CSE 5311 **Project 2** **Spring 2022**

Due Date: April 28, 2022

For this assignment, you will implement

a) Longest Common Subsequence **Brute Force approach** (LCS_BF(X,Y))
b) Longest Common Subsequence **Dynamic Programming approach** (LCS_DP(X,Y))
c) Longest Common Subsequence Dynamic Programming approach with b and c arrays (LCS_DP_CB(X,Y)) (Page 394 from textbook)

Detailed requirements:

- Write three programs for each of the algorithms named as **LCS_BF.py, LCS_DP.py and LCS_DP_CB.py** (or another extension if the code is in a language other than python). **Code may be implemented in any programming language**.
- **LCS_BF.py, LCS_DP.py** both read a file **LCS1.txt** with two strings in each line and find/print the following**:**
  - Length of the Longest common Subsequence of the two strings
  - Time taken to find the length of the Longest common Subsequence of the two strings
- **LCS_DP_CB.py does the following:**
  - **reads a file LCS2.txt** with two strings in each line and uses them as X and Y input variables for a function **LCS_DP_CB**(X,Y))
  - **LCS_DP_CB**(X,Y)) function
    - implements the dynamic programming version of LCS-LENGTH(X,Y) include on page 394 in your text book (with some additional print statements)
    - populates arrays b and c
    - stores **\, ^, <** in array c instead of diagonal up arrow, up arrow, and left arrow.
    - and produces output with corresponding b[i][j] c[i][j] side by side as shown below for all pairs of strings in **LCS2.txt**
      - X = "Panther" Y = "Partner"

```
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     Y   P   a   r   t   n   e   r
  X  0   0   0   0   0   0   0   0
  P  0 \ 1 < 1 < 1 < 1 < 1 < 1 < 1
  a  0 ^ 1 \ 2 < 2 < 2 < 2 < 2 < 2
  n  0 ^ 1 ^ 2 ^ 2 ^ 2 \ 3 < 3 < 3
  t  0 ^ 1 ^ 2 ^ 2 \ 3 ^ 3 ^ 3 ^ 3
  h  0 ^ 1 ^ 2 ^ 2 ^ 3 ^ 3 ^ 3 ^ 3
  e  0 ^ 1 ^ 2 ^ 2 ^ 3 ^ 3 \ 4 < 4
  r  0 ^ 1 ^ 2 \ 3 ^ 3 ^ 3 ^ 4 \ 5
++++++++++++++++++++++++++++++++++++
Length of the Longest Common Subsequence is:  5
The Longest Common Subsequence of "Panther" and "Partner" is "Pater"
```

      - X = "Bat" Y = "Boa"

```
++++++++++++++++++++++++++++++++++++
     Y   B   o   a
  X  0   0   0   0
  B  0 \ 1 < 1 < 1
  a  0 ^ 1 ^ 1 \ 2
  t  0 ^ 1 ^ 1 ^ 2
++++++++++++++++++++++++++++++++++++
Length of the Longest Common Subsequence is:  2
The Longest Common Subsequence of "Bat" and "Boa" is "Ba"
```

      - X = "Bogart" Y = "Bart"

```
++++++++++++++++++++++++++++++++++
     Y   B   a   r   t
  X  0   0   0   0   0
  B  0 \ 1 < 1 < 1 < 1
  o  0 ^ 1 ^ 1 ^ 1 ^ 1
  g  0 ^ 1 ^ 1 ^ 1 ^ 1
  a  0 ^ 1 \ 2 < 2 < 2
  r  0 ^ 1 ^ 2 \ 3 < 3
  t  0 ^ 1 ^ 2 ^ 3 \ 4
++++++++++++++++++++++++++++++++++
Length of the Longest Common Subsequence is:  4
The Longest Common Subsequence of "Bogart" and "Bart" is "Bart"
```

- X="Popper" Y="Paper"

```
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     Y   P   a   p   e   r
  X  0   0   0   0   0   0
  P  0 \ 1 < 1 < 1 < 1 < 1
  o  0 ^ 1 ^ 1 ^ 1 ^ 1 ^ 1
  p  0 ^ 1 ^ 1 \ 2 < 2 < 2
  p  0 ^ 1 ^ 1 \ 2 ^ 2 ^ 2
  e  0 ^ 1 ^ 1 ^ 2 \ 3 < 3
  r  0 ^ 1 ^ 1 ^ 2 ^ 3 \ 4
++++++++++++++++++++++++++++++++++
Length of the Longest Common Subsequence is:  4
The Longest Common Subsequence of "Popper" and "Paper" is "Pper"
```

- Ensure that your code is readable (indented/commented).
- Submit a README file that explains how to run the code including any environment dependency (language versions), Make Sure TA can run your code. TAs may ask you to demo your project. **The student who is not present for the demo will receive a zero**.
- **Project will be completed by and submitted by groups of two students**. Only 1 student will submit the assignment, but both will be present for the demo.
- All files need to be zipped in a zip file before submission that is named as follows:
    - CSE5311-Sectionno-P1- **LANG**-1000XXXXX-1000YYYYY
    - LANG is replaced by Python, Java, C, etc based on the programming language used
        - for e.g., CSE5311-02-P2-**Python**-1000XXXXX-1000YYYYY
  - If **Section no is 2 or 9 or 11 or 12** and the Student ids of the two students are 1000XXXXX and 1000YYYYY, the zip file will be named as shown here:
    - CSE5311-02-P2-LANG-1000XXXXX-1000YYYYY
    - CSE5311-09-P2- LANG-1000XXXXX-1000YYYYY
    - CSE5311-11-P2- LANG-1000XXXXX-1000YYYYY
    - CSE5311-12-P2- LANG-1000XXXXX-1000YYYYY
- Zip file CSE5311-Sectionno-P2- LANG-1000XXXXX-1000YYYYY will contain the following:
  - 3 files for three algorithms
  - **1 report**
- Your **report documents** the following:
  - List any sites/sources referred
  - Time complexity of each of the three algorithms
  - Your comparative experimental results for strings in **LCS1.txt** as X and Y for **LCS_BF.py and LCS_DP.py**
    - **1)** length of the LCS and
    - **2)** the time it takes for each algorithm to find LCS
  - Explain any differences between the experimental and theoretical results.
  - Compare and contrast the results between the **LCS_BF.py, LCS_DP.py (Brute Force and Dynamic Programming)** algorithms Explain anomalies if any.

    - List the results of executing **LCS_DP_CB.py with strings in LCS2.txt** used as X and Y parameters in the format shown above.
    - Report of 1-2 pages should be enough.
    - Honor code (stated in red in this document)
- Implement your code yourself without copying from anywhere
- **The code will be tested for plagiarism. Any plagiarism will result in zero for all students involved.**

Some rules to follow:

1. The project is to be completed in a group of two students from the same section.
2. Include both names and IDs in your document along with a description of **what each member did.**
3. **Handwrite, sign, and date (with date of submission) a copy of the Honor Code (shown below) and share the image as part of your project; a handwritten, signed, and dated (with the date of submission) copy of the Honor Code must be included with every project and exam submission. (Failing to include will cost 20 points)**
4. **Students are required to NOT share their solutions to the project even after the semester is over or even after graduation. However, they can show their projects during their interviews. They are also required to not discuss the solution with others or use anyone else's solution. Any violation of the policy will result in a 0 for this project for all students concerned.**

HONOR CODE

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or that I contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code

I will not participate in any form of cheating/sharing the questions/solutions.