CSCI 3104 Fall 2022
Instructors: Prof. Grochow and Chandra Kanth Nagesh

Midterm S24

Due Date ..... Saturday Nov 19, 2022 4pm MT
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Student ID **109603994**
Quiz Code (enter in Canvas to get access to the LaTeX template) **Fzvvci3sss**

Contents

Instructions

- You may either type your work using this template, or you may handwrite your work and embed it as an image in this template. **If you choose to handwrite your work, the image must be legible, and oriented so that we do not have to rotate our screens to grade your work.** We have included some helpful LaTeX commands for including and rotating images commented out near the end of the LaTeX template.
- You should submit your work through the **class Gradescope 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.
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Problem HC.

- My submission is in my own words and reflects my understanding of the material.
- Any collaborations and external sources have been clearly cited in this document.
- I have not posted to external services including, but not limited to Chegg, Reddit, StackExchange, etc.
- I have neither copied nor provided others solutions they can copy.

I agree to the above, Tyler Huynh. □

24 Standard 24: Backtracking to find solutions

Problem 24. Consider the LONGEST COMMON SUBSEQUENCE problem with input $x = clear$ and $y = color$. The following is the dynamic programming table for the length of the longest common subsequence of the prefixes of x and y. From the table, **clearly indicate the steps you take to backtrace to find the longest common subsequence.** Indicate the longest common subsequence found.
Referenced from **http://masc.cs.gmu.edu/wiki/LongestCommonSubsequence**

	-	c	o	l	o	r
	0	1	2	3	4	5
- 0	0	0	0	0	0	0
c 1	0	1	1	1	1	1
l 2	0	1	1	2	2	2
e 3	0	1	1	2	2	2
a 4	0	1	1	2	2	2
r 5	0	1	1	2	2	3

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	j	-	c	o	l	o	r
		0	1	2	3	4	5
-	0	0	0	0	0	0	0
c	1	0	1	1	1	1	1
l	2	0	1	1	2	2	2
e	3	0	1	1	2	2	2
a	4	0	1	1	2	2	2
r	5	0	1	1	2	2	3

Recurrence of Longest Common Subsequence:

$$c[i,j] = \begin{cases} 0 & \text{if } i=0 \text{ or } j=0 \\ c[i-1][j-1]+1 & \text{if } i,j>0 \text{ and } x_i = y_j \\ \max(c[i,j-1], c[i-1,j]) & \text{if } i,j>0 \text{ and } x_i \neq y_j \end{cases}$$

Steps:

1.) The first step we would do would be to compare 3 at $c[5,5]$ since x_5 and y_5 are equal to each other we know that this value came from $c[4,4]$

2.) The next step we would do would be to determine where $c[4,4]$ came from so we would compare x_4 and y_4 and we know these values do not equal, we know this comes from the max of $c[4,3]$, $c[3,4]$ which 2 respectively, so we know that we can $c[4,4]$ from either of these values.

3.) The next step we would do would be to determine where $c[4,3]$ and $c[3,4]$ came from, we would compare x_4 and y_3 for $c[4,3]$ and we see they're not equal to each other, thus $c[4,3]$ comes from the max of $c[4,2]$ and $c[3,3]$ and the max will be 2 which is $c[3,3]$, for $c[3,4]$ we will compare the values of x_3 and y_4 which are not equal we see that $c[3,4]$ came from the max of $c[3,3]$ and $c[2,4]$ which is 2. There are the same values so these values can come from either position.

4.) The next step we would do/we need be to determine where $c[3,3]$, $c[2,4]$ come from. For $c[3,3]$ we can see that x_3 does not equal y_3 which comes from the max of $c[2,3]$ and $c[3,2]$ which is 2 for $c[2,2]$. For $c[2,4]$ we know that x_2 does not equal y_4 so it will come from the max of $c[1,4]$ and $c[2,3]$ and the max is 2 at $c[2,3]$

5.) The next step would be to determine where $c[2,3]$ came from, we would x_2 and y_3 we can see that this value came from $c[1,2]$

6.) The next step would be to determine where $c[1,2]$ came from, we would x_1 and y_2 such that these values are not equal, this it comes from the max of $c[1,1]$ and $c[0,2]$ which is 1 or $c[1,1]$.

7.) the last step would be to determine where $c[1,1]$ came from by comparing x_1 and y_1 to each other and these values are equal. Thus $c[1,1]$ comes from $c[0,0]$.

We have completed the backtracking, thus our longest common subsequence is:

CLR

where we include the characters that come from a diagonal.