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Could you run Part C(DictionaryCPP) separately on CLion. I tried to submit just the cpp files but CLion requires CMakeLists files to run the project.

## PART A

### Test 1

```
-----
| | | |
-----
| | | |
-----
| | | |
-----
Enter a row (0, 1, 2) for player X : 0
Enter a column (0, 1, 2) for player X: 0
-----
| X | | |
-----
| | | |
-----
| | | |
-----
Enter a row (0, 1, 2) for player O : 0
Enter a column (0, 1, 2) for player O: 0
This cell is already occupied. Try a different cell
Enter a row (0, 1, 2) for player O : 0
Enter a column (0, 1, 2) for player O: 1
-----
| X | O | |
-----
| | | |
-----
| | | |
-----
Enter a row (0, 1, 2) for player X : 1
Enter a column (0, 1, 2) for player X: 1
-----
| X | O | |
-----
| | X | |
-----
| | | |
-----
Enter a row (0, 1, 2) for player O : 2
Enter a column (0, 1, 2) for player O: 2
-----
| X | O | |
-----
| | X | |
-----
| | | O |
-----
Enter a row (0, 1, 2) for player X : 1
Enter a column (0, 1, 2) for player X: 0
```

```

-----
| x | o |  | 
-----
| x | x |  | 
-----
|  |  | o | 
-----
Enter a row (0, 1, 2) for player O : 2
Enter a column (0, 1, 2) for player O: 0
-----
| x | o |  | 
-----
| x | x |  | 
-----
| o |  | o | 
-----
Enter a row (0, 1, 2) for player X : 1
Enter a column (0, 1, 2) for player X: 2
-----
| x | o |  | 
-----
| x | x | x | 
-----
| o |  | o | 
-----
X player won

```

Test 2

```

-----
| | | |
-----
| | | |
-----
| | | |
-----
Enter a row (0, 1, 2) for player X : 1
Enter a column (0, 1, 2) for player X: 1
-----
| | | |
-----
| | X | |
-----
| | | |
-----
Enter a row (0, 1, 2) for player O : 0
Enter a column (0, 1, 2) for player O: 2
-----
| | | O |
-----
| | X | |
-----
| | | |
-----
Enter a row (0, 1, 2) for player X : 2
Enter a column (0, 1, 2) for player X: 2
-----
| | | O |
-----
| | X | |
-----
| | | X |
-----
Enter a row (0, 1, 2) for player O : 0
Enter a column (0, 1, 2) for player O: 0
-----
| O | | O |
-----
| | X | |
-----
| | | X |
-----
Enter a row (0, 1, 2) for player X : 2
Enter a column (0, 1, 2) for player X: 0
-----
| O | | O |
-----
| | X | |
-----
| X | | X |
-----
Enter a row (0, 1, 2) for player O : 2
Enter a column (0, 1, 2) for player O: 1

```

```

-----
| o |   | o |
-----
|   | x |   |
-----
| x | o | x |
-----
Enter a row (0, 1, 2) for player X   : 1
Enter a column (0, 1, 2) for player X: 0

-----
| o |   | o |
-----
| x | x |   |
-----
| x | o | x |
-----
Enter a row (0, 1, 2) for player O   : 1
Enter a column (0, 1, 2) for player O: 2

-----
| o |   | o |
-----
| x | x | o |
-----
| x | o | x |
-----
Enter a row (0, 1, 2) for player X   : 0
Enter a column (0, 1, 2) for player X: 1

-----
| o | x | o |
-----
| x | x | o |
-----
| x | o | x |
-----
No winner

```

Part B

```

1 371449635398431 is valid
2 4444444444444448 is valid
3 4444424444444440 is valid
4 4110144110144115 is valid
5 4114360123456785 is valid
6 4061724061724061 is valid
7 5500005555555559 is valid
8 5115915115915118 is valid
9 5555555555555557 is valid
10 6011016011016011 is valid
11 372449635398431 is not valid
12 4444544444444448 is not valid
13 4444434444444440 is not valid
14 4110145110144115 is not valid
15 4124360123456785 is not valid
16 4062724061724061 is not valid
17 5501005555555559 is not valid
18 5125915115915118 is not valid
19 5556555555555557 is not valid
20 6011116011016011 is not valid
21 372449635397431 is not valid
22 4444544444444448 is not valid
23 4444434444544440 is not valid
24 4110145110184115 is not valid
25 4124360123457785 is not valid
26 4062724061724061 is not valid
27 5541005555555559 is not valid
28 5125115115915118 is not valid
29 5556551555555557 is not valid
30 6011316011016011 is not valid

```

## Part C

```

! Opening data file.... ./Data.CS.SFSU.txt! Loading data...
! Loading completed...
! Closing data file... ./Data.CS.SFSU.txt

===== DICTIONARY 340 C++ =====
-----Keywords: 19
-----Definitions: 61

Search [1]: !help
|
| PARAMETER HOW-TO, please enter:
| 1. A search key - then 2. An optional part of partOfSpeech - then
| 3. An optional 'distinct' - then 4. An optional 'reverse'
Search [2]:
|
| PARAMETER HOW-TO, please enter:
| 1. A search key - then 2. An optional part of partOfSpeech - then
| 3. An optional 'distinct' - then 4. An optional 'reverse'
Search [3]: aRRow
|
| Arrow [noun] : Here is one arrow: <IMG> -->> </IMG>..
Search [4]: adverb
|
| Adverb [noun] : Adverb is a word that adds more information about place, time, manner, cause or degree to a verb, an adjective, a phrase or another adverb.
Search [5]: noun noun reverse
|
| Noun [noun] : Noun is a word that refers to a person, (such as Ann or doctor), a place (such as Paris or city) or a thing, a quality or an activity (such as plant, sorrow or tennis).
Search [6]: cSc220
|
| cSc220 [adjective] : Ready to create complex data structures.
| cSc220 [noun] : Data Structures.
| cSc220 [verb] : To create data structures.
Search [7]: cSc340 noun distinct REVERSE
|
| cSc340 [noun] : Programming Methodology.
| cSc340 [noun] : Many hours outside of class.
| cSc340 [noun] : A CS upper division course.
Search [8]: book NOUN distinct reverse
|
| Book [noun] : A written work published in printed or electronic form.
| Book [noun] : A set of pages.

```

```
Search [9]: placeHOLDER
|
Placeholder [adjective] : To be updated...
Placeholder [adjective] : To be updated...
Placeholder [adverb] : To be updated...
Placeholder [conjunction] : To be updated...
Placeholder [interjection] : To be updated...
Placeholder [noun] : To be updated...
Placeholder [noun] : To be updated...
Placeholder [noun] : To be updated...
Placeholder [preposition] : To be updated...
Placeholder [pronoun] : To be updated...
Placeholder [verb] : To be updated...
|
Search [10]: placeholder distinct
|
Placeholder [adjective] : To be updated...
Placeholder [adverb] : To be updated...
Placeholder [conjunction] : To be updated...
Placeholder [interjection] : To be updated...
Placeholder [noun] : To be updated...
Placeholder [preposition] : To be updated...
Placeholder [pronoun] : To be updated...
Placeholder [verb] : To be updated...
|
Search [11]: placeHolder adjective reverse
|
Placeholder [adjective] : To be updated...
Placeholder [adjective] : To be updated...
|
Search [12]: distinCT DISTINct
|
Distinct [adjective] : Familiar. Worked in Java.
Distinct [adjective] : Unique. No duplicates. Clearly different or of a different kind.
Distinct [adverb] : Uniquely. Written "distinctly".
Distinct [noun] : A keyword in this assignment.
Distinct [noun] : An advanced search option.
Distinct [noun] : Distinct is a parameter in this assignment.
|
Search [13]: distinct noun distinct REVERSE
|
Distinct [noun] : Distinct is a parameter in this assignment.
Distinct [noun] : An advanced search option.
Distinct [noun] : A keyword in this assignment.
|
```

Search [14]: reverse reverse

Reverse [verb] : Turn something inside out.  
Reverse [verb] : To be updated...  
Reverse [verb] : To be updated...  
Reverse [verb] : Revoke ruling.  
Reverse [verb] : Go back.  
Reverse [verb] : Change something to opposite.  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : The opposite.  
Reverse [noun] : Change to opposite direction.  
Reverse [noun] : A dictionary program's parameter.  
Reverse [adjective] : Opposite to usual or previous arrangement.  
Reverse [adjective] : On back side.

Search [15]: reverse distinct reVERSE

Reverse [verb] : Turn something inside out.  
Reverse [verb] : To be updated...  
Reverse [verb] : Revoke ruling.  
Reverse [verb] : Go back.  
Reverse [verb] : Change something to opposite.  
Reverse [noun] : To be updated...  
Reverse [noun] : The opposite.  
Reverse [noun] : Change to opposite direction.  
Reverse [noun] : A dictionary program's parameter.  
Reverse [adjective] : Opposite to usual or previous arrangement.  
Reverse [adjective] : On back side.

Search [16]: reverse ok

<The entered 2nd parameter 'ok' is NOT a part of speech.>  
<The entered 2nd parameter 'ok' is NOT 'distinct'.>  
<The entered 2nd parameter 'ok' is NOT 'reverse'.>  
<The entered 2nd parameter 'ok' was disregarded.>  
<The 2nd parameter should be a part of speech or 'distinct' or 'reverse'.>

Reverse [adjective] : On back side.  
Reverse [adjective] : Opposite to usual or previous arrangement.  
Reverse [noun] : A dictionary program's parameter.  
Reverse [noun] : Change to opposite direction.  
Reverse [noun] : The opposite.  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [verb] : Change something to opposite.  
Reverse [verb] : Go back.  
Reverse [verb] : Revoke ruling.  
Reverse [verb] : To be updated...  
Reverse [verb] : To be updated...  
Reverse [verb] : Turn something inside out.

Search [17]: reverse noun ok

<The entered 3rd parameter 'ok' is NOT 'distinct'.>  
<The entered 3rd parameter 'ok' is NOT 'reverse'.>  
<The entered 3rd parameter 'ok' was disregarded.>  
<The 3rd parameter should be 'distinct' or 'reverse'.>

Reverse [noun] : A dictionary program's parameter.  
Reverse [noun] : Change to opposite direction.  
Reverse [noun] : The opposite.  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...

Search [18]: reverse noun distinct ok

<The entered 4th parameter 'ok' is NOT 'reverse'.>  
<The entered 4th parameter 'ok' was disregarded.>  
<The 4th parameter should be 'reverse'.>

Reverse [noun] : A dictionary program's parameter.  
Reverse [noun] : Change to opposite direction.  
Reverse [noun] : The opposite.  
Reverse [noun] : To be updated...

Search [19]: reverse ok ok ok

<The entered 2nd parameter 'ok' is NOT a part of speech.>  
<The entered 2nd parameter 'ok' is NOT 'distinct'.>  
<The entered 2nd parameter 'ok' is NOT 'reverse'.>  
<The entered 2nd parameter 'ok' was disregarded.>  
<The 2nd parameter should be a part of speech or 'distinct' or 'reverse'.>

<The entered 3rd parameter 'ok' is NOT 'distinct'.>  
<The entered 3rd parameter 'ok' is NOT 'reverse'.>  
<The entered 3rd parameter 'ok' was disregarded.>  
<The 3rd parameter should be 'distinct' or 'reverse'.>

<The entered 4th parameter 'ok' is NOT 'reverse'.>  
<The entered 4th parameter 'ok' was disregarded.>  
<The 4th parameter should be 'reverse'.>



Reverse [adjective] : On back side.  
Reverse [adjective] : Opposite to usual or previous arrangement.  
Reverse [noun] : A dictionary program's parameter.  
Reverse [noun] : Change to opposite direction.  
Reverse [noun] : The opposite.  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [verb] : Change something to opposite.  
Reverse [verb] : Go back.  
Reverse [verb] : Revoke ruling.  
Reverse [verb] : To be updated...  
Reverse [verb] : To be updated...  
Reverse [verb] : Turn something inside out.

Search [20]: reverse reverse ok ok

<The entered 3rd parameter 'ok' is NOT 'distinct'.>  
<The entered 3rd parameter 'ok' is NOT 'reverse'.>  
<The entered 3rd parameter 'ok' was disregarded.>  
<The 3rd parameter should be 'distinct' or 'reverse'.>

<The entered 4th parameter 'ok' is NOT 'reverse'.>  
<The entered 4th parameter 'ok' was disregarded.>  
<The 4th parameter should be 'reverse'.>

Reverse [verb] : Turn something inside out.  
Reverse [verb] : To be updated...  
Reverse [verb] : To be updated...  
Reverse [verb] : Revoke ruling.  
Reverse [verb] : Go back.  
Reverse [verb] : Change something to opposite.  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : To be updated...  
Reverse [noun] : The opposite.  
Reverse [noun] : Change to opposite direction.  
Reverse [noun] : A dictionary program's parameter.  
Reverse [adjective] : Opposite to usual or previous arrangement.  
Reverse [adjective] : On back side.

```
Search [21]: reverse distinct reverse ok
|
|<The entered 4th parameter 'ok' is NOT 'reverse'.>
|<The entered 4th parameter 'ok' was disregarded.>
|<The 4th parameter should be 'reverse'.>
|
|Reverse [verb] : Turn something inside out.
|Reverse [verb] : To be updated...
|Reverse [verb] : Revoke ruling.
|Reverse [verb] : Go back.
|Reverse [verb] : Change something to opposite.
|Reverse [noun] : To be updated...
|Reverse [noun] : The opposite.
|Reverse [noun] : Change to opposite direction.
|Reverse [noun] : A dictionary program's parameter.
|Reverse [adjective] : Opposite to usual or previous arrangement.
|Reverse [adjective] : On back side.
|
Search [22]: reverse distinct reverse ok ok
|
|PARAMETER HOW-TO, please enter:
|1. A search key - then 2. An optional part of partOfSpeech - then
|3. An optional 'distinct' - then 4. An optional 'reverse'
|
Search [23]: reverse adverb
|
|<NOT FOUND> To be considered for the next release. Thank you.
|
|PARAMETER HOW-TO, please enter:
|1. A search key - then 2. An optional part of partOfSpeech - then
|3. An optional 'distinct' - then 4. An optional 'reverse'
|
Search [24]: facebook
|
|<NOT FOUND> To be considered for the next release. Thank you.
|
|PARAMETER HOW-TO, please enter:
|1. A search key - then 2. An optional part of partOfSpeech - then
|3. An optional 'distinct' - then 4. An optional 'reverse'
|
Search [25]: !Q
-----THANK YOU-----
```

The provided information and the provided complete sample output are clear enough. However, some assumptions are not stated:

1. There is no way to quit the program when the user cannot enter the correct data file path.
2. What if the database is broken? Should the program ignore a broken line/keyword, or should the user enter another database?
3. The capitalization of CSC220 and CSC340 is different from other words. In the database, they have a lower form, but in the display, they are all upper. I think that the database should be upper.

The problem that we are solving is to implement an interactive directory that takes one line input from the users. The program should look up the values associated with the key that the user enters. The data is stored in an external database, not hard coded in the script. This is good as non-coder/non-programmer can easily update the database.

We store the data in the external text file as one line in one keyword. A line has two delimiters. The first delimiter is “|” which separates the keyword and the list of parts of speech and definition pair. The second delimiter is “-=>>” which separates the part of speech and the definition. There is a default database in the program. But, if the default database is not found, the user should enter the database name. The database should be in the same directory with the program.

In this dictionary case, we have unique keywords. There is no duplicate keyword. In consideration of that, we use a “map” data structure. Maps are associative containers that store elements in a mapped fashion. Each element has a key value and a mapped value. No two mapped values can have the same key values. In this case, the key is a string, and the mapped value is a class. The class has two attributes to store the part of speech and the definitions. Two attributes datatype is a vector of string.

The program works properly. The output is similar to the sample output. These are some features that can improve the program:

1. Allowing users to exit the program even when the user enters the database name may be helpful.
2. Showing short help at first may be useful.
3. Handling exceptions may be helpful, especially if we have a corrupt database.