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CPSC 450
Assignment 3 - Report
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Psedocode

```
main:
        string1 <- from file
        string2 <- from file

        table <- make_table(string1, string2)
        lcs <- LCS(table, string1, string2, len(string0), len(string1))
        lcs_all <- LCS_All(table, string1, string2, len(string0), len(string1))

        display lcs
        display lcs_all

make_table(string1, string2):
        table = height[len(string2) + 1], width[len(string1) + 1]
        table <- all values set to 0

        for i from 1 to table width:
                for j from 1 to table height:
                        if string1[i - 1] == string2[j - 1]:
                                table[i][j] = table [i - 1][j - 1] + 1
                        else:
                                table[i][j] = max(table[i][j - 1], table[i - 1][j])

        return table

LCS(table, string1, string2, i, j):
        if (i or j == 0):
                return ""

        if (string1[i - 1] == string2[j - 1]):
                return LCS(table, string1, string2, i - 1, j - 1) + string1[i - 1]

        if (table[i][j - 1] > table[i - 1][j]):
                return LCS(table, string1, string2, i, j - 1)

        return LCS(table, string1, string2, i - 1, j)

LCS_All(table, string1, string2, i, j):
        if (i or j == 0):
                return [""]

        if (string1[i - 1] == string2[j - 1]):
                lcs = LCS_All(table, string1, string2, i - 1, j - 1)

                for k in len(lcs):
                        lcs[k] = lcs[k] + string1[i - 1]

                return lcs
```

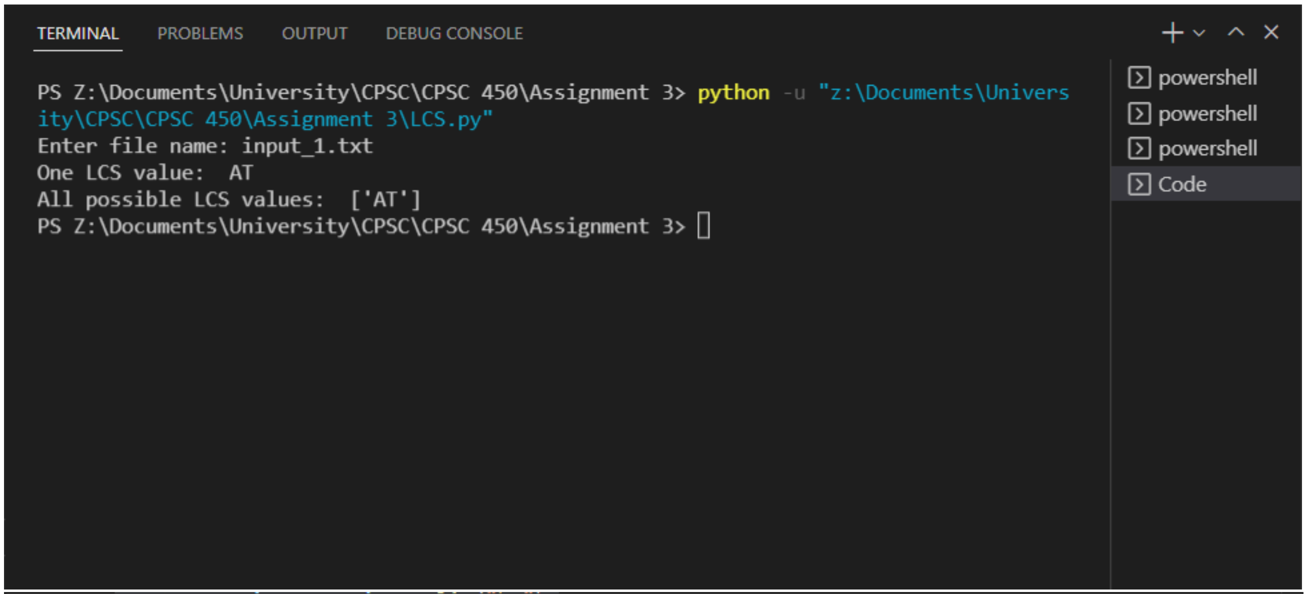
```
list <- []

if (table[i][j - 1] >= table[i - 1][j]):
        list = LCS_All(table, string1, string2, i, j - 1)

if (table[i - 1][j] >= table[i][j - 1]):
        list = list + LCS_All(table, string1, string2, i, j - 1)

return list
```

Program Code

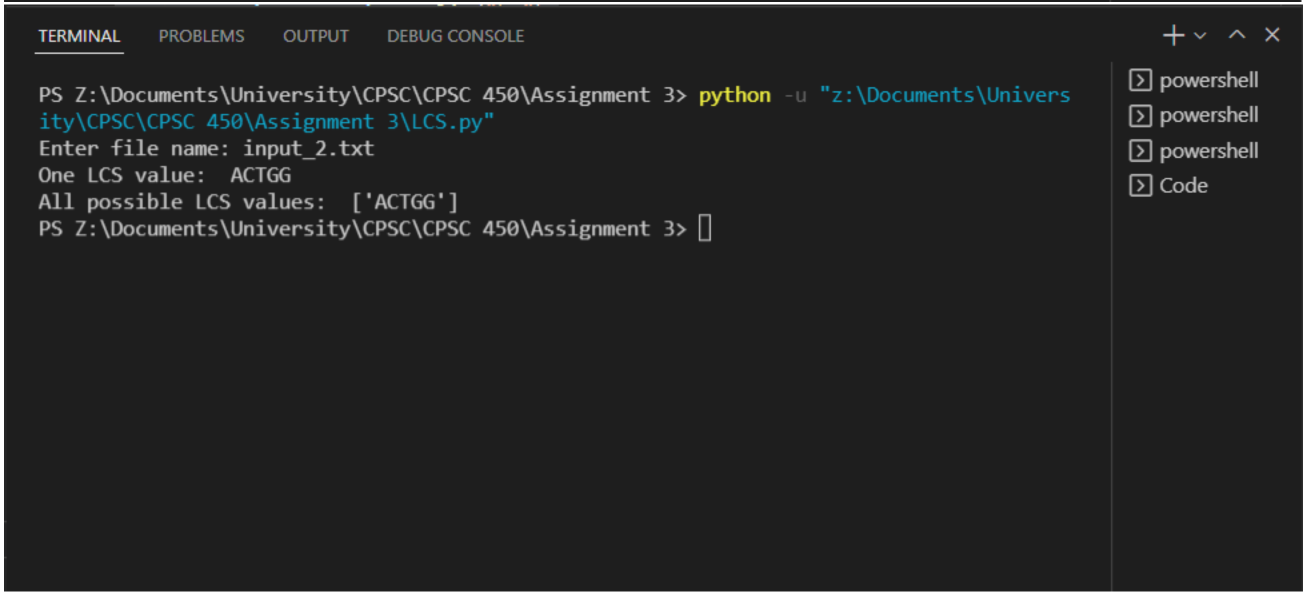
LCS.py

```
def main():
    """
        Main driver method

        Parameters:

            None

        Returns:

            None. Side effect.
    """
    file_input = input("Enter file name: ")

    with open(file_input, "r") as file:
        string = file.read()
        string = string.split("\n")

        table = make_table(string[0], string[1])
        print("One LCS value: ", LCS(table, string[0], string[1], len(string[0]),
                len(string[1])))
        print("All possible LCS values: ", LCS_all(table, string[0], string[1],
                len(string[0]), len(string[1])))

def make_table(string1, string2):
    """
        Makes the DP Table and fills in values

        Parameters:

            string1 (String): First string
            string2 (String): Second string

        Returns:

            table (list[list[int]]): Dynamic programming 2D table
    """

    # Initialize all values to 0
    table = [[0 for row in range(len(string2) + 1)]
                for col in range(len(string1) + 1)]

    # Populate the count of each character in the order for both strings
    for i in range(1, len(string1) + 1):
        for j in range(1, len(string2) + 1):
            if (string1[i - 1] == string2[j - 1]):
                table[i][j] = table[i - 1][j - 1] + 1
            else:
                table[i][j] = max(table[i][j - 1], table[i - 1][j])

    return table

def LCS(table, string1, string2, i, j):
    """
        Takes the DP Table and bracktracks out a Longest Common Sequence

        Parameters:

            table (list[list[int]]): DP Table
            string1 (String): First string
            string2 (String): Second string
            i (int): current x location in DP table
            j (int): current y location in DP table

        Returns:

            lcs (String): Longest common sequence
    """
    # Finished backtracking
    if (i == 0 or j == 0):
        return ""

    # If both values are equal, go diagonal
    if (string1[i - 1] == string2[j - 1]):
        return LCS(table, string1, string2, i - 1, j - 1) + string1[i - 1]

    # If the value above is greater, move up
    if (table[i][j - 1] > table[i - 1][j]):
        return LCS(table, string1, string2, i, j - 1)

    # If the value left is greater, go left
    return LCS(table, string1, string2, i - 1, j)

def LCS_all(table, string1, string2, i, j):
    """
        Takes the DP Table and bracktracks out all
        possible longest common sequences

        Parameters:

            table (list[list[int]]): DP Table
            string1 (String): First string
            string2 (String): Second string
            i (int): current x location in DP table
            j (int): current y location in DP table

        Returns:

            lcs (list[String]): Longest common sequence
    """
    # Finished backtracking
    if (i == 0 or j == 0):
        return [""]

    # If both values are equal, go diagonal
    if (string1[i - 1] == string2[j - 1]):
        lcs = LCS_all(table, string1, string2, i - 1, j - 1)

        for k in range(len(lcs)):
            lcs[k] = lcs[k] + string1[i - 1]

        return lcs

    # Define empty list to be added to
    list = []

    # If the value above is greater, backtrack from there
    if (table[i][j - 1] >= table[i - 1][j]):
        list = LCS_all(table, string1, string2, i, j - 1)

    # If the value to the left is greater, backtrack from there
    if (table[i - 1][j] >= table[i][j - 1]):
        list = list + LCS_all(table, string1, string2, i - 1, j)

    return list

if __name__ == "__main__":
    main()
```

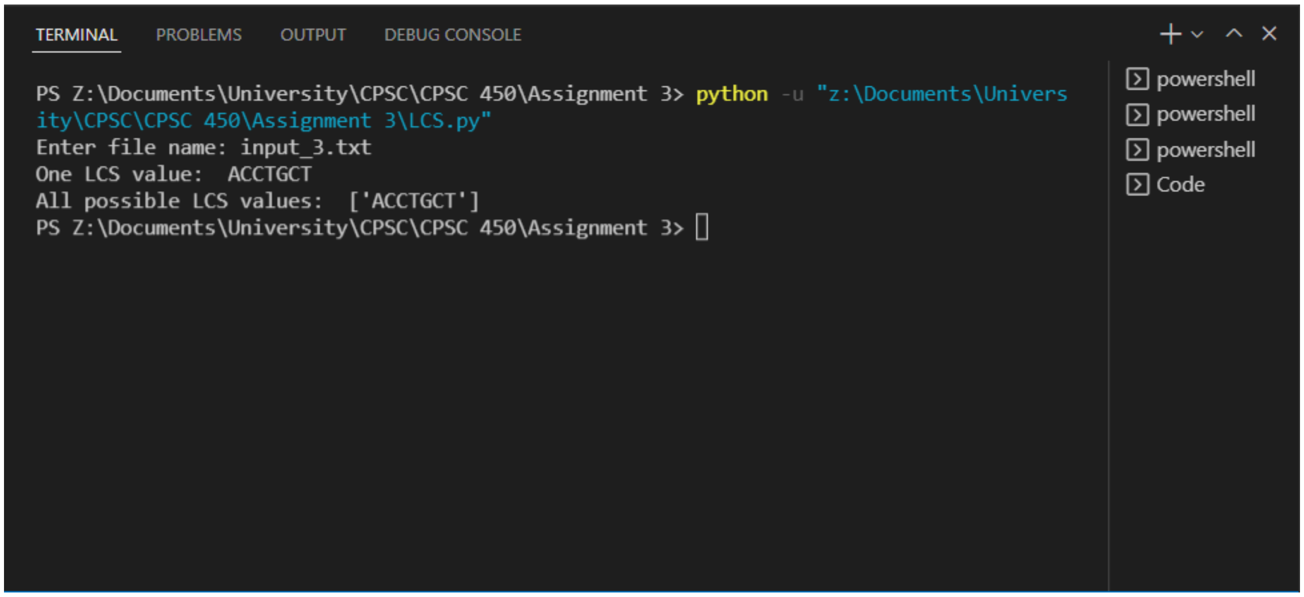
Examples with Output



```
PS Z:\Documents\University\CPSC\CPSC 450\Assignment 3> python -u "z:\Documents\Univers
ity\CPSC\CPSC 450\Assignment 3\LCS.py"
Enter file name: input_1.txt
One LCS value:  AT
All possible LCS values:  ['AT']
PS Z:\Documents\University\CPSC\CPSC 450\Assignment 3>
```



```
PS Z:\Documents\University\CPSC\CPSC 450\Assignment 3> python -u "z:\Documents\Univers
ity\CPSC\CPSC 450\Assignment 3\LCS.py"
Enter file name: input_2.txt
One LCS value:  ACTGG
All possible LCS values:  ['ACTGG']
PS Z:\Documents\University\CPSC\CPSC 450\Assignment 3>
```



```
PS Z:\Documents\University\CPSC\CPSC 450\Assignment 3> python -u "z:\Documents\Univers
ity\CPSC\CPSC 450\Assignment 3\LCS.py"
Enter file name: input_3.txt
One LCS value:  ACCTGCT
All possible LCS values:  ['ACCTGCT']
PS Z:\Documents\University\CPSC\CPSC 450\Assignment 3> 
```