CSCI 3104 Spring 2023
Instructors: Prof. Layer and Chandra Kanth Nagesh

# Midterm 2 Standard 21 - Dynamic Programming: Identify the precise subproblems

Due Date ..... April 28th
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Quiz Code (enter in Canvas to get access to the LaTeX template) ..... **vHOMf**

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## 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 21 - Dynamic Programming: Identify the precise subproblems

## 2.1 Problem 1

**Problem 1.** Consider the max slice problem that takes a list of positive and negative integers as input and returns the slice (continuous sub-list) with the largest sum. For example, for the list $[-1, 10, -3, 4, -5, 3, 2]$, the max slice is $[10, -3, 4]$.

Identify the recursive structure. That is, suppose we are solving the subproblem at index $i$. What precise sub-problems do we need to consider? How do we combine them?

*Answer.* Let $T(j, k)$ denote the value of slices of our list $L$ of positive and negative integers from $L_j \to L_n$ and let $n$ be the length of our list. At $L_j$ we need to consider the value of each of our slices from $L_{j+i} \to L_k$ to the end of the list $L$ for each $i \in [0, 1, ..., n]$ and each $k \in [i, i+1, ...n]$. That is we consider $T(j+1, k)$, $T(j+2, k)$, ..., $T(j+n, k)$ and then take the maximum value of what these produce.

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