

14BHD COMPUTER SCIENCES, 2020/2021

Laboratory 10

Goals

- Reading and writing files
- Acquisition and processing of real data
- Manage input/output errors through exceptions

Technical Contents

- Read and write text files
 - Process data collection
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To be solved in the laboratory

Exercise 1. Write a program that reads a file containing text named *input.txt*. Read each line and send it to the output file *output.txt*, preceded by line numbers between characters */** and **/*.

Mary had a little lamb
Whose fleece was white as snow.
And everywhere that Mary went,
The lamb was sure to go!

The file *output.txt* will be:

```
/*1*/ Mary had a little lamb
/*2*/ Whose fleece was white as snow.
/*3*/ And everywhere that Mary went,
/*4*/ The lamb was sure to go!
```

[P7.2]

Exercise 2. Write a program that reads each line in a file (*input.txt*), reverses its lines, and writes them to another file (*output.txt*). For example, if the file *input.txt* contains the lines:

Mary had a little lamb
Its fleece was white as snow
And everywhere that Mary went

The lamb was sure to go.

The the file *output.txt* will be:

The lamb was sure to go.

And everywhere that Mary went

Its fleece was white as snow

Mary had a little lamb

[P7.9]

- Exercise 3. Write a program, *find.py*, that looks for a given word in the content of a group of files. The program first asks for the list of files (to be inserted on a single line, separated by commas) and the word to search. The file names will be stored in a list (files), the word to search is stored in a variable. You must display all the lines containing the word, regardless of whether they are upper of lower case, each line preceded by the name of the file in which it is located. For example, if the word is “ring”, and list contains:

book.txt, address.txt, homework.py

Then the program might print:

book.txt: There is only one Lord of the Ring, only one who can bend it to his will

book.txt: The ring has awoken; it's heard its masters call.

address.txt: Kris Kringle, North Pole

address.txt: Homer Simpson, Springfield

homework.py: string = “text”

[P7.6]

- Exercise 4. A hotel salesperson enters sales in a text file. Each line contains the following, separated by semicolons: The name of the client, the service sold (such as Dinner, Conference, Lodging, and so on), the amount of the sale, and the date of that event. Write a program that reads such a file and displays the total amount for each service category. Display an error if the file does not exist or the format is incorrect. [P7.29]
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To solve at home

Exercise 5. *Random monoalphabet cipher.* The Caesar cipher, which shifts all letters by a fixed amount, is far too easy to crack. Here is a better idea. As the key, don't use numbers but words. Suppose the key word is FEATHER. Then first remove duplicate letters, yielding FEATHR, and append the other letters of the alphabet in reverse order:

F	E	A	T	H	R	Z	Y	X	W	V	U	S	Q	P	O	N	M	L	K	J	I	G	D	C	B
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Now encrypt the letters as follows:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
F	E	A	T	H	R	Z	Y	X	W	V	U	S	Q	P	O	N	M	L	K	J	I	G	D	C	B

Write a program that encrypts or decrypts a file using this cipher. For example,
`crypt.py -d -kFEATHER encrypt.txt output.txt`
decrypts a file using the keyword FEATHER. It is an error not to supply a keyword.
The first parameter (-d) determines if you have to encrypt (-e) or decrypt (-d) the
input file (encrypt.txt in the example). [P7.20]

Exercise 6. *Playfair cipher.* Another way of thwarting a simple letter frequency analysis of an encrypted text is to encrypt pairs of letters together. A simple scheme to do this is the Playfair cipher. You pick a keyword and remove duplicate letters from it. Then you fill the keyword, and the remaining letters of the alphabet, into a 5×5 square. (Because there are only 25 squares, I and J are considered the same letter.). Here is such an arrangement with the keyword PLAYFAIR.

P	L	A	Y	F
I	R	B	C	D
E	G	H	K	M
N	O	Q	S	T
U	V	W	X	Z

To encrypt a letter pair, say AM, look at the rectangle with corners A and M:

P	L	A	Y	F
I	R	B	C	D
E	G	H	K	M
N	O	Q	S	T
U	V	W	X	Z

The encoding of this pair is formed by looking at the other two corners of the rectangle, in this case, FH. If both letters happen to be in the same row or column, such as GO, simply swap the two letters. Decryption is done in the same way. Write a program that encrypts or decrypts an input text according to this cipher. [P7.23]

Exercise 7. Write a program that displays the list of exams passed by a student, with their grades. There is a file, *classes.txt*, that contains the names of all the teachings given in the school (a U.S. college), whose content will be similar to this one:

```
CSC1
CSC2
CSC46
CSC151
MTH121
...
```

Then, for each teaching, there is a file (whose name is equal to the teaching code followed by *.txt*) that lists the students who have passed the relevant exam and contains the student ID numbers and grades, like this one, which could be the *CSC2.txt* file:

```
11234 A-
12547 B
16753 B+
21886 C
...
```

Write a program that asks the user for a student's ID and displays the list of exams that that student has passed, with the relative grades obtained, as in this example:

```
Student ID 16753
CSC2 B+
```

MTH121 C+

CHN1 A

PHY50 A-

[P7.28]