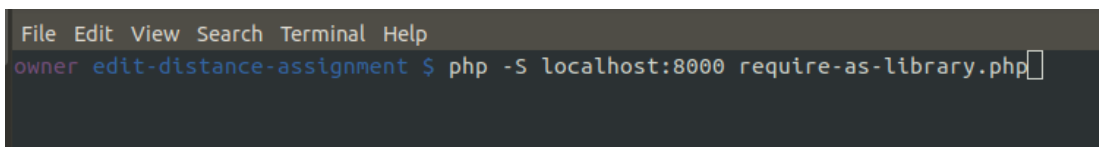# Edit Distance (Hamming and Levenshtein) Guidance

- This document holds steps to go through the files one by one
- First of all, php must be installed on the operating system. Refer to the following documentation: https://www.php.net/manual/en/install.php
- Kindly, go through the files in order. Each file has comments to help understanding the code.

1. **edit-distance.php**
   - This file holds Hamming and Levenshtein classes and their abstract class.
     - **EditDistance class**
       - An abstract class represented as a blueprint
       - It holds the mutual properties and methods for Hamming and Levenshtein classes to inherit.
     - **Hamming class**
       - It holds properties and methods to calculate edit distance in Hamming mode
       - It uses substitution operation only
     - **Levenshtein class**
       - It holds properties and methods to calculate edit distance in Levenshtein mode
       - It uses substitution, deletion, and insertion operations

2. **require-as-library.php**
   - This file requires *'edit-distance.php'* file as a library.
   - It holds some arbitrary inputs for the strings and shows the minimum edit distance required to convert string A into string B.

   - <u>In order to run this file</u>
     - Open the terminal in the same directory and type the following in the command line
       php –S localhost:8000 require-as-library.php
     - Then open your web browser and type the following in the navigation bar
       localhost:8000

```
File  Edit  View  Search  Terminal  Help
owner edit-distance-assignment $ php -S localhost:8000 require-as-library.php
```

   - Results

String A: 'empty string'
String B: 'empty string'
Hamming Distance => Both strings are empty. The minimum Edit Distance is 0
Levenshtein Distance => Both strings are empty. The minimum Edit Distance is 0

String A: friday
String B: monday
Hamming Distance => 3
Levenshtein Distance => 3

String A: saturday
String B: sunday
Hamming Distance => Not of same length! Hamming can not be performed. Refer to Levenshtein
Levenshtein Distance => 3

String A: 'empty string'
String B: not empty
Hamming Distance => Not of same length! Hamming can not be performed. Refer to Levenshtein
Levenshtein Distance => 9

String A: ahmad
String B: ahmed
Hamming Distance => 1
Levenshtein Distance => 1

String A: ababa
String B: babab
Hamming Distance => 5
Levenshtein Distance => 2

3. **Test.php**
   - This file requires **'edit-distance.php'** file as a library. It performs some specified tests on instances of Hamming and Levenshtein classes.
   - **'Test.php'** file is located inside **'test'** directory which is located inside 'testing' directory
   - **'testing'** directory holds the testing process using **PHPUnit Testing Framework**
     https://phpunit.de/getting-started/phpunit-8.html
     - **P.S:** The only step on your behalf is to make sure to install **PHPUnit Testing Framework** inside **'testing'** directory using **composer**
       - Open the terminal in the same directory and type the following in the command line
         composer require phpunit/phpunit

   - In order to run this file
     - Open the terminal in the same directory and type the following in the command line
       cd ..
       ./vendor/bin/phpunit
     - Or go to **'testing'** directory, open the terminal and type the following in the command line
       ./vendor/bin/phpunit

```
File   Edit   View   Search   Terminal   Help
owner  test  $ cd ..
owner  testing  $ ./vendor/bin/phpunit
```

   - In case of **success**

```
File  Edit  View  Search  Terminal  Help
owner testing $ ./vendor/bin/phpunit
PHPUnit 8.5.0 by Sebastian Bergmann and contributors.

Runtime:       PHP 7.2.24-0ubuntu0.18.04.1
Configuration: /home/owner/Desktop/GHZAWI/opensooq-assignment/edit-distance-assignment/testing/phpunit.xml

Edit Distance Tests
 ✓ Two empty strings in Hamming should result in 0   11 ms
 ✓ Two strings with different lengths in Hamming can not be performed   1 ms
 ✓ Two strings with same length and one different character in Hamming should result in 1   1 ms
 ✓ Two strings with same length and more than one different characters in Hamming should result in more than 1   1 ms
 ✓ Two empty strings in Levenshtein should result in 0   1 ms
 ✓ One of the two strings empty in Levenshtein should result in the length of the second string   1 ms
 ✓ Two strings with different lengths in Levenshtein should result in 1 or more   1 ms
 ✓ Two strings with same length and one different character in Levenshtein should result in 1   1 ms
 ✓ Two strings with same length and more than one different characters in Levenshtein should result in more than 1   1 ms

Time: 123 ms, Memory: 4.00 MB

OK (9 tests, 9 assertions)
owner testing $
```

   - In case of **failure**

```
File  Edit  View  Search  Terminal  Help
owner testing $ ./vendor/bin/phpunit
PHPUnit 8.5.0 by Sebastian Bergmann and contributors.

Runtime:       PHP 7.2.24-0ubuntu0.18.04.1
Configuration: /home/owner/Desktop/GHZAWI/opensooq-assignment/edit-distance-assignment/testing/phpunit.xml

Edit Distance Tests
 ✓ Two empty strings in Hamming should result in 0   6 ms
 ✓ Two strings with different lengths in Hamming can not be performed   1 ms
 ✓ Two strings with same length and one different character in Hamming should result in 1   1 ms
 ✓ Two strings with same length and more than one different characters in Hamming should result in more than 1   1 ms
 ✓ Two empty strings in Levenshtein should result in 0   1 ms
 ✓ One of the two strings empty in Levenshtein should result in the length of the second string   1 ms
 ✗ Two strings with different lengths in Levenshtein should result in 1 or more   6 ms

   Failed asserting that 1 matches expected 2.

   /home/owner/Desktop/GHZAWI/opensooq-assignment/edit-distance-assignment/testing/test/Test.php:60


 ✓ Two strings with same length and one different character in Levenshtein should result in 1   1 ms
 ✓ Two strings with same length and more than one different characters in Levenshtein should result in more than 1   1 ms

Time: 124 ms, Memory: 6.00 MB

Summary of non-successful tests:

Edit Distance Tests
 ✗ Two strings with different lengths in Levenshtein should result in 1 or more   6 ms

   Failed asserting that 1 matches expected 2.

   /home/owner/Desktop/GHZAWI/opensooq-assignment/edit-distance-assignment/testing/test/Test.php:60


FAILURES!
Tests: 9, Assertions: 9, Failures: 1.
owner testing $
```

4. **command-line.php**
   - This file requires *'edit-distance.php'* file as a library. It is designed to run on terminal as a **command line tool.**
   - It accepts two strings as inputs and shows the minimum edit distance in Hamming and Levenshtein.

   - <u>In order to run this file</u>
     - Open the terminal in the same directory and type the following in the command line
       php command-line.php
     - Go along with it in order to see the results

```
File  Edit  View  Search  Terminal  Help
owner edit-distance-assignment $ php command-line.php
```

   - Results

```
File  Edit  View  Search  Terminal  Help
owner edit-distance-assignment $ php command-line.php
Welcome to Edit Distance Command Line Tool
It takes two strings as inputs to calculate the edit distance between them
There are two methods:
   1. Hamming
   2. Levenshtein
By transforming string (A) into string (B)

Enter string (A) >>> ababa
Enter string (B) >>> babab


Hamming Distance => 5
Levenshtein Distance => 2

Want to go again? 'yes' or 'no' to exit >>> t
Want to go again? 'yes' or 'no' to exit >>> y
Want to go again? 'yes' or 'no' to exit >>> u
Want to go again? 'yes' or 'no' to exit >>> yes

Enter string (A) >>> sunday
Enter string (B) >>> saturday


Hamming Distance => Not of same length! Hamming can not be performed. Refer to Levenshtein
Levenshtein Distance => 3

Want to go again? 'yes' or 'no' to exit >>> no
owner edit-distance-assignment $
```

5. **web-page-form.php**
   - This file requires *'edit-distance.php'* file as a library.
   - The user can insert two string and submit the form to find Hamming distance or Levenshtein distance.

   - <u>In order to run this file</u>
     - Open the terminal in the same directory and type the following in the command line
       php –S localhost:9000 web-page-form.php
     - Then open your web browser and type the following in the navigation bar
       localhost:9000

File Edit View Search Terminal Help
owner edit-distance-assignment $ php -S localhost:9000 web-page-form.php

   - Results

Hamming and Levenshtein Distance

String **A**

    Enter String (A)...

String **B**

    Enter String (B)...

    Hamming   Levenshtein

Levenshtein mode

String A: 'empty string'

String B: 'empty string'

Distance: Both strings are empty. The minimum Edit Distance is 0

Hamming and Levenshtein Distance

String **A**

sunday

String **B**

saturday

[Hamming] [Levenshtein]

Hamming mode

String A: sunday

String B: saturday

Distance: Not of same length! Hamming can not be performed. Refer to Levenshtein

Hamming and Levenshtein Distance

String **A**

sunday

String **B**

saturday

[Hamming] [Levenshtein]

Levenshtein mode

String A: sunday

String B: saturday

Distance: 3

Hamming and Levenshtein Distance

Hamming mode

String A: 'empty string'

String B: 'empty string'

Distance: Both strings are empty. The minimum Edit Distance is 0

Hamming and Levenshtein Distance

String **A**

Enter String (A)...

String **B**

Enter String (B)...

Hamming   Levenshtein

Levenshtein mode

String A: 'empty string'

String B: 'empty string'

Distance: Both strings are empty. The minimum Edit Distance is 0

Hamming and Levenshtein Distance

String **A**

> babab

String **B**

> ababa

[Hamming] [Levenshtein]

Hamming mode

String A: babab

String B: ababa

Distance: 5

Hamming and Levenshtein Distance

String **A**

> babab

String **B**

> ababa

[Hamming] [Levenshtein]

Levenshtein mode

String A: babab

String B: ababa

Distance: 2