Sabancı University

Faculty of Engineering and Natural Sciences

CS204 Advanced Programming

Fall 2023-2024

Homework #1

Due: 17/10/2023 - 23:59

PLEASE NOTE:

Your program should be a robust one such that you have to consider all relevant programmer mistakes and extreme cases; you are expected to take actions accordingly!

You HAVE TO write down the code on your own.
You CANNOT HELP any friend while coding.
Plagiarism will not be tolerated!!

1 Introduction

The aim of this homework is to recall CS201 material and practice on matrices (two dimensional arrays/vectors). You are asked to find the list of chars (i.e. strings) having a simple property and their locations in a 2D matrix via basic search mechanisms, extract information out of it and process that information.

In this homework, you are going to implement a program that searches a given input matrix of characters and displays the words which satisfies a condition. The details about the homework will be explained in the following sections of this document.

2 Input

The program prompts for the input file name. Then, it reads the file name from the standard input. A simple input file can be as follows:

```
15
XOBEICDOCGVAJBV
GJJPEDPISLOISSB
PUBCXJEREBCARAV
LCNKUSVFDAKNENI
WPNOMKLBFDBFECX
SAIAMGYOSIHPTRH
QOUMJBVIQUTVWSR
PVKKBZUUVHIVBGE
TAWCWMLTHMXWFZJ
SYPSEHIUNDVZCOD
WSHTOPCBOSAZOTF
FXEPFVPIRMXULAN
IKTEBTZOOJDBAZK
MZHLHSAQPJOQUSP
KTYTWZSLRXJLPSV
12
NIKAIDO
AMMONIUM
BLOCKADE
```

```
CONSUMPTION
  DIGITAL
  HUNGRY
  PERIOD
RENAISSANCE
  ROOIBOS
  SQUID
  STUDENT
  TOWEL
```

3 Sample Input File

Notice that the input file only contains upper-case letters. This will be true for all the input files that will be used to test your program. First line of the file is matrix's size(n). From the sample input file, the matrix is $15x15$. Following n lines contain a (nxn) matrix of letters that is a manifestation of a 2-dimentional matrix. You need to check that each line needs to have the same number of letters and the lines contain only upper-case letters and nothing else. You have to check and take action for any irregularities in the input file, and if the file is valid you need to use an appropriate container to hold this 2-dimensional matrix in memory. Please see sample runs to see some irregularities that may occur in the input files. After the matrix elements, following line gives the number of words to be searched in the matrix. In the sample input file there are 12 words to be searched. The last lines of the input file, you will find the words.

In this homework, you need to develop an algorithm to check if the given words can be found in the matrix in spiral form. For the explanation of the spiral form, please see the search directions. We want you to implement a program that searches the matrix in several directions and displays the words which are found in the matrix. A word found by your program does not need to be a meaningful. Please see sample runs for some examples.

4 Search Directions

Starting from any coordinate in the matrix, a word can go spirally. Hence, you are expected to search the input file checking all directions from clockwise *and counter clockwise*. For example: If you go up in the first step, you need to go right in the second step, then go down. If you go right in the first step, you will go down in the second and go left in the third step. You can see possible search locations below. You can assume the search words will contain at least 3 letters.

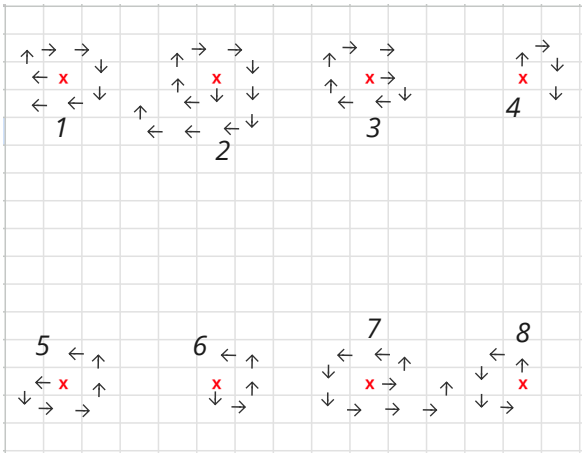

Figure 1: Possible spiral directions from clockwise and counter clockwise

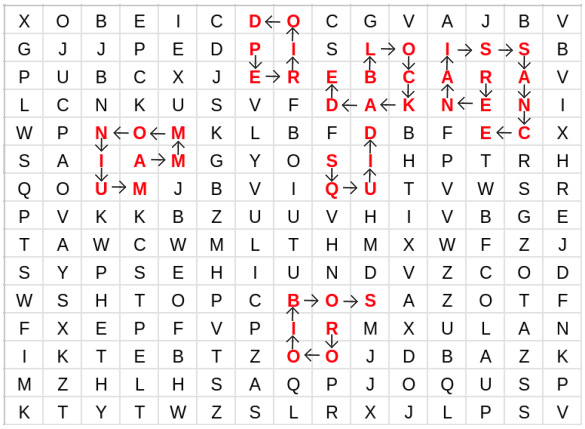

Figure 2: Annotated sample input

5 Rules for Input and Execution

There are some rules for input files and your output. Consider the following while writing your code:

- Your program should perform input check and ask for new file name until an input file is found (matrix_4_2.board)
- Your program should perform input check on input file. Input files should comply with those rules;
  - Matrix should be *nxn* and all rows must be equal size (matrix_4_2.board)
  - Matrix cannot include any of these characters: [a-z], +, -, *, /, %, [0-9] (matrix_7_5.board)
- Number of words to search and number of found words could be different. (matrix_8_3.board)
- Found words in the output don't have to be sorted. But they should comply with the format: `N Words are Found:(2 empty space) WORD1 WORD2 WORD3 WORD4`
  N is 4 in this case.

6 Sample Runs

To have a better understanding, some sample runs are given below. Note that these are not comprehensive and you must consider all cases.

File: matrix_4_2.board

```
4
HXBU
LUHGAG
HCTT
UWFZC
2
BUG
CTHULHU
```

Output:

```
Enter the name of the file
```

data.txt

```
Could not open the file data.txt
Enter the name of the file
```

matrix_4_2.board

Error: Input file is not in correct format!

File: matrix_5_3.board

```
5
KWMMF
OROCK
RMLBA
RIBED
TMUGM
3
BLOCKADE
BUG
MIRROR
```

Output:
Enter the name of the file
matrix_5_3.board
3 Words are Found: MIRROR BLOCKADE BUG

File: matrix_8_3.board

```
8
VBSNGAQP
SGJVFYTV
IFLUXZRN
QDEKVSDV
IDOUFLCU
ANTZTOGQ
KILLEWKX
WZHRWXGW
6
CACHE
CARRY
LUKE
NIKAIDO
PERCEPTION
TOWEL
```

Output:
Enter the name of the file
matrix_8_3.board
3 Words are Found: TOWEL LUKE NIKAIDO

File: matrix_7_5.board

```
7
APHLAFK
NICVJAR
AMDTWKK
AGONVEN
WZRDFDC
JLOEWVI
B66RJCR
5
DONT
KRAKEN
ORDER66
PANIC
ROOIBOS
```

Output:
```
Enter the name of the file
matrix_7_5.board
Error:  Input file is not in correct format!
```

7 Some Important Rules

In order to get a full credit, your programs must be efficient and well presented, presence of any redundant computation or bad indentation, or missing, irrelevant comments are going to decrease your grades. You also have to use understandable identifier names, informative introduction and prompts. Modularity is also important; you have to use functions wherever needed and appropriate.

When we grade your homeworks we pay attention to these issues. Moreover, in order to observe the real performance of your codes, we may run your programs in *Release* mode and **we may test your programs with *very large test cases and edge cases***

What and where to submit (PLEASE READ, IMPORTANT): You should prepare your program using C++. We will use the standard C++ compiler and libraries while testing your homework. It'd be a good idea to write your name and last name in the program (as a comment line of course). Submissions guidelines are below. Some parts of the grading process are automatic. Students are expected to strictly follow these guidelines in order to have a smooth grading process. If you do not follow these guidelines, depending on the severity of the problem created during the grading process, 5 or more penalty points are to be deducted from the grade.
Name your cpp file that contains your program as follows:

SUCourseUserName_YourLastname_YourName_HWnumber.cpp

Your SUCourse user name is actually your SUNet username that is used for checking sabanciuniv e-mails. Do NOT use any spaces, non-ASCII and Turkish characters in the file name. For example, if your SUCourse user name is cago, name is Çağlayan, and last name is Özbugsızkodyazaroğlu, then the folder name must be:

cago_Caglayan_Ozbugsizkodyazaroglu_hw1.cpp

Do not add any other character or phrase to the folder name. Make sure that it contains the last version of your homework program. Compress this folder using WINZIP or WINRAR program. Please use "zip" compression. **"rar" or another compression mechanism is NOT allowed.**. Our homework processing system works only with zip files. Therefore, make sure that the resulting compressed file has a zip extension. Check that your compressed file opens up correctly and it contains your cpp file.
You will receive no credits if your compressed folder does not expand or it does not contain the correct files. The name of the zip file should be as follows:

SUCourseUserName_YourLastname_YourName_HWnumber.zip

For example zubzipler_Zipleroglu_Zubeyir_hw1.zip is a valid name, but

hw1_hoz_HasanOz.zip, HasanOzHoz.zip

are **NOT** valid names. **Submit via SUCourse ONLY!** You will receive no credits if you submit by other means (e-mail, paper, etc.).

Successful submission is one of the requirements of the homework. If, for some reason, you cannot successfully submit your homework and we cannot grade it, your grade will be 0.

Good Luck!

CS204 Team