

BOĞAZİÇİ UNIVERSITY

CMPE 493

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## Assignment 1 - Report

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## 1 Problem Definition

In this assignment, we are asked to output:

1. The Levenshtein edit distance between two input strings, the corresponding edit table, and the sequence of operations needed to transform the first string into the second one.
2. The Damerau-Levenshtein edit distance between two input strings, the corresponding edit table, and the sequence of operations needed to transform the first string into the second one.

## 2 Program Interface

The program has been written in **Python 3**. In order to run the program please enter the following command in terminal:

```
>> python3 2015400183.py [string1] [string2]
```

**Arguments:**

1. string1: Source string that you want to transform into **string2**
2. string2: Target string.

## 3 Input & Output

1. (a) Input:

```
python3 2015400183.py emperor empress
```

- (b) Output:

```
The Levenshtein Edit Distance for transforming emperor into empress is: 4
    e m p r e s s
  0 1 2 3 4 5 6 7
e 1 0 1 2 3 4 5 6
m 2 1 0 1 2 3 4 5
p 3 2 1 0 1 2 3 4
e 4 3 2 1 1 1 2 3
r 5 4 3 2 1 2 2 3
o 6 5 4 3 2 2 3 3
r 7 6 5 4 3 3 3 4
The Sequence of Operations:
1: Copy e
```

```

2: Copy m
3: Copy p
4: Insert r
5: Copy e
6: Replace r with s
7: Replace o with s
8: Delete r

```

The Damerau-Levenshtein Edit Distance for transforming emperor into empress is: 3

```

  e m p r e s s
0 1 2 3 4 5 6 7
e 1 0 1 2 3 4 5 6
m 2 1 0 1 2 3 4 5
p 3 2 1 0 1 2 3 4
e 4 3 2 1 1 1 2 3
r 5 4 3 2 1 1 2 3
o 6 5 4 3 2 2 2 3
r 7 6 5 4 3 3 3 3

```

The Sequence of Operations:

```

1: Copy e
2: Copy m
3: Copy p
4: Transpose e with r
5: Replace o with s
6: Replace r with s

```

(c) Screenshot:

```

denizkorkmaz@denizkorkmaz:~/PycharmProjects/CHPE493:Assignment1$ python3 2015400183.py empress emperor
The Levenshtein Edit Distance for transforming empress into emperor is: 4
  e m p e r o r
  0 1 2 3 4 5 6 7
e 1 0 1 2 3 4 5 6
m 2 1 0 1 2 3 4 5
p 3 2 1 0 1 2 3 4
r 4 3 2 1 1 1 2 3
e 5 4 3 2 1 2 2 3
s 6 5 4 3 2 2 3 3
s 7 6 5 4 3 3 3 4
The Sequence of Operations:
1: Copy e
2: Copy m
3: Copy p
4: Insert e
5: Copy r
6: Replace e with o
7: Replace s with r
8: Delete s

The Damerau-Levenshtein Edit Distance for transforming empress into emperor is: 3
  e m p e r o r
  0 1 2 3 4 5 6 7
e 1 0 1 2 3 4 5 6
m 2 1 0 1 2 3 4 5
p 3 2 1 0 1 2 3 4
r 4 3 2 1 1 1 2 3
e 5 4 3 2 1 1 2 3
s 6 5 4 3 2 2 2 3
s 7 6 5 4 3 3 3 3
The Sequence of Operations:
1: Copy e
2: Copy m
3: Copy p
4: Transpose r with e
5: Replace s with o
6: Replace s with r

```

Figure 1: Output Example

2. (a) Input:

```
python3 2015400183.py oslo snow
```

(b) Output:

```
The Levenshtein Edit Distance for transforming oslo into snow is: 3
```

```

  s n o w
  0 1 2 3 4
o 1 1 2 2 3
s 2 1 2 3 3
l 3 2 2 3 4
o 4 3 3 2 3

```

```
The Sequence of Operations:
```

```

1: Delete o
2: Copy s
3: Replace l with n
4: Copy o
5: Insert w

```

```
The Damerau-Levenshtein Edit Distance for transforming oslo into snow is: 3
```

```

      s n o w
    0 1 2 3 4
o 1 1 2 2 3
s 2 1 2 3 3
l 3 2 2 3 4
o 4 3 3 2 3
The Sequence of Operations:
1: Delete o
2: Copy s
3: Replace l with n
4: Copy o
5: Insert w

```

(c) Screenshot:

```

denizkorkmaz@denizkorkmaz:~/PycharmProjects/CMPE493/Assignment1$ python3 2015400183.py oslo snow
The Levenshtein Edit Distance for transforming oslo into snow is: 3
  s n o w
0 1 2 3 4
o 1 1 2 2 3
s 2 1 2 3 3
l 3 2 2 3 4
o 4 3 3 2 3
The Sequence of Operations:
1: Delete o
2: Copy s
3: Replace l with n
4: Copy o
5: Insert w

The Damerau-Levenshtein Edit Distance for transforming oslo into snow is: 3
  s n o w
0 1 2 3 4
o 1 1 2 2 3
s 2 1 2 3 3
l 3 2 2 3 4
o 4 3 3 2 3
The Sequence of Operations:
1: Delete o
2: Copy s
3: Replace l with n
4: Copy o
5: Insert w

```

Figure 2: Output Example

3. (a) Input:

```
python3 2015400183.py cat catcat
```

(b) Output:

```

The Levenshtein Edit Distance for transforming cat into catcat is: 3
  c a t c a t
0 1 2 3 4 5 6
c 1 0 1 2 3 4 5
a 2 1 0 1 2 3 4
t 3 2 1 0 1 2 3

```

The Sequence of Operations:

- 1: Copy c
- 2: Copy a
- 3: Copy t
- 4: Insert c
- 5: Insert a
- 6: Insert t

The Damerau-Levenshtein Edit Distance for transforming cat into catcat is: 3

```
  c a t c a t
0 1 2 3 4 5 6
c 1 0 1 2 3 4 5
a 2 1 0 1 2 3 4
t 3 2 1 0 1 2 3
```

The Sequence of Operations:

- 1: Copy c
- 2: Copy a
- 3: Copy t
- 4: Insert c
- 5: Insert a
- 6: Insert t

(c) Screenshot:

```
denizkorkmaz@denizkorkmaz:~/PycharmProjects/CMPE493/Assignment1$ python3 2015400103.py cat catcat
The Levenshtein Edit Distance for transforming cat into catcat is: 3
  c a t c a t
0 1 2 3 4 5 6
c 1 0 1 2 3 4 5
a 2 1 0 1 2 3 4
t 3 2 1 0 1 2 3
The Sequence of Operations:
1: Copy c
2: Copy a
3: Copy t
4: Insert c
5: Insert a
6: Insert t

The Damerau-Levenshtein Edit Distance for transforming cat into catcat is: 3
  c a t c a t
0 1 2 3 4 5 6
c 1 0 1 2 3 4 5
a 2 1 0 1 2 3 4
t 3 2 1 0 1 2 3
The Sequence of Operations:
1: Copy c
2: Copy a
3: Copy t
4: Insert c
5: Insert a
6: Insert t
```

Figure 3: Output Example

4. (a) Input:

```
python3 2015400183.py baran deniz
```

(b) Output:

The Levenshtein Edit Distance for transforming baran into deniz is: 5

d e n i z

0 1 2 3 4 5

b 1 1 2 3 4 5

a 2 2 2 3 4 5

r 3 3 3 3 4 5

a 4 4 4 4 4 5

n 5 5 5 4 5 5

The Sequence of Operations:

1: Replace b with d

2: Replace a with e

3: Replace r with n

4: Replace a with i

5: Replace n with z

The Damerau-Levenshtein Edit Distance for transforming baran into deniz is: 5

d e n i z

0 1 2 3 4 5

b 1 1 2 3 4 5

a 2 2 2 3 4 5

r 3 3 3 3 4 5

a 4 4 4 4 4 5

n 5 5 5 4 5 5

The Sequence of Operations:

1: Replace b with d

2: Replace a with e

3: Replace r with n

4: Replace a with i

5: Replace n with z

(c) Screenshot:

```
denizkorkmaz@denizkorkmaz:~/PycharmProjects/CHPE493:Assignment1$ python3 2015400103.py baran deniz
The Levenshtein Edit Distance for transforming baran into deniz is: 5
  d e n i z
0 1 2 3 4 5
b 1 1 2 3 4 5
a 2 2 2 3 4 5
r 3 3 3 3 4 5
a 4 4 4 4 4 5
n 5 5 5 4 5 5
The Sequence of Operations:
1: Replace b with d
2: Replace a with e
3: Replace r with n
4: Replace a with i
5: Replace n with z

The Damerau-Levenshtein Edit Distance for transforming baran into deniz is: 5
  d e n i z
0 1 2 3 4 5
b 1 1 2 3 4 5
a 2 2 2 3 4 5
r 3 3 3 3 4 5
a 4 4 4 4 4 5
n 5 5 5 4 5 5
The Sequence of Operations:
1: Replace b with d
2: Replace a with e
3: Replace r with n
4: Replace a with i
5: Replace n with z
```

Figure 4: Output Example

## 4 References

- <https://nlp.stanford.edu/IR-book/html/htmledition/edit-distance-1.html>
- [https://en.wikipedia.org/wiki/Damerau%E2%80%93Levenshtein\\_distance#Optimal\\_string\\_alignment\\_distance](https://en.wikipedia.org/wiki/Damerau%E2%80%93Levenshtein_distance#Optimal_string_alignment_distance)