Course – Section	Programming Fundamentals (CS1002 - Fall 2022) – BCS Section 1G
Assignment Num.	Project
Total Marks	100
Start Date	15-November-2022
Due Date/Time	04-December-2022 (11:59 PM)
Submission	Submit .cpp files on the google classroom
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Submission Guidelines	- *Projects must be received before the deadline. Submissions after the deadline will face a 25% grade penalty (within 1 day) or a 50% grade penalty (within 2 days).* - *Please do the work by yourself, this is an individual assignment.* - *Plagiarism cases will be dealt with strictly.* - *Create a separate file for each question.* - *Name the file according to the following format: 22L-Proj_01.cpp. Not doing so will result in deduction of marks.* - *Do not zip the files. Submit all of them separately.* - *Make sure the code is presented well and contains comments.* - *Make sure to handle boundary cases, negative values cases and any other value that could break the code when entered.*

Teleword is a word puzzle designed by David Ouellet that appears in the leisure columns of newspapers around the world, including the daily Dawn in Pakistan. In this homework, your task is to write a program that will solve any Teleword puzzle fed into it as a text file.

1. How is Teleword played

It's a simple game. It consists of a 15 x 15 grid of letters, as you can see in the following photographs of the puzzle published in the Dawn paper of September 30, 2018. Other than the grid, it contains a list of words. The goal is to find all the words of the list in the grid. The words might appear in the forward or backward direction in a row, column or diagonal of the grid. Two or more words may overlap. In other words, some letters of the grid maybe shared by two or more words.

Once the player has found all the words, and circled out all the letters in the grid covered by these words (as shown in the right hand picture) the left-over letters (i.e. the uncircled letters) spell the Teleword. Finding this Teleword is the goal.
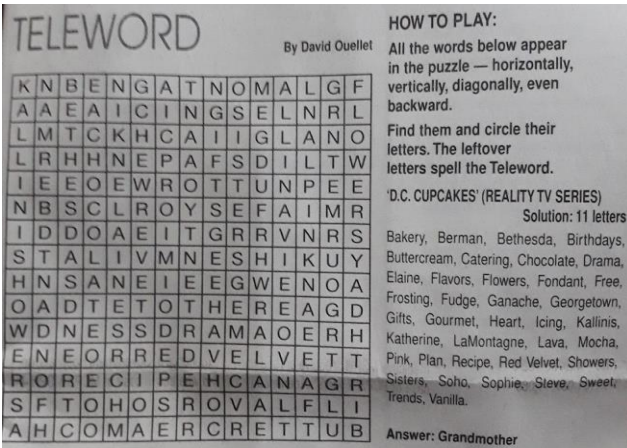
An unsolved Teleword Puzzle
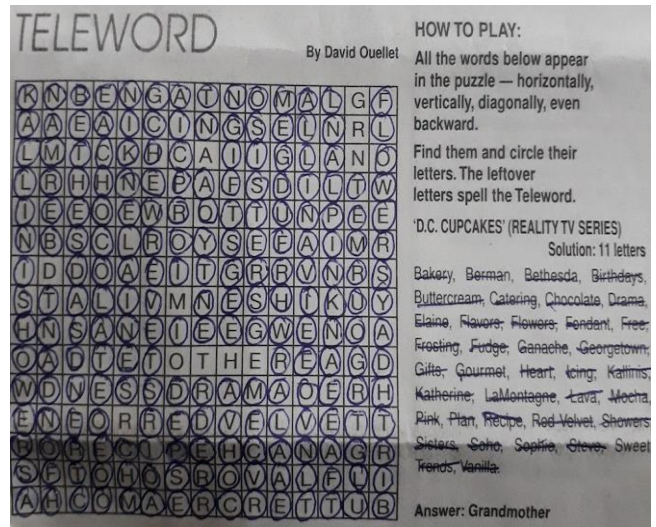
A solved Teleword Puzzle
The leftover letters spell 'Grandmother' when read row by row.

For example, in the solved puzzle above, the left-over letters spell Grandmother. The left-over letters should be read row by row from top to bottom, scanning each row from left to right. The letters are put together in this order to get the Teleword.

2. What will be the input to your program

Your program will load a Teleword puzzle from a text file called teleword.txt. For convenience, you may store this file in the same folder as your program. The format of the file will be as below:

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

Accountant, Actor, Actress, Advertiser, Artist, Banker, Beautician, Cash, Chef, Cleaner, Dancer, Dentist, Designer, Doctor, Draw, Driver, Earn, Editor, Farmer, Find, Fishing, Guard, Help, Hunter, Leading, Model, Notary, Nurse, Painter, Pilot, Planner, Plays, Preparing, Reporter, Secretary, Sharing, Skill, Talk, Teacher, Training, Waitress, Writer.

A text file containing data for one Teleword puzzle

The first fifteen lines of the file contain 15 letters each of the grid. The letters in each line are separated by single spaces.

After the grid there is an empty line.

After that is the list of words. The words in the list are separated by a comma followed by a space. The last word is followed by a full-stop. (Note: there are no new lines between the words, it only appears that there is a line between, for example, Chef and Cleaner because of the small screen size which had to display the content in the next line; there is no actual new-line character there).

Your program will need to open the file and load both the grid and the word list. Obviously, no word in the list can be more than **15** letters long.

Note: you will be provided with three sample files so that you can test your program's working; however, your program will be tested on different files during evaluations.

3. How should the program work

After reading the data from the file, the Teleword Solver should display the grid on the screen, followed by the word list, exactly as they are shown in the picture of the file above.

After this, the program should print 3 options:

1. Press S to solve the puzzle at once.
2. Press T to solve the puzzle step by step.
3. Press X to print puzzle statistics.

The working of these options is explained below:

Option 1 "Press S to solve the puzzle at once."
If the user selects this option, the program should simply print the entire grid with all the covered letters in colors and the uncovered letters in white after all words have been found in the grid. After that, the program should display the Teleword and terminate.

There is one added feature of this option: the covered letters should be colored according to the number of words they occur in. If a letter appears is only one word it should be yellow, if it appears in two words it should be blue, if it appears in more than two words it should be red; the leftover letters should be white.

Option 2 "Press T to solve the puzzle step by step."
If the user selects this option, the program should allow them to see one word being found at a time. First, they should see the whole grid and list in white. When they press enter, they should see the first word of the list turned yellow in the grid. On each successive enter, the next word in the list is turned yellow in the grid (the shared letters being color coded as in option 1). Once all words have been found, the grid should look exactly as at the end of option 1, and the program should terminate.

For instance, in the example shown above, which contains 42 words in the list, the program will terminate after 42 enters.

Option 3 "Press X to print puzzle statistics."
If the user presses X, then they should see the entire output of option 1, and after that the following information printed line by line:

- **Time to Solve:** the time taken by the program to solve the puzzle (not including the time to compute statistics): a value in number of seconds (this could be a fraction of a second). Figure out how to do this in code.
- **Word Statistics:** Longest word length; shortest word length, average word length.
- **Word Distribution:** number of horizontal, vertical and diagonal words. Each count should also mention how many were forward and backwards among them.
    - For example: Horizontal: 16 (10, 6), Vertical: 19 (7, 12), Diagonal: 7 (2, 5) The numbers in the brackets are forward and backward counts respectively.
- **The Teleword Scatter:** how many rows were touched by the Teleword letters. For instance, in the example given in the picture, the letters of 'Grandmother' come from 7 different rows. So the Teleword Scatter is 7.
- **Heaviest Row, Heaviest Column:** the row and column numbers that were touched by most words.

These statistics should be printed line by line in the following order:

Time to Solve:
Longest Word Length: , Shortest Word Length: , Average Word Length:
Word Distribution:
Teleword Scatter:
Heaviest Row:
Heaviest Column:

(Good Luck)