CSCI 3104 Spring 2022
Instructor: Profs. Chen and Layer

Midterm 2 Standard 19 - (Dynamic Programming) Identify the precise subproblems

Due Date ..... April 17
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Contents

1 Instructions

- The solutions **should be typed**, using proper mathematical notation. We cannot accept hand-written solutions. Here's a short intro to LaTeX.
- You should submit your work through the **class Canvas page** only. Please submit one PDF file, compiled using this LaTeX template.
- You may not need a full page for your solutions; pagebreaks are there to help Gradescope automatically find where each problem is. Even if you do not attempt every problem, please submit this document with no fewer pages than the blank template (or Gradescope has issues with it).
- You **may not collaborate with other students**. **Copying from any source is an Honor Code violation. Furthermore, all submissions must be in your own words and reflect your understanding of the material.** If there is any confusion about this policy, it is your responsibility to clarify before the due date.
- Posting to **any** service including, but not limited to Chegg, Discord, Reddit, StackExchange, etc., for help on an assignment is a violation of the Honor Code.

2 Standard 19 - (Dynamic Programming) Identify the precise subproblems

2.1 Problem 1

Problem 1. For the weighted interval scheduling problem, identify the subproblem and prove that it has optimal substructure.

Answer.

- At each iteration, we need to decide whether we should include this new interval so that it maximize the profit.
- Assuming there are n total intervals, and we are at ith iteration. At this iteration, we first need to decide whether ith interval has conflict with previous intervals. Then, after we find it doesn't have any conflicts with previous intervals, we need to decide whether we should include this ith interval so that it maximize the profit. And we need to make a comparison between the profits from the previous iteration and profits including ith interval.
- If the profits including ith interval is greater than the profits from the previous iteration, we should include this new interval to our scheduling. vice versa.
- Since at each iteration, or each sub problem, we always choose the maximum profit decision, the problem at the end also has the maximum profit. i.e. we use MAX function to make the decision at each substructure. It will result in an optimal structure because of maximum profit decision in every sub problem.

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