CSCI 432 Handout 08: Dynamic Programming

Name: _____

Collaborators: _____

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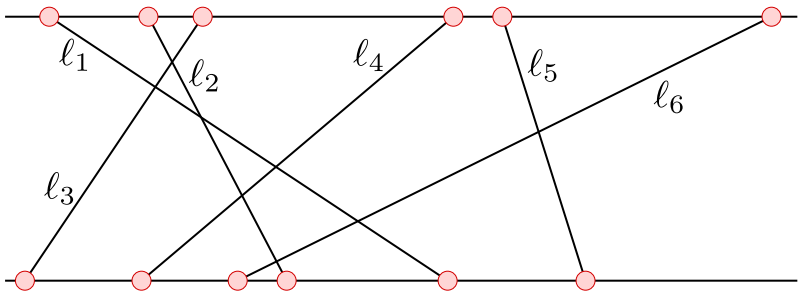
The Problem

Suppose we are given a set L of n line segments in the plane, where each segment has one endpoint on the line $y = 0$ and one endpoint on the line $y = 1$, and all $2n$ endpoints are distinct. Describe and analyze an algorithm to compute the largest subset of L in which no pair of segments intersects.

From JE, Chapter 3, Problem 19 (a).

Practice

1. Before getting started, let's consider an example. What would the desired output be for the following input set?



Try it!

2. **Formulate the problem recursively: Specification**. The first step in thinking of a dynamic program is to formulate the problem recursively. Before even doing that, write down precisely WHAT problem you are solving. Namely, what is the input, the output, and the relationship between them?
   Try it!

3. **Formulate the problem recursively: Solution**. Provide a clear recursive formula that solves this problem.
   Try it!

4. **Build solution: Identify the subproblems**. What are all of the different subproblems that your recursive formula would require solving as intermediate steps? Be sure to include the initial input as one of those subproblems!
   Try it!

5. **Build solution: Choose a memoization data structure.** What data structure can store EVERY subproblem that you identified?
   Try it!

6. **Build solution: identify dependencies**. Draw the dependency graph among your subproblems.
   Try it!

7. **Build solution: find a good evaluation order**. Keeping your dependency graph in mind, select a good evaluation order so that by the time you need a subproblem, it is already computed.
   Try it!

8. **Build solution: analyze space and running time**. What are the space and worst-case time complexities of your algorithm?
   Try it!

9. **Write down the algorithm**. Give pseudocode!
   Try it!