CSCE 5150 – Analysis of Computer Algorithms

Programming Assignment 2 – Dynamic Programming

Neha Goud Baddam

11519516

In [64]:
```
# The longest common subsequence in Python
def lcs(X, Y, m, n):

    C = [[0 for x in range(n+1)] for x in range(m+1)]
    B = [[0 for x in range(n+1)] for x in range(m+1)]

    # Building the mtrix in bottom-up way
    for i in range(m+1):
        for j in range(n+1):
            if i == 0 or j == 0:
                C[i][j] = 0
            elif X[i-1] == Y[j-1]:
                C[i][j] = C[i-1][j-1] + 1
                B[i][j] = u'\u2b09'

            else:

                if C[i-1][j] > C[i][j-i]:
                    B[i][j] = u'\u2b06'
                else:
                    B[i][j] =  u'\u2190'

                C[i][j] = max(C[i-1][j], C[i][j-1])
    return B,C


def compute_lcs(C,m,n):

    i = m
    j = n

    x = C[i][j]

    res = [""] * (x+1)

    while i > 0 and j > 0:
        if X[i-1] == Y[j-1]:
            res[x-1] = X[i-1]
            i -= 1
            j -= 1
            x -= 1
        elif C[i-1][j] > C[i][j-1]:
            i -= 1
        else:
            j -= 1

    return res

def print_lcs(b,c,m,n):

    for i in range(1,n+1):
        b[0][i] = Y[i-1]
        i=i+1
    for i in range(1,m+1):
        b[i][0] = X[i-1]
        i=i+1
```

```
print("\nTable B:")
for row in b:
    for col in row:
        print(col,end = " ")
    print()

print("\nTable C: ")
for row in c:
    for col in row:
        print(col,end = " ")
    print()
```

In [65]:
```
X = str(input("Enter first string "))
Y = str(input("Enter second string "))

m = len(X)
n = len(Y)

print("\nX value is ", X)
print("\nY value is ", Y)

b,c =  lcs(X,Y,m,n)

result = compute_lcs(c,m,n)

print_lcs(b,c,m,n)

print("\nLongest common sequence between X and Y is : ","".join(result))
```

```
Enter first string spanking
Enter second string amputation

X value is  spanking

Y value is  amputation

Table B:
0 a m p u t a t i o n
s ← ← ← ← ← ← ← ← ← ←
p ← ← ↖ ← ← ← ← ← ← ←
a ↖ ← ↑ ← ← ↖ ← ← ← ←
n ↑ ↑ ↑ ↑ ← ↑ ↑ ↑ ↑ ↖
k ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑
i ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↖ ↑ ↑
n ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↖
g ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑ ↑

Table C:
0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0
0 0 0 1 1 1 1 1 1 1 1
0 1 1 1 1 1 2 2 2 2 2
0 1 1 1 1 1 2 2 2 2 3
0 1 1 1 1 1 2 2 2 2 3
0 1 1 1 1 1 2 2 3 3 3
0 1 1 1 1 1 2 2 3 3 4
0 1 1 1 1 1 2 2 3 3 4

Longest common sequence between X and Y is :  pain
```

In [62]:
```
X = str(input("Enter first string "))
Y = str(input("Enter second string "))

m = len(X)
n = len(Y)

print("\nX value is ", X)
print("\nY value is ", Y)

b,c =  lcs(X,Y,m,n)

result = compute_lcs(c,m,n)

print_lcs(b,c,m,n)

print("\nLongest common sequence between X and Y is : ","".join(result))
```

```
Enter first string AGGTAB
Enter second string GXTXAYB

X value is  AGGTAB

Y value is  GXTXAYB

Table B:
0 G X T X A Y B
A ← ← ← ← ↖ ← ←
G ↖ ← ← ← ← ← ←
G ↖ ↑ ↑ ← ← ← ←
T ↑ ↑ ↖ ↑ ← ← ←
A ↑ ↑ ↑ ↑ ↖ ↑ ↑
B ↑ ↑ ↑ ↑ ↑ ↑ ↖

Table C:
0 0 0 0 0 0 0 0
0 0 0 0 0 1 1 1
0 1 1 1 1 1 1 1
0 1 1 1 1 1 1 1
0 1 1 2 2 2 2 2
0 1 1 2 2 3 3 3
0 1 1 2 2 3 3 4

Longest common sequence between X and Y is :  GTAB
```

In [63]:
```
X = str(input("Enter first string "))
Y = str(input("Enter second string "))

m = len(X)
n = len(Y)

print("\nX value is ", X)
print("\nY value is ", Y)

b,c =  lcs(X,Y,m,n)

result = compute_lcs(c,m,n)

print_lcs(b,c,m,n)

print("\nLongest common sequence between X and Y is : ","".join(result))
```

```
Enter first string ABCDGH
Enter second string AEDFHR

X value is  ABCDGH

Y value is  AEDFHR

Table B:
0 A E D F H R
A ↖ ← ← ← ← ←
B ↑ ↑ ← ← ← ←
C ↑ ↑ ↑ ← ← ←
D ↑ ↑ ↖ ↑ ← ←
G ↑ ↑ ↑ ↑ ↑ ↑
H ↑ ↑ ↑ ↑ ↖ ↑

Table C:
0 0 0 0 0 0 0
0 1 1 1 1 1 1
0 1 1 1 1 1 1
0 1 1 1 1 1 1
0 1 1 2 2 2 2
0 1 1 2 2 2 2
0 1 1 2 2 3 3

Longest common sequence between X and Y is :  ADH
```

In [ ]:

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