

# International Islamic University Chittagong



**Data Structure Project Lab Report (3<sup>rd</sup> Semester)**

**Course Code: CSE-2322**

**Project Name: Dictionary using Binary Search Tree (BST)**

**Group Name: Code\_Crafters**

**Team Members:**

- |                          |   |             |
|--------------------------|---|-------------|
| 1. Mohammad Tanim Tahmid | ; | ID: C223130 |
| 2. Minhaz Ahmmed         | ; | ID: C231011 |
| 3. Ayman Abrar           | ; | ID: C231001 |

**Submitted To:**

**Prof. Mohammad Shamsul Alam**

**Dean, Faculty of Science & Engineering**

**International Islamic University Chittagong**

## Introduction:

The purpose of this project is to develop a dictionary application using a Binary Search Tree (BST) as the underlying data structure. The dictionary allows for efficient storage, retrieval, and management of word definitions. The BST is chosen for its efficient search, insert, and delete operations, which operate in average-case  $O(\log n)$  time complexity.

## Features:

1. **Word Insertion:** Allows the user to insert new words along with their definitions.
2. **Word Search:** Enables users to search for words and retrieve their definitions.
3. **Word Deletion:** Provides functionality to delete words from the dictionary.
4. **Display Dictionary:** Prints the entire dictionary in alphabetical order.
5. **Update Definition:** Allows updating the definition of an existing word.

## Implementation:

### Flowchart for Insertion of a Word:

Start



Input Word and Definition



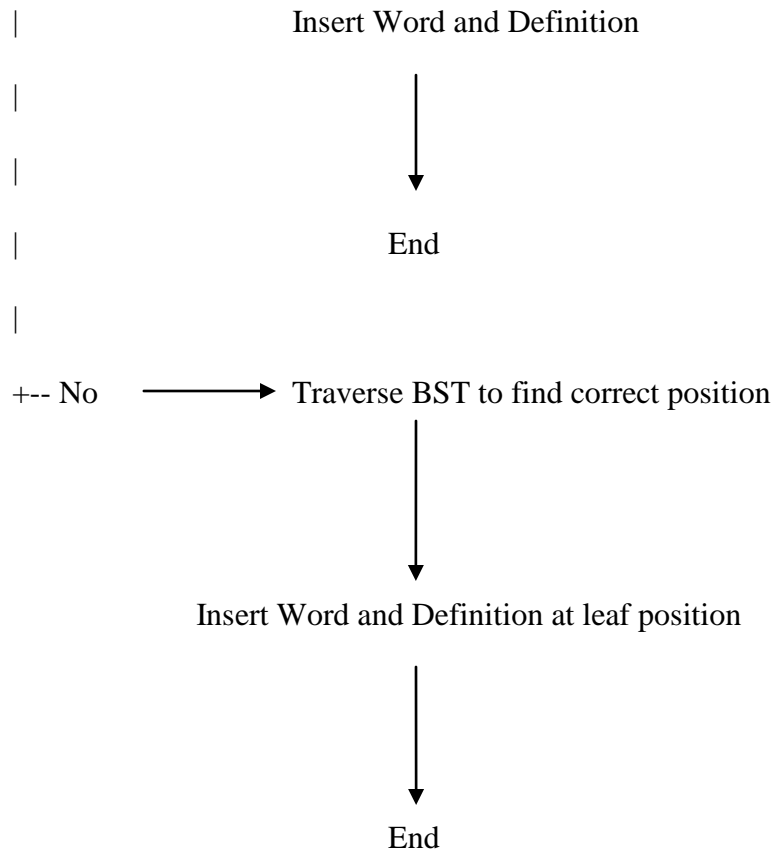
Is the BST empty?

|

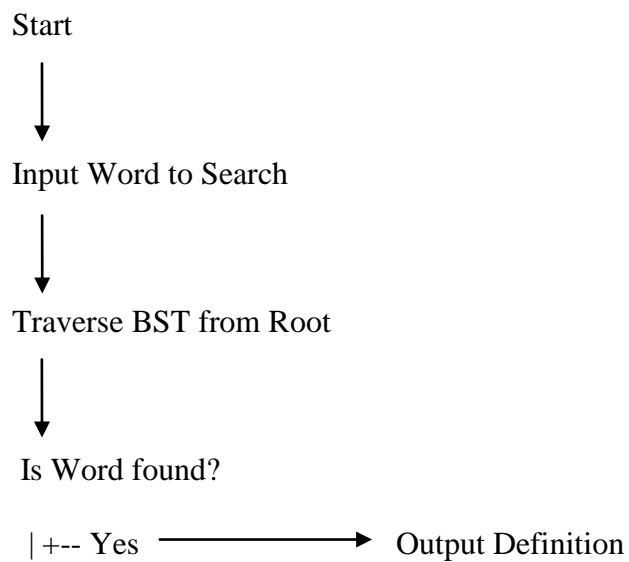
--- Yes → Create Root Node

|

|



### Flowchart for Searching a Word:



|

|

End

--- No



Output "Word Not Found"



End

### Flowchart for Deleting a Word:

Start



Input Word to Delete



Traverse BST from Root



Is Word found?

|

--- Yes



Is it a leaf node?

|

|

|

--- Yes



Remove the node

|

|



End

|

|

|

|

|

--- No



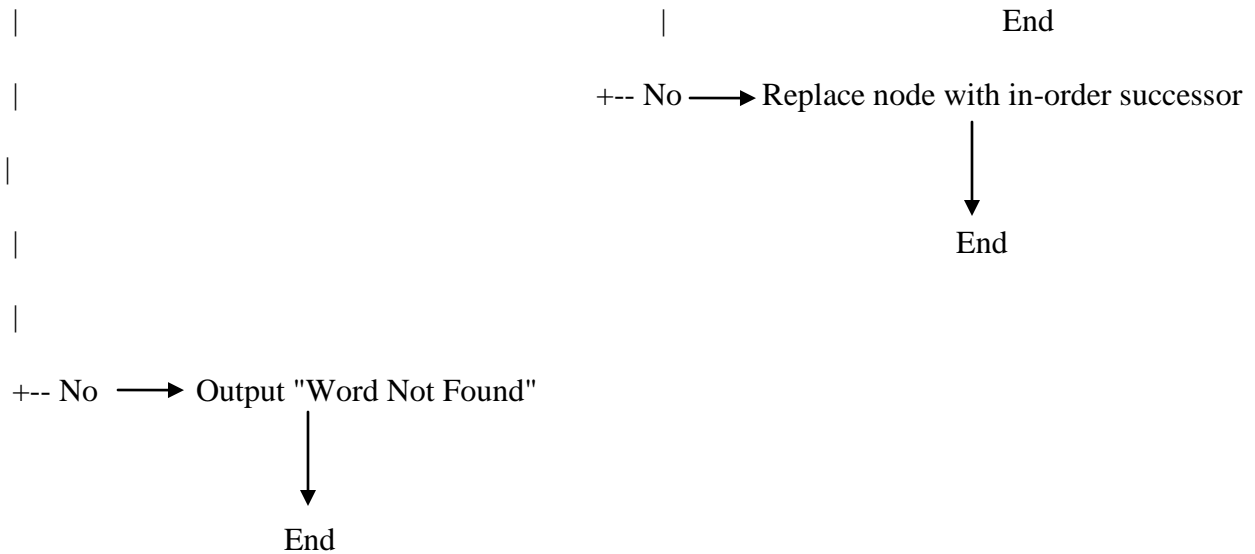
Does it have one child?

|



--- Yes --> Replace node with child |





## Functions Used:

### 1. `insert(word, definition)`

- **Description:** Inserts a word and its definition into the BST.
- **Parameters:**
  - `word`: The word to be inserted.
  - `definition`: The definition of the word.

### 2. `search(word)`

- **Description:** Searches for a word in the BST and returns its definition.
- **Parameters:**
  - `word`: The word to be searched.

### 3. `delete(word)`

- **Description:** Deletes a word and its definition from the BST.
- **Parameters:**
  - `word`: The word to be deleted.

### 4. `update(word, new_definition)`

- **Description:** Updates the definition of an existing word.
- **Parameters:**
  - `word`: The word to be updated.
  - `new_definition`: The new definition of the word.

## 5.display\_in\_order()

- **Description:** Displays all words and their definitions in alphabetical order.
- **Parameters:** None.

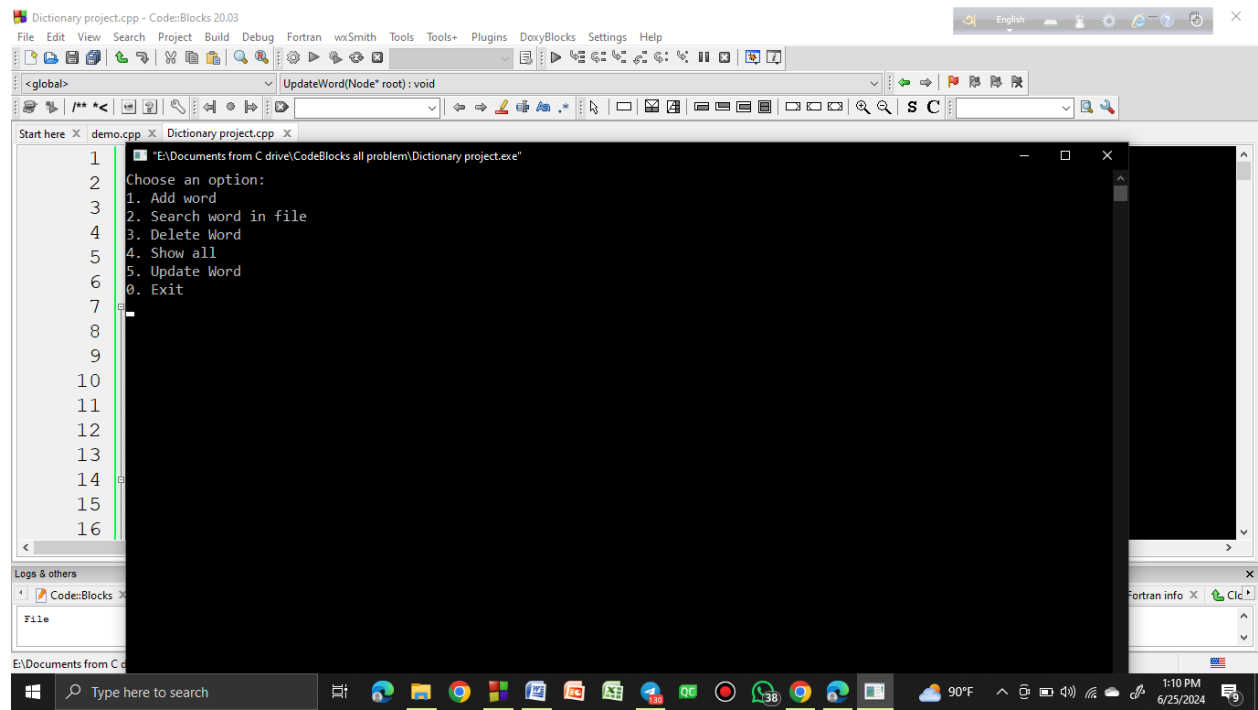
### Implementation Details:

- **Node Structure:** Each node in the BST contains a word, its definition, and pointers to the left and right children.
- **BST Operations:** The BST supports the standard operations of insertion, deletion, and in-order traversal, which are adapted to handle the word-definition pairs.

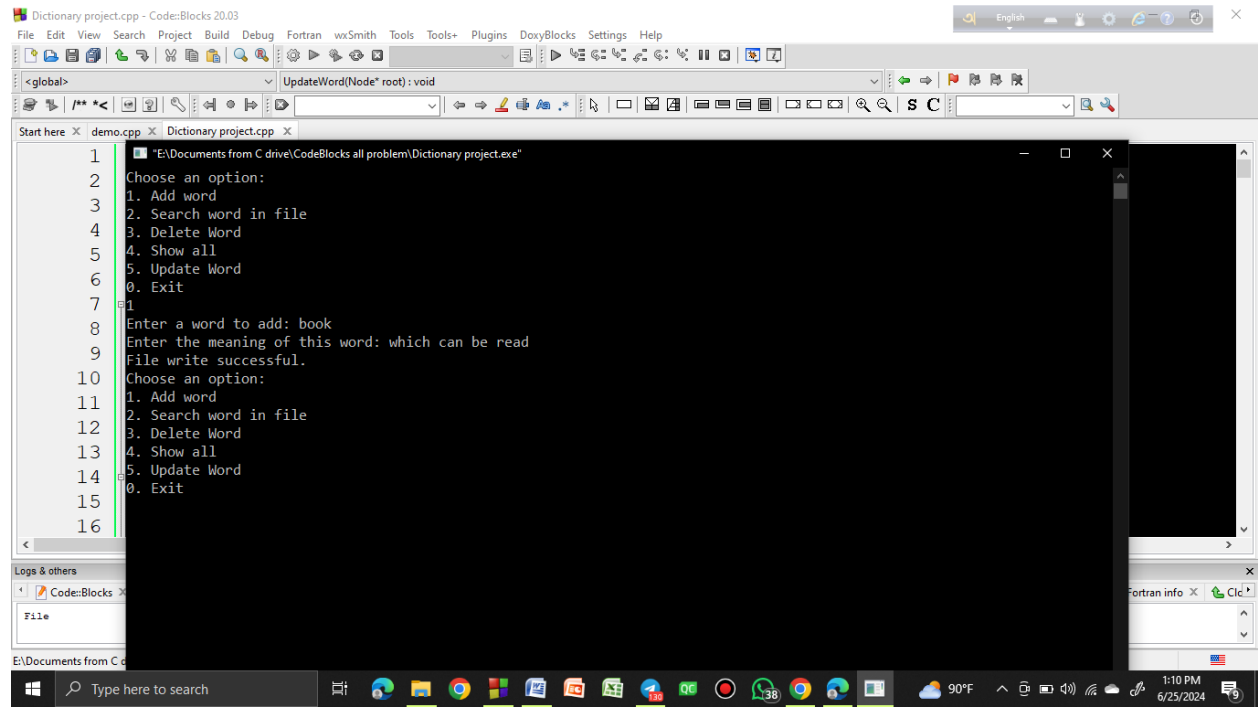
## Screen Shots:

### If part:

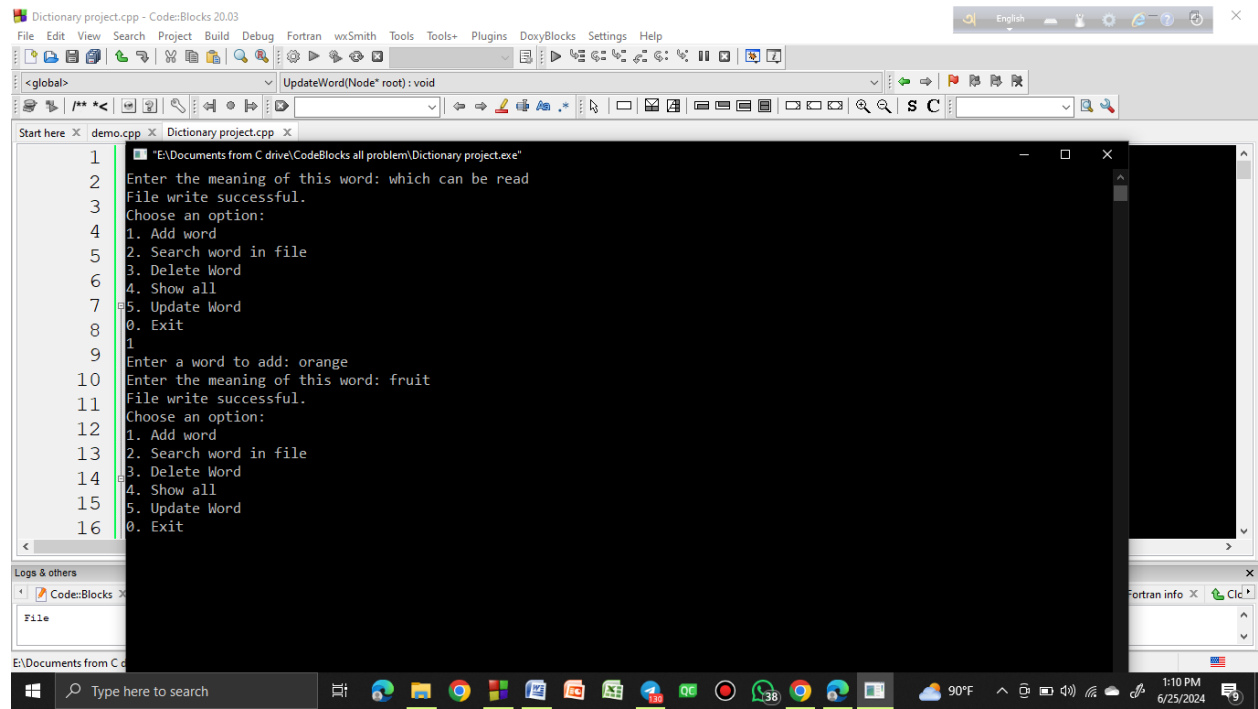
### Main menu:



## Add Word:



```
1  "E:\Documents from C drive\CodeBlocks all problem\Dictionary project.exe"
2  Choose an option:
3  1. Add word
4  2. Search word in file
5  3. Delete Word
6  4. Show all
7  5. Update Word
8  0. Exit
9  1
10 Enter a word to add: book
11 Enter the meaning of this word: which can be read
12 File write successful.
13 Choose an option:
14 1. Add word
15 2. Search word in file
16 3. Delete Word
17 4. Show all
18 5. Update Word
19 0. Exit
```



```
1  "E:\Documents from C drive\CodeBlocks all problem\Dictionary project.exe"
2  Enter the meaning of this word: which can be read
3  File write successful.
4  Choose an option:
5  1. Add word
6  2. Search word in file
7  3. Delete Word
8  4. Show all
9  5. Update Word
10 0. Exit
11 1
12 Enter a word to add: orange
13 Enter the meaning of this word: fruit
14 File write successful.
15 Choose an option:
16 1. Add word
17 2. Search word in file
18 3. Delete Word
19 4. Show all
20 5. Update Word
21 0. Exit
```

Dictionary project.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global> UpdateWord(Node\* root): void

Start here demo.cpp Dictionary project.cpp

```
1 "E:\Documents from C drive\CodeBlocks all problem\Dictionary project.exe"
2
3 Enter a word to add: orange
4 Enter the meaning of this word: fruit
5 File write successful.
6 Choose an option:
7 1. Add word
8 2. Search word in file
9 3. Delete Word
10 4. Show all
11 5. Update Word
12 0. Exit
13
14 Enter a word to add: apple
15 Enter the meaning of this word: fruit which can eat
16 File write successful.
17 Choose an option:
18 1. Add word
19 2. Search word in file
20 3. Delete Word
21 4. Show all
22 5. Update Word
23 0. Exit
```

Logs & others

Code::Blocks

File

E:\Documents from C

Type here to search

90°F

1:12 PM 6/25/2024

Dictionary project.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

<global> UpdateWord(Node\* root): void

Start here demo.cpp Dictionary project.cpp

```
1 "E:\Documents from C drive\CodeBlocks all problem\Dictionary project.exe"
2
3 Enter a word to add: apple
4 Enter the meaning of this word: fruit which can eat
5 File write successful.
6 Choose an option:
7 1. Add word
8 2. Search word in file
9 3. Delete Word
10 4. Show all
11 5. Update Word
12 0. Exit
13
14 Enter a word to add: table
15 Enter the meaning of this word: furniture
16 File write successful.
17 Choose an option:
18 1. Add word
19 2. Search word in file
20 3. Delete Word
21 4. Show all
22 5. Update Word
23 0. Exit
```

Logs & others

Code::Blocks

File

E:\Documents from C

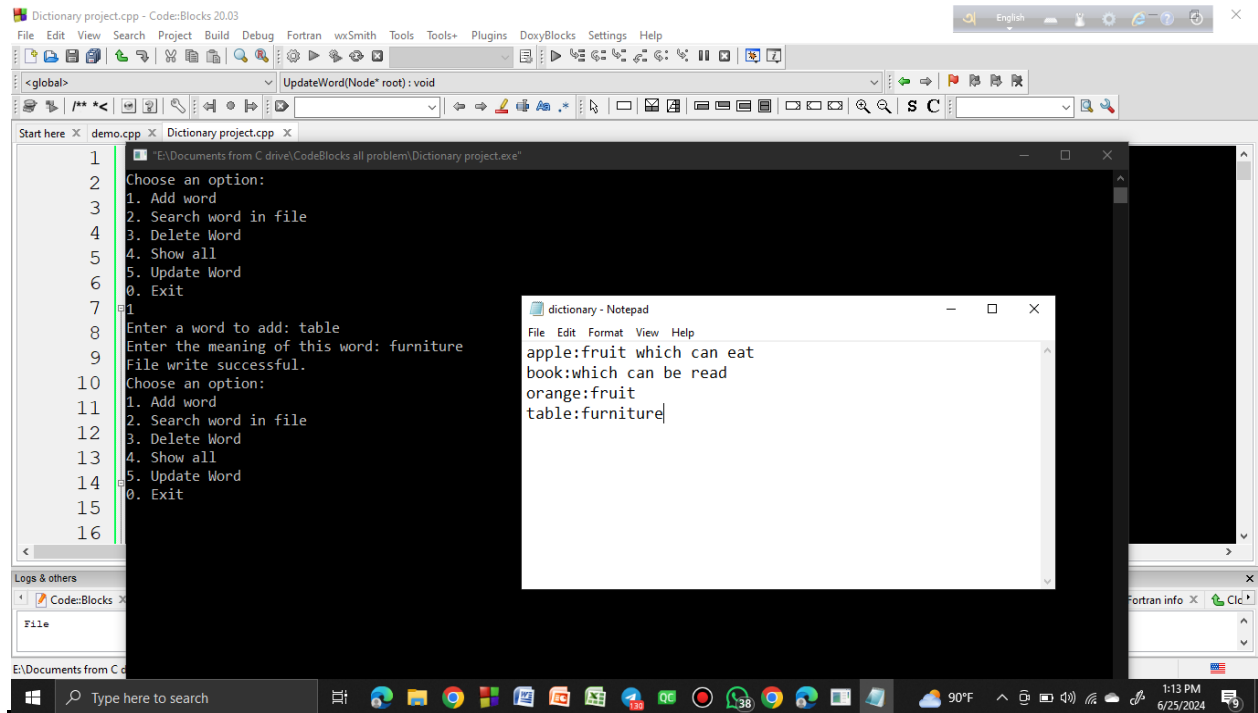
Type here to search

90°F

1:13 PM 6/25/2024



## Database after adding words:



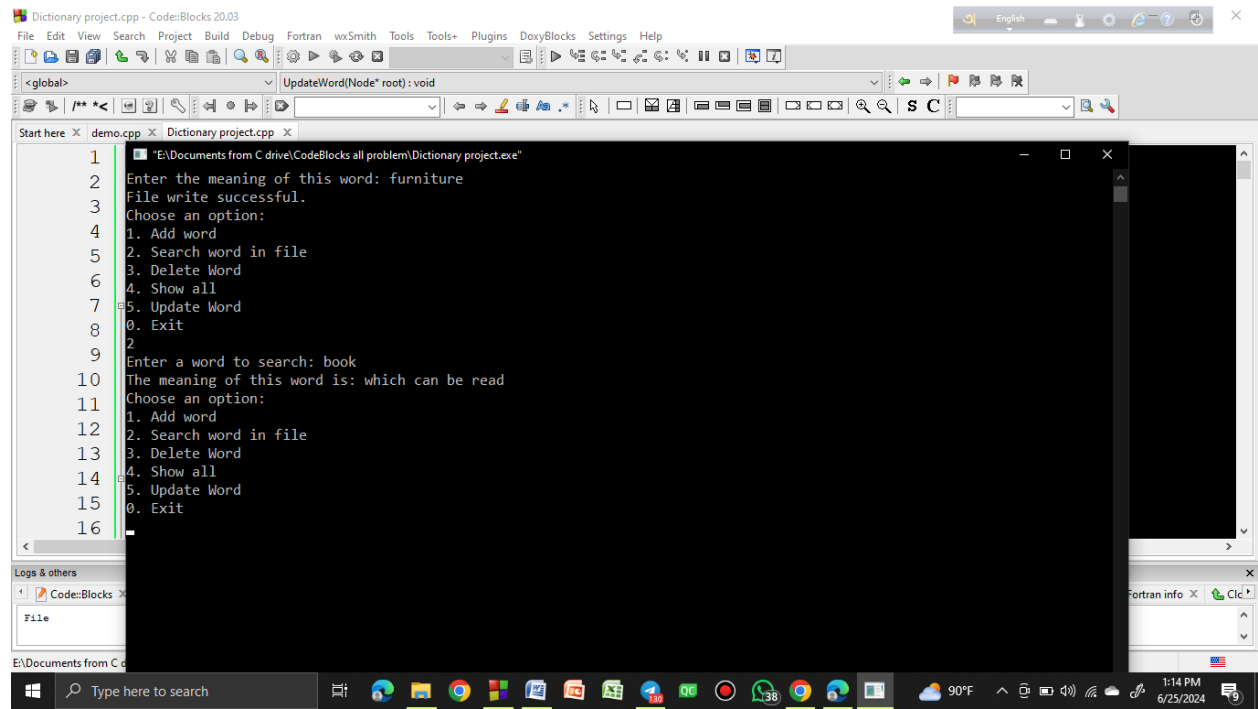
The screenshot shows the Code::Blocks IDE with the 'Dictionary project.cpp' file open. The console window displays the following output:

```
1 Choose an option:  
2 1. Add word  
3 2. Search word in file  
4 3. Delete Word  
5 4. Show all  
6 5. Update Word  
7 0. Exit  
8 Enter a word to add: table  
9 Enter the meaning of this word: furniture  
10 File write successful.  
11 Choose an option:  
12 1. Add word  
13 2. Search word in file  
14 3. Delete Word  
15 4. Show all  
16 5. Update Word  
17 0. Exit
```

A Notepad window titled 'dictionary - Notepad' shows the contents of the dictionary file:

```
File Edit Format View Help  
apple:fruit which can eat  
book:which can be read  
orange:fruit  
table:furniture
```

## Search word in file:



The screenshot shows the Code::Blocks IDE with the 'Dictionary project.cpp' file open. The console window displays the following output:

```
1 Enter the meaning of this word: furniture  
2 File write successful.  
3 Choose an option:  
4 1. Add word  
5 2. Search word in file  
6 3. Delete Word  
7 4. Show all  
8 5. Update Word  
9 0. Exit  
10 Enter a word to search: book  
11 The meaning of this word is: which can be read  
12 Choose an option:  
13 1. Add word  
14 2. Search word in file  
15 3. Delete Word  
16 4. Show all  
17 5. Update Word  
18 0. Exit
```

A Notepad window titled 'dictionary - Notepad' shows the contents of the dictionary file:

```
File Edit Format View Help  
apple:fruit which can eat  
book:which can be read  
orange:fruit  
table:furniture
```

The screenshot shows a C++ IDE with the following components:

- Menu Bar:** File, Edit, View, Search, Project, Build, Debug, Fortran, wxSmith, Tools, Tools+, Plugins, DoxyBlocks, Settings, Help.
- Toolbar:** Standard IDE icons for file operations, editing, and running.
- Editor:** Displays `Dictionary project.cpp` with the following code:
 

```

1  // "E:\Documents from C drive\CodeBlocks all problem\Dictionary project.exe"
2  0. Exit
3  2
4  Enter a word to search: table
5  The meaning of this word is: furniture
6  Choose an option:
7  1. Add word
8  2. Search word in file
9  3. Delete Word
10 4. Show all
11 5. Update Word
12 0. Exit
13 3
14 Enter the word you want to delete: apple
15 File write successful.
16 Choose an option:
17 1. Add word
18 2. Search word in file
19 3. Delete Word
20 4. Show all
21 5. Update Word
22 0. Exit
      
```
- Output Window:** Shows the program's execution, including the menu options and the user's input 'apple'.
- Taskbar:** Displays the Windows taskbar with various application icons and system information (90°F, 6/25/2024, 1:15 PM).

The screenshot shows a Windows desktop with a Code::Blocks IDE open. The main window displays the source code for 'Dictionary project.cpp'. The console window is open, showing the program's execution. The program prompts the user to enter a word to delete, and the user enters 'apple' and 'table'. The program then prompts the user to choose an option from a menu: 1. Add word, 2. Search word in file, 3. Delete Word, 4. Show all, 5. Update Word, 0. Exit. The program successfully updates the file and displays the updated contents.

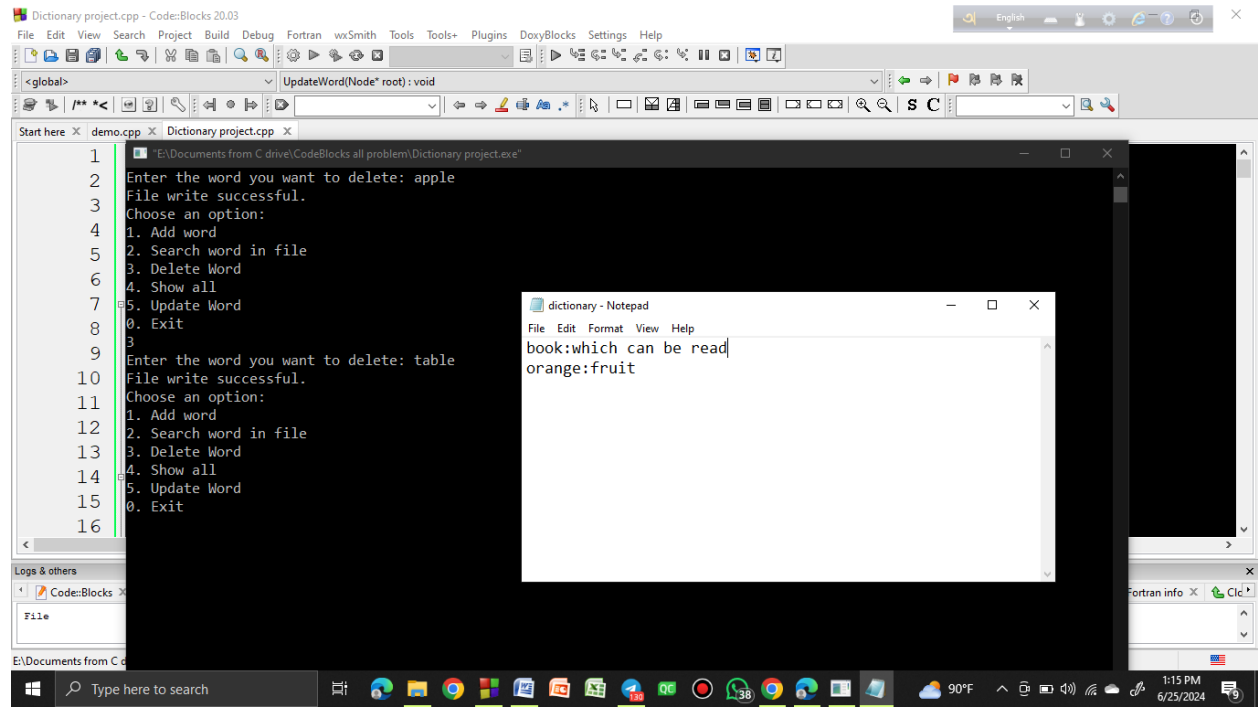
```

1  "E:\Documents from C drive\CodeBlocks all problem\Dictionary project.exe"
2  Enter the word you want to delete: apple
3  File write successful.
4  Choose an option:
5  1. Add word
6  2. Search word in file
7  3. Delete Word
8  4. Show all
9  5. Update Word
10 0. Exit
11
12 Enter the word you want to delete: table
13 File write successful.
14 Choose an option:
15 1. Add word
16 2. Search word in file
17 3. Delete Word
18 4. Show all
19 5. Update Word
20 0. Exit
21

```

The taskbar at the bottom shows the Windows Start button, a search bar, and several open applications including a web browser, a file explorer, and a terminal window. The system clock in the bottom right corner shows the time as 1:15 PM on 6/25/2024.

## Database after deleting words:



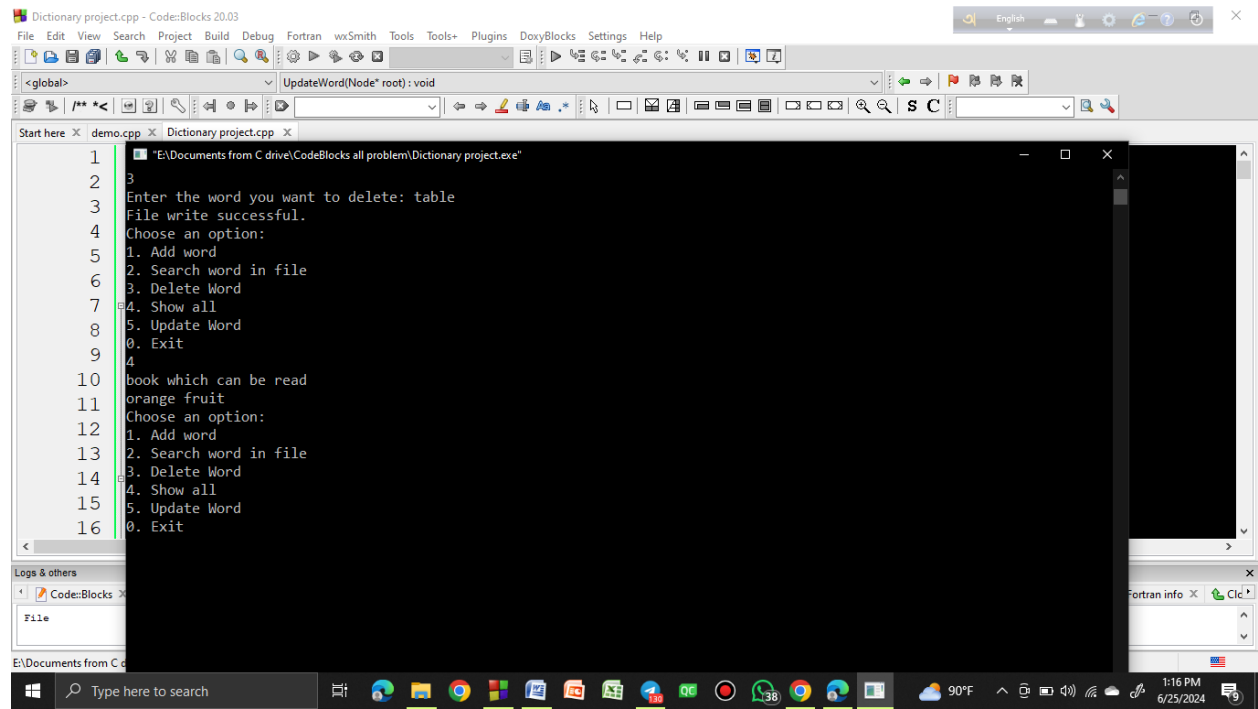
The screenshot shows the Code::Blocks IDE with the 'Dictionary project.cpp' file open. The console window displays the following output:

```
1  "E:\Documents from C drive\CodeBlocks all problem\Dictionary project.exe"  
2  Enter the word you want to delete: apple  
3  File write successful.  
4  Choose an option:  
5  1. Add word  
6  2. Search word in file  
7  3. Delete Word  
8  4. Show all  
9  5. Update Word  
10 0. Exit  
11 3  
12 Enter the word you want to delete: table  
13 File write successful.  
14 Choose an option:  
15 1. Add word  
16 2. Search word in file  
17 3. Delete Word  
18 4. Show all  
19 5. Update Word  
20 0. Exit
```

A Notepad window titled 'dictionary - Notepad' is open, showing the current state of the database:

```
File Edit Format View Help  
book:which can be read  
orange:fruit
```

## Show all:



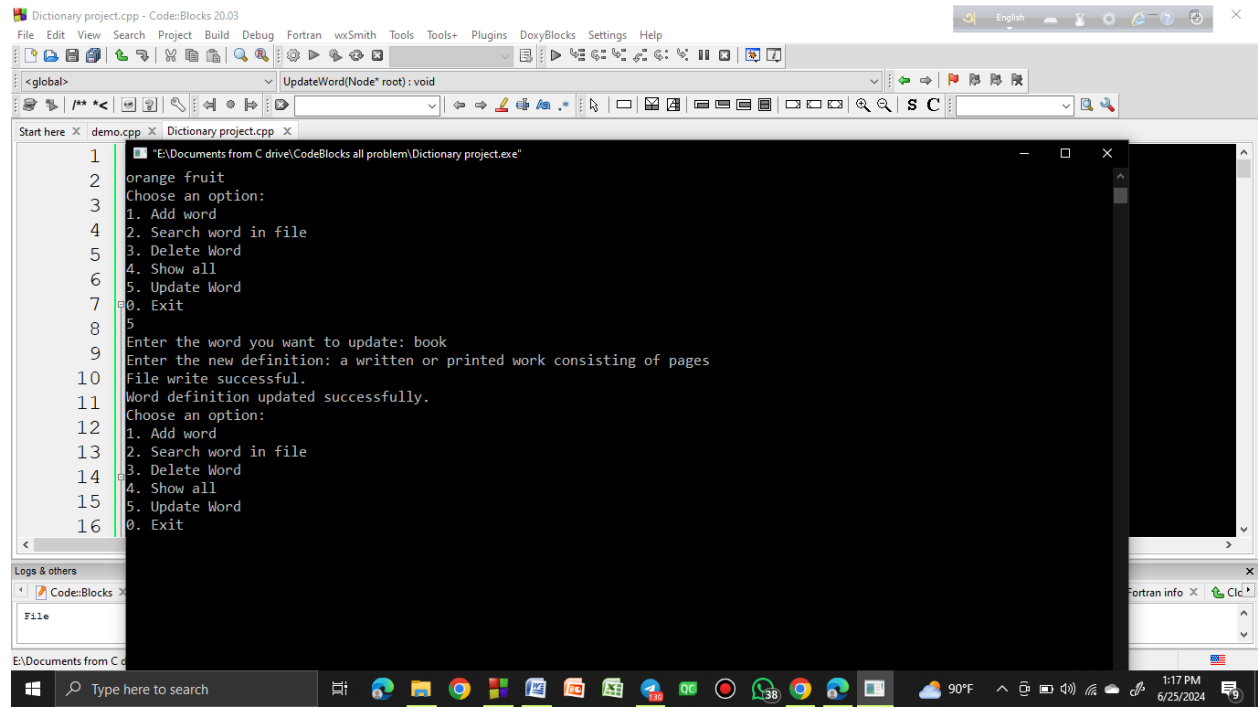
The screenshot shows the Code::Blocks IDE with the 'Dictionary project.cpp' file open. The console window displays the following output:

```
1  "E:\Documents from C drive\CodeBlocks all problem\Dictionary project.exe"  
2  3  
3  Enter the word you want to delete: table  
4  File write successful.  
5  Choose an option:  
6  1. Add word  
7  2. Search word in file  
8  3. Delete Word  
9  4. Show all  
10 5. Update Word  
11 0. Exit  
12 4  
13 book which can be read  
14 orange fruit  
15 Choose an option:  
16 1. Add word  
17 2. Search word in file  
18 3. Delete Word  
19 4. Show all  
20 5. Update Word  
21 0. Exit
```

A Notepad window titled 'dictionary - Notepad' is open, showing the current state of the database:

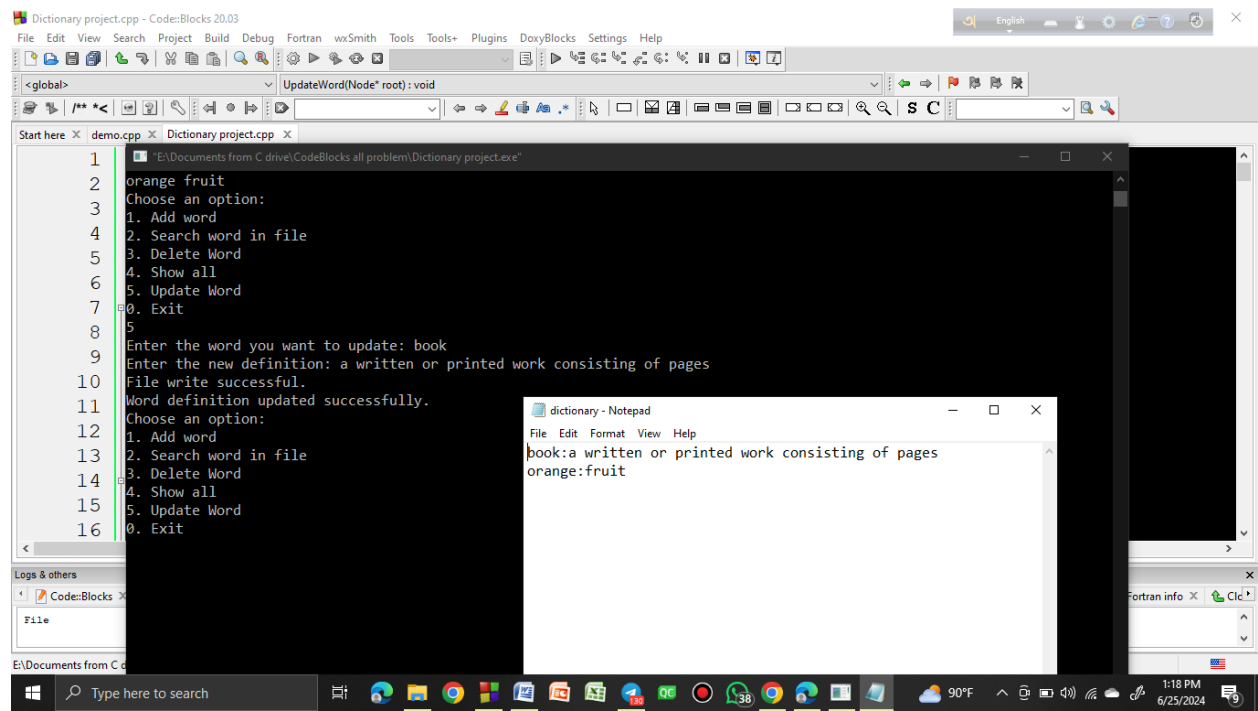
```
File Edit Format View Help  
book:which can be read  
orange:fruit
```

## Update word:



```
1 orange fruit
2 Choose an option:
3 1. Add word
4 2. Search word in file
5 3. Delete Word
6 4. Show all
7 5. Update Word
8 6. Exit
9
10 Enter the word you want to update: book
11 Enter the new definition: a written or printed work consisting of pages
12 File write successful.
13 Word definition updated successfully.
14 Choose an option:
15 1. Add word
16 2. Search word in file
17 3. Delete Word
18 4. Show all
19 5. Update Word
20 6. Exit
```

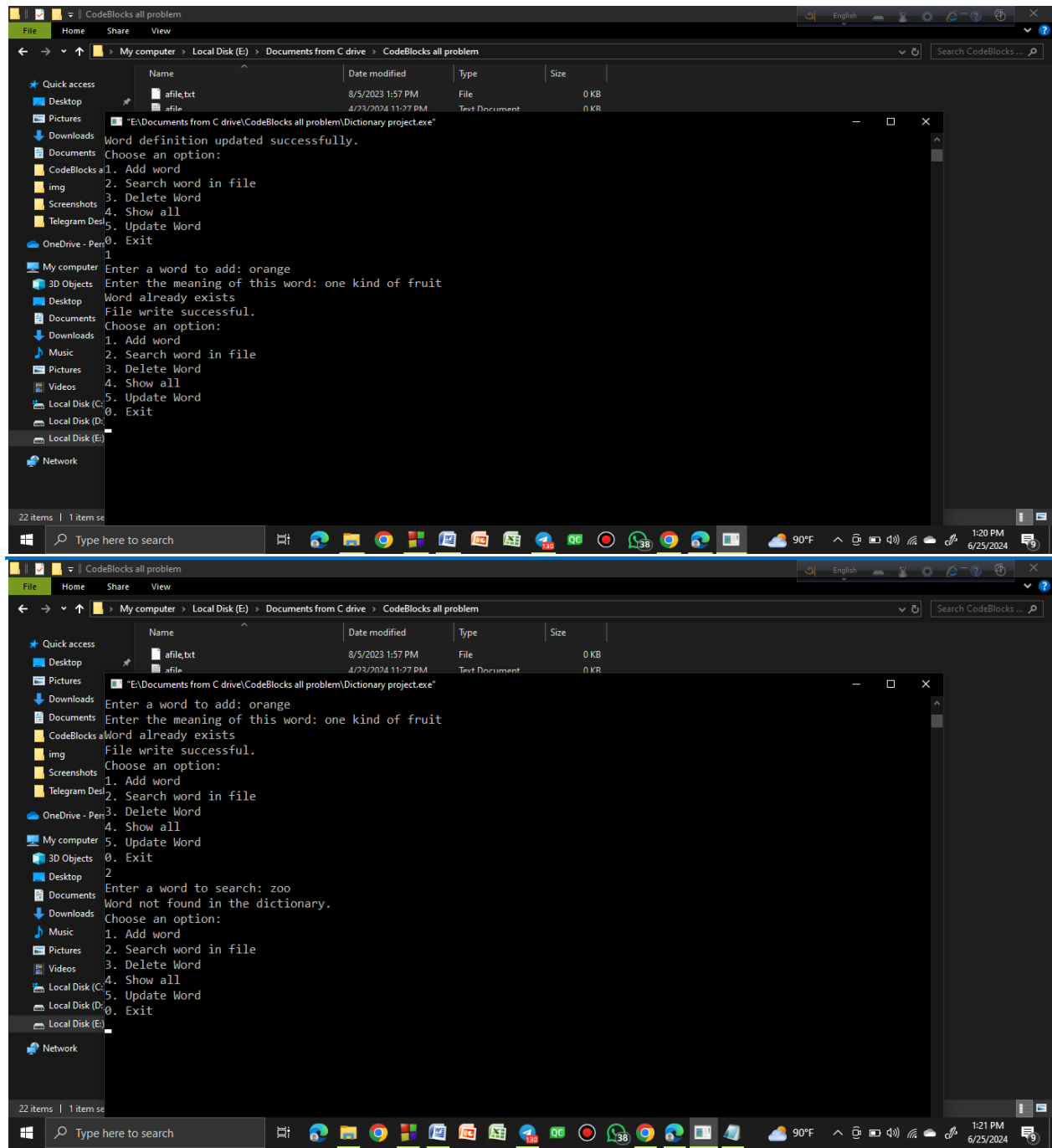
## Database after updating words:



```
1 orange fruit
2 Choose an option:
3 1. Add word
4 2. Search word in file
5 3. Delete Word
6 4. Show all
7 5. Update Word
8 6. Exit
9
10 Enter the word you want to update: book
11 Enter the new definition: a written or printed work consisting of pages
12 File write successful.
13 Word definition updated successfully.
14 Choose an option:
15 1. Add word
16 2. Search word in file
17 3. Delete Word
18 4. Show all
19 5. Update Word
20 6. Exit
```

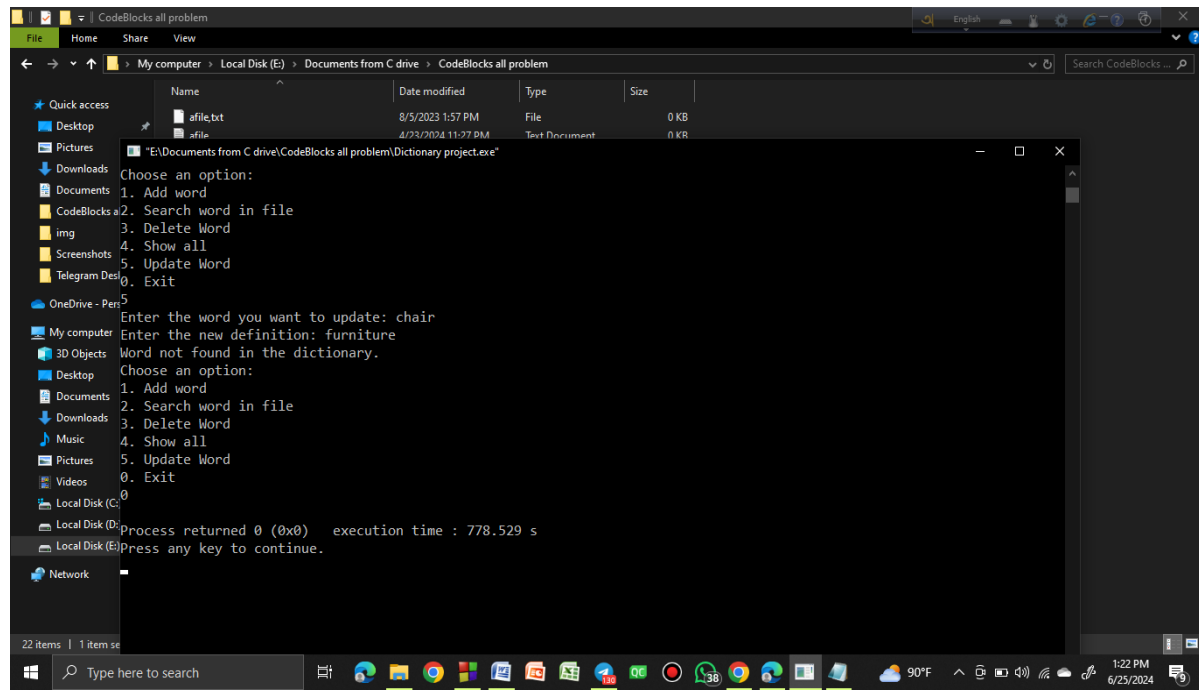
```
dictionary - Notepad
File Edit Format View Help
book:a written or printed work consisting of pages
orange:fruit
```

## Else part:





## Exit the program:



## Future Plan/Possible Extension:

1. **Graphical User Interface (GUI):** Develop a user-friendly graphical interface for the dictionary.
2. **Autocomplete Feature:** Implement an autocomplete feature to suggest words as the user types.
3. **Spell Check:** Integrate a spell-check feature to help users find correct words.
4. **Synonyms and Antonyms:** Extend the dictionary to include synonyms and antonyms for each word.
5. **Persistent Storage:** Add functionality to save the dictionary to a file and load it upon program startup.

## Conclusion:

The dictionary application using a Binary Search Tree efficiently handles word insertion, search, deletion, and update operations. The project demonstrates the practical application of BST in creating a dynamic and efficient dictionary. Future enhancements such as a GUI, autocomplete, and persistent storage can further improve the usability and functionality of the application.

-----