of paths. All of the artifacts are in the same treasure room, which is located at one of the intersections. However, the artifacts are extremely burdensome, so Jones can only carry one artifact at a time. There is only one entrance to the labyrinth, which is also a node in the graph. The entrance serves as the only exit as well. All the paths are protected by human-eating vines, which will be woken up after someone passes the path, so Jones can only go through each path once. Given the map of the labyrinth and the location of the treasure, give an algorithm that determines how many artifacts Jones can obtain and how he can do so.

2. We're asked to help the captain of the USC tennis team to arrange a series of matches against UCLA's team. Both teams have *n* players; the tennis rating (a positive number, where a higher number can be interpreted to mean a better player) of the *i*-th member of USC's team is t_i and the tennis rating for the *k*-th member of UCLA's team is b_k. We would like to set up a competition in which each person plays one match against a player from the opposite school. Our goal is to make *as many matches as possible* in which the USC player has a higher tennis rating than his or her opponent. Give an algorithm to decide which matches to arrange to achieve this objective.

3. CSCI 570 is a large class with n TAs. Each week TAs must hold office hours in the TA office room. There is a set of hour-long time intervals I_1, I_2, … I_k in which the office room is available. Each TA provides a subset of the time intervals he or she can hold office hours with the minimum requirement of one hour per week. Lastly, the total number of office hours held during the week must be H. Design an algorithm to determine if there is a valid way to schedule the TA's office hours with respect to these constraints.