At this lab section, we will experiment different implementation of the ADT Dictionary in Java.

Dictionaries

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PART 1 – Dictionaries

A dictionary provides a powerful way to organize searchable data as finding a word's definition, a friend's address, or someone's telephone number.

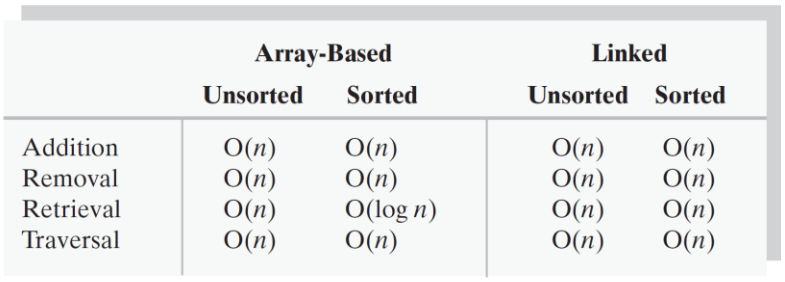
The ADT dictionary—also called a map, table, or associative array—contains entries that each have two parts:

- A keyword—usually called a search key—such as an English word or a person's name
- A value—such as a definition, an address, or a telephone number—associated with that key

The ADT dictionary has the same major operations:

- Add a new entry to the dictionary, given a search key and associated value
- Remove an entry, given its associated search key
- Retrieve a value associated with a given search key
- See whether the dictionary contains a given search key
- Traverse all the search keys in the dictionary
- Traverse all the values in the dictionary
- Detect whether a dictionary is empty
- Get the number of entries in the dictionary
- Remove all entries from the dictionary

You can implement a dictionary by using either an array or a chain of linked nodes. Some dictionaries do sort their entries by search key, while other dictionaries have unsorted entries. The worst-case efficiencies of the dictionary operations for array-based and linked implementations are given in the following table. Using an array to implement a sorted dictionary allows for an efficient retrieval operation because you can use a binary search.



	Array-Based		**Linked**	
	Unsorted	**Sorted**	**Unsorted**	**Sorted**
Addition	O(n)	O(n)	O(n)	O(n)
Removal	O(n)	O(n)	O(n)	O(n)
Retrieval	O(n)	O($\log n$)	O(n)	O(n)
Traversal	O(n)	O(n)	O(n)	O(n)

Exercise – 1

In this section, you will experiment with array-based ADT Dictionary implementation.

Step – 1

Create a new Java Project. Add the interface "DictionaryInterface.java" and "ArrayDictionary.java" given in *src* folder.

Step – 2

Add a new class with the name of "Test.java". Create an instance of ArrayDictionary and add the given *contact_name – phone_number* pairs into the dictionary.

contact_name	**phone_number**
"Dirk"	"555-1234"
"Abel"	"555-5678"
"Miguel"	"555-9012"
"Tabbie"	"555-3456"
"Tom"	"555-5555"
"Sam"	"555-7890"
"Reiss"	"555-2345"
"Bette"	"555-7891"
"Carole"	"555-7892"
"Derek"	"555-7893"
"Nancy"	"555-7894"

Step – 3

Add the following method into "Test.java" and display the current content of the dictionary.

```
public static void display(DictionaryInterface<String, String> dictionary)
{
    Iterator<String> keyIterator   = dictionary.getKeyIterator();
    Iterator<String> valueIterator = dictionary.getValueIterator();

    while (keyIterator.hasNext() && valueIterator.hasNext())
        System.out.println(keyIterator.next() + " : " + valueIterator.next());
    System.out.println();
} // end display
```

Step – 4

In Test.java, perform the operations given below:

- Display the phone book.
- Show the contact count in your phone book.
- Retrieve the Sam's phone number.
- Query whether Bo in your contact list.
- Update the Miguel's phone number as "555-9015".
- Remove Reiss from your contacts.
- Display your current phone book.
- Delete your all contacts.

Your `Test.java`

Your Output

Exercise – 2

In this section, you will experiment with sorted-array-based ADT Dictionary implementation.

Step – 1

Add the “SortedArrayDictionary.java” given in *src* folder. Experiment the same operations in Exercise - 1 by using sorted-array-based ADT Dictionary implementation.

Your `Test.java`

Your Output

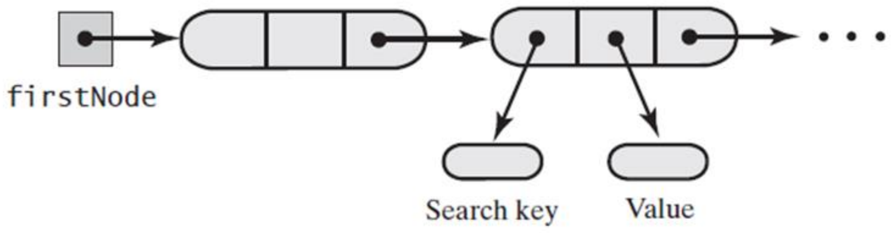
Step – 2

Compare the `locateIndex` methods in “ArrayDictionary.java” and “SortedArrayDictionary.java”. What is the difference between the two methods? Can we use binary search technique in “ArrayDictionary.java”, as well?

Your answer

Exercise – 3

In this section, you will experiment with linked-based ADT Dictionary implementation. One of the possible ways to use linked nodes to represent the entries is a chain of nodes that each reference a search key and a value as shown in the figure below.



Step – 1

Add the “SortedLinkedDictionary.java” given in *src* folder.

Step – 2

You are given TR_SuperLeague_19_20.txt that stores the Turkish Football Super Leage match results of 2019-2020 season. Using a SortedLinkedDictionary calculate and display the final points of all the teams. Indicate the champion team of the season.

Hint: Teams get 3 points for a win, one point for a draw, and zero for a defeat.

Your code

Your Output