1 Overview

For this assignment, we will implement a simple typing tutor. The program will give users the option to spell commonly misspelled words, display some words from one of the data sets, practice typing random words from a dictionary, or to search for a word in the dictionary. The goal is to give students practice with

- string comparisons

- reading and accessing data from files

- implementing an algorithm (binary search)

2 The Provided Files

In this project, you will be working with data stored in external files. They are described below.

- **program3.cc** the starter code that will have all your work, and will be the file you submit for grading.

- **dictionary.txt** holds a list of words that are sorted in alphabetical order. The format for the data is one word on each line.

- **misspelled.txt** a list of word pairs the *misspelled* version of the word and the *correctly* spelled version of the word. The format is one pair per line, with the misspelled word first (then a space) followed by the correctly spelled version of that word.

3 How To Work On This Assignment

We are taking a different approach for this program by having you complete a collection of functions, each with their own role. We first prepared the solution and then removed the body of most of the functions. In later sections, we describe each menu option separately and functions in the starter code will reference their associated sections. While completing this assignment, there are important restrictions you need to follow.

4 Restrictions For Program 3

In the starter code, you will find 14 functions that need completing. We have listed them below, but note that the names might be slightly different if you selected the camel-case version of the starter code. That will be available soon.

- `display_header`
- `randn`
- `extract_dict`
- `extract_misspelled`
- `display_elems`
- `extract_spelling_answers`
- `extract_spelling_mistakes`

- `report_misspell_mistakes`
- `evaluate_user_misspells`
- `misspelled`
- `full_dict`
- `print_range`
- `display_in_range`
- `bsearch`

Each of these functions, has their own *signature*, which is their type and parameters. **You are not allowed to change this**. What this means is that you cannot

1. change what the function returns

2. change the number of parameters

3. change the type of the parameters

4. remove the `const` from any parameters.

5 Where To Submit

Just like the previous two assignments, this one will be submitted to Gradescope. There, you can find an assignment called *Program 3*. We will provide an autograder as well, although it might not be available at the time of release.

6 At Program Start

```
*** Typing Tutor
There are 263533 words in the dictionary.
There are 114 commonly misspelled words.
```

When the program first starts, it should display the program title the size of the dictionary, and the number of commonly misspelled words. Make sure you **do not hard code** the number of words in the dictionary or the number of commonly misspelled words. We reserve the right to use a different dataset during grading, but we will always guarantee the specification in Section 2.

7 Menu Option 1: Spelling Misspelled

For this first option, your program will select five random words from the *misspelled.txt* data set and have the user spell them correctly.

```
*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 1


*** Using commonly misspelled words.
truely grammer honourary concious therefor
Type the words above with the correct spelling:
truly grammar honorary conscious therefore
No misspelled words!
15 points: 5 spelled correctly x 3 points for each.
0 point penalty: 0 spelled incorrectly x -6 points for each.
Score: 15
```

The above example shows the output for selecting the first menu option, and then correctly typing all the misspelled words. If the user typed a word incorrectly, then we would have the following.

```
Type the words above with the correct spelling:
truly grammar honorary conscience therefar
Misspelled words:
    conscience -> conscious
    therefar -> therefore
9 points: 3 spelled correctly x 3 points for each.
12 point penalty: 2 spelled incorrectly x -6 points for each.
Score: -3
```

The program will have to compare the answers given by the user with the correct answer. The scoring breaks down as follows

- 3 points for each correct spelling

- -6 points for each incorrect.

8 Menu Option 2: Typing From Dictionary

```
*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 2

*** Using full dictionary.
metapsychics roadshow fickles flouter springle
Correctly type the words above:
metapsychics roadshow fickles flouter springle
No misspelled words!
15 points: 5 spelled correctly x 3 points for each.
0 point penalty: 0 spelled incorrectly x -6 points for each.
Score: 15
```

For this option, the user will be given five random words from *dictionary.txt*. If you have your solution to menu option 1 already, then this option might be easy for you to implement because you have functions that you can re-use here. Discovering this is exactly what we intend for you to do, so if you are struggling with this option (and are re-writing everything from scratch) then you should instead re-work your code for menu option 1. Above, we show an example of the user correctly typing all words and below is when they have mistakes.

```
Type the words above with the correct spelling:
metapsychics roadshow fickles flouter sprinfle
Misspelled words:
    sprinfle -> springle
12 points: 4 spelled correctly x 3 points for each.
6 point penalty: 1 spelled incorrectly x 6 points for each.
Score: 6
```

9   Menu Option 3: Word Range

For this option, the program will print out a range of words from the user's chosen data source. First, the user must select the data source.

```
*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 3

*** Displaying word list entries.
Which words do you want to display?
A. Dictionary of all words
B. Commonly misspelled words (wrongly spelled)
C. Commonly misspelled words (correctly spelled)
Your choice:
```

Each option will have one of the corresponding effects

   A. use words from *dictionary.txt*

   B. use words from *misspelled.txt* and display the **wrongly** spelled version.

   C. use words from *misspelled.txt* and display the **correctly** spelled version.

After the user picks the source, your program must report the total range of valid indices. These range from $0 \to (n-1)$, where n is the number rows in the source. Then the user will provide two integers that represent the starting and ending index for the selected range. See the example below, which prints words from index $5 \to 10$.

```
Your choice: A
*** Enter the start and end indices between 0 and 263532: 5 10
5. aal
6. aalii
7. aaliis
8. aals
9. aardvark
10. aardvarks
```

If the user gives values that are not in range or backwards, then display the following error message and return to the main menu. See the example below.

```
*** Enter the start and end indices between 0 and 263532: 10 5
The end index must come after the start, and the indices must be in range.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice:
```

10 Menu Option 4: Binary Search

For this menu option, your program will search `dictionary.txt` for a word given by the user. Your program will use the *Binary Search* algorithm. We provide an example `bsearch.cc` that searches through an array of integers. Below is an example of what the program's output will look like.

```
Your choice: 4
*** Enter word to search: hello
    1. Comparing to: mankier
    2. Comparing to: dormins
    3. Comparing to: hammering
    4. Comparing to: interrupted
    5. Comparing to: hyperplanes
    6. Comparing to: hipparchs
    7. Comparing to: helices
    8. Comparing to: herniotomies
    9. Comparing to: hemoptyses
   10. Comparing to: helplessly
   11. Comparing to: helis
   12. Comparing to: hellishness
   13. Comparing to: helminthologists
   14. Comparing to: helmet
   15. Comparing to: hellos
   16. Comparing to: hello
hello was found.
```

Binary search works when the data, like `dictionary.txt` is sorted, and on every iteration of the algorithm it compares the midpoint in the data with the target. The program will print every word it compares with the target along the search path. Below is another example of the output, but when the search is unsuccessful.

```
Your choice: 4
*** Enter word to search: otherx
    1. Comparing to: mankier
    2. Comparing to: rucs
    3. Comparing to: pentadactyls
    4. Comparing to: nonconceptual
    5. Comparing to: outtake
    6. Comparing to: oillets
    7. Comparing to: orthogenetic
    8. Comparing to: outers
    9. Comparing to: otoscopies
   10. Comparing to: ossicle
   11. Comparing to: ostiaries
   12. Comparing to: ostrichlike
   13. Comparing to: otitic
   14. Comparing to: otherwhile
   15. Comparing to: otherworlds
   16. Comparing to: otioseness
   17. Comparing to: otiose
   18. Comparing to: otic
otherx was NOT found.
```

11 Example Output

The format for all of the examples is that one option menu is selected, followed by an exit.

11.1 Option 1

```
*** Typing Tutor
There are 263533 words in the dictionary.
There are 114 commonly misspelled words.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 1

*** Using commonly misspelled words.
truely grammer honourary concious therefor
Type the words above with the correct spelling:
truly grammar honorary conscious therefore
No misspelled words!
15 points: 5 spelled correctly x 3 points for each.
0 point penalty: 0 spelled incorrectly x -6 points for each.
Score: 15

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 5
Exiting.
```

```
*** Typing Tutor
There are 263533 words in the dictionary.
There are 114 commonly misspelled words.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 1

*** Using commonly misspelled words.
ecstacy wierd Phillipines untill publically
Type the words above with the correct spelling:
ectacy weird Philipines until publicly
Misspelled words:
    ectacy -> ecstasy
    Philipines -> Philippines
9 points: 3 spelled correctly x 3 points for each.
12 point penalty: 2 spelled incorrectly x -6 points for each.
Score: -3

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 5
Exiting.
```

11.2 Option 2

```
*** Typing Tutor
There are 263533 words in the dictionary.
There are 114 commonly misspelled words.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 2

*** Using full dictionary.
subgovernment grinderies actinomorphic capitalizes encephalitogens
Correctly type the words above:
subgovernment grinderies actinomorphic capitalizes encephalitogens
No misspelled words!
15 points: 5 spelled correctly x 3 points for each.
0 point penalty: 0 spelled incorrectly x -6 points for each.
Score: 15

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 5
Exiting.
```

11.3   Option 3

```
*** Typing Tutor
There are 263533 words in the dictionary.
There are 114 commonly misspelled words.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 3

*** Displaying word list entries.
Which words do you want to display?
A. Dictionary of all words
B. Commonly misspelled words (wrongly spelled)
C. Commonly misspelled words (correctly spelled)
Your choice: b
*** Enter the start and end indices between 0 and 113: 5 12
5. acheive
6. agressive
7. apparantly
8. appearence
9. arguement
10. assasination
11. basicly
12. begining

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 5
Exiting.
```

```
*** Typing Tutor
There are 263533 words in the dictionary.
There are 114 commonly misspelled words.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 3

*** Displaying word list entries.
Which words do you want to display?
A. Dictionary of all words
B. Commonly misspelled words (wrongly spelled)
C. Commonly misspelled words (correctly spelled)
Your choice: a
*** Enter the start and end indices between 0 and 263532: -2 100
The end index must come after the start, and the indices must be in range.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 5
Exiting.
```

11.4   Option 4

```
There are 263533 words in the dictionary.
There are 114 commonly misspelled words.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 4
*** Enter word to search: computer
     1. Comparing to: mankier
     2. Comparing to: dormins
     3. Comparing to: catechismal
     4. Comparing to: crashworthy
     5. Comparing to: cogon
     6. Comparing to: consumptivenesses
     7. Comparing to: compressing
     8. Comparing to: confounders
     9. Comparing to: concretionary
    10. Comparing to: concentrator
    11. Comparing to: computerphobes
    12. Comparing to: compulsively
    13. Comparing to: computations
    14. Comparing to: computerises
    15. Comparing to: computerdom
    16. Comparing to: compute
    17. Comparing to: computer
computer was found.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 5
Exiting.
```

```
*** Typing Tutor
There are 263533 words in the dictionary.
There are 114 commonly misspelled words.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 4
*** Enter word to search: phantome
    1. Comparing to: mankier
    2. Comparing to: rucs
    3. Comparing to: pentadactyls
    4. Comparing to: pugarees
    5. Comparing to: polyploidy
    6. Comparing to: pickle
    7. Comparing to: phalange
    8. Comparing to: photochronographs
    9. Comparing to: philopena
   10. Comparing to: phenazines
   11. Comparing to: pharmacists
   12. Comparing to: phantasimes
   13. Comparing to: phantomatic
   14. Comparing to: pharisaicalnesses
   15. Comparing to: pharaohs
   16. Comparing to: phantomy
   17. Comparing to: phantomlike
   18. Comparing to: phantomish
phantome was NOT found.

*** Select a menu option:
1. Spell commonly misspelled words
2. Type random words from the full dictionary
3. Display some words from one of the lists
4. Use binary search to lookup a word in the dictionary
5. Exit the program.
Your choice: 5
Exiting.
```