GIT Department of Computer Engineering
CSE 222/505 - Spring 2020
Homework 2 – Report

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Problem Solutions Approach

We implement a simple text editor in 2 type of list for observing the performance of the java's list collection. For the observe, we implement 4 method for each type. Our first type is arrayList and we divide the type two. First one is the array list with iterator and the second one the arraylist without iterator. We implement the read method to read in a text file and construct the text, add method that adds one or more characters at the specified position in our text, find method that returns the start index of the first occurrence of the searched group of characters and replace method that replace all occurrences of a character with another character in this two type which is with iterator and without iterator. After, I implement the same thing for the linked list in this time. And measure the running times of my implementations in a test.

When I look the time measures, I realize the difference between performances. *Experimental results are,*

In read method for sorting performance,

arrayList without iterator > arrayList with iterator > LinkedList with iterator> LinkedList without iterator.

In add method for sorting performance,

LinkedList without iterator > arrayList without iterator > arrayList with iterator > LinkedList with iterator.

In find method for sorting performance,

arrayList with iterator > LinkedList without iterator > arrayList without iterator > LinkedList with iterator.

In replace method for sorting performance,

arrayList with iterator > LinkedList without iterator LinkedList with iterator > arrayList without iterator.

I analys *the theoretical performance* and find the appropriate asymptotic notatin which is below.

1) ReadIter (String fileName) : That method turns file's character number time. If we say n is character number
   Tbest = Q(1), Tworst = Q(n) and T = O(n)

2) ReadWithoutIter(String fileName): That method turns file's character number time either. If we say n is character number,
   Tbest = Q(1), Tworst = Q(n) and T = O(n)

3) addIter(String str,int index): That method turns index*str.length() time.
   Tbest = Q(1) condition is out of bound index.
   Tworst = Q(index*str.length()) and
   T = O(index* str.length())

4) addWithoutIter(String str,int index): That method turns str.length() time.
   Tbest = Q(1) condition is out of bound index.
   Tworst = Q(str.lenght())
   T = O(str.length())

5) findIter(String str): That method turns to find the element which means up to list's size. And inside that loop is there a another loop which turns str.length() time. If we say list's size is n;
   Tbest = Q(str.length()) condition is first element observed iterator's first element and searching the string's rest of the characters.
   Tworst = Q(n * str.length()).
   T = O(n * str.length()).

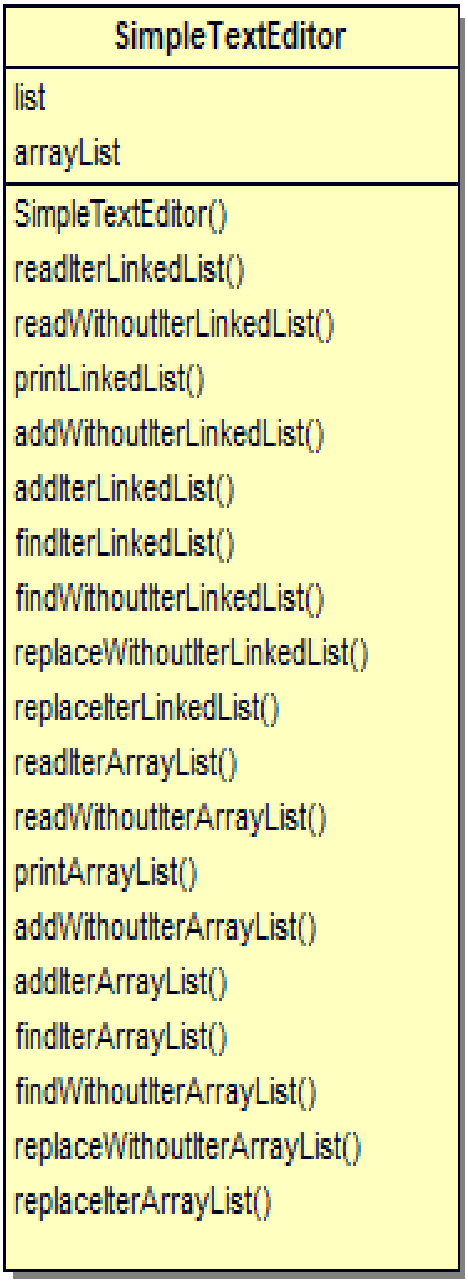
6) findWithoutIter(String str): That method turns to find the element which means up to list's size. And inside that loop is there a another loop which turns str.length() time. If we say list's size is n;
   Tbest = Q(str.length()) condition is first element observed iterator's first element and searching the string's rest of the characters.
   Tworst = Q(n * str.length()).
   T = O(n * str.length()).

7) replaceIter(char c1, char c2): That method turns list's size times.
   And if we assume list's size is n;
   Tbest = Q(1) condition is c1 equals to first element of list.
   Tworst = Q(n)
   T = Q(n)

8) replaceWithoutIter(char c1,char c2): That method turns list's size times and if we assume list's size is n;
   Tbest = Q(1) condition is c1 equals to first element of list.
   Tworst = Q(n)
   T = Q(n)

In a conclusion, therotically read,replace and find methods' versions which are with iterators and without iterator methods should be close or same. But add method's which is written with iterator, worst case is worse than without iterator version. Which means theoretically we should write add method without iterator for best performance. In the other methods should be give almost the same performance.

Class Diagram



Test cases:

ArrayList with iterator:

1) *If program could not find the file, throws an FileNotFoundException.*

```
Reading bb.txt file and write to the arrayList with iterator...
java.io.FileNotFoundException: bb.txt (Sistem belirtilen dosyayı bulamıyor)
```

2) *If the index is out of the bounds, program throws an IndexOutOfBoundsException.*

```
Add 'ada' to the index -6
java.lang.IndexOutOfBoundsException: -6 is out of bound.
a b c d e f g h
Time taken: 0 milliseconds
```

```
----------------------
Add 'ela' to the index 12
java.lang.IndexOutOfBoundsException: 12 is out of bound.
a b c d e f g h
Time taken: 0 milliseconds
----------------------
```

3) *If the string which find method is looking for does not exist, program throws an Exception.*

```
Lets find the 'nesli' on the arrayList...
java.lang.Exception:  that element is not in this list.
Time taken: 0 milliseconds
```

4) *If the element which is replace method's parameter is not exist on list, Program throws an exception.*

```
----------------------
Now, replace the x with y
java.lang.Exception: Element x not found.
a k k b c d e q g h
Time taken: 0 milliseconds
----------------------
```

ArrayList without iterator:

1) *If program could not find the file, throws an FileNotFoundException.*

```
Reading cc.txt file and write to the arrayList without iterator...
java.io.FileNotFoundException: cc.txt (Sistem belirtilen dosyayı bulamıyor)
Now printing the arrayList...

Time taken: 0 milliseconds
```

2) *If the index is out of the bounds, program throws an IndexOutOfBoundsException.*

```
----------------------
Add 'elif' to the index -9
java.lang.IndexOutOfBoundsException: -9is out of bound.
a b c d e f g h
Time taken: 0 milliseconds

----------------------
Add 'levo' to the index 36
java.lang.IndexOutOfBoundsException: 36is out of bound.
a b c d e f g h
Time taken: 0 milliseconds
```

3) *If the string which find method is looking for does not exist, program throws an Exception.*

```
-----------------------
Lets find the 'eq' on the arrayList...
java.lang.Exception:  that element is not in this list.
Time taken: 0 milliseconds
```

4) *If the element which is replace method's parameter is not exist on list, Program throws an exception.*

```
------------------------
Now, replace the t with q
java.lang.Exception: Element t not found.
a b c n e s l i d e f g h
Time taken: 0 milliseconds
```

LinkedList with iterator

1) *If program could not find the file, throws an FileNotFoundException.*

```
Reading dd.txt file and write to the linked list with iterator...
java.io.FileNotFoundException: dd.txt (Sistem belirtilen dosyayı bulamıyor)
```

2) *If the index is out of the bounds, program throws an IndexOutOfBoundsException.*

```
Add 'qew' to the index -45
java.lang.IndexOutOfBoundsException: -45is out of bound.
a k k b c d e f g h
Time taken: 0 milliseconds

----------------------
Add 'yuı' to the index 123
java.lang.IndexOutOfBoundsException: 123is out of bound.
a k k b c d e f g h
Time taken: 0 milliseconds

----------------------
```

3) *If the string which find method is looking for does not exist, program throws an Exception.*

```
Lets find the 'bck' on the LinkedList...
java.lang.Exception:  that element is not in this list.
Time taken: 0 milliseconds
```

4) *If the element which is replace method's parameter is not exist on list, Program throws an exception.*

```
----------------------
Now, replace the x with q
java.lang.Exception: Element x not found.
a k k b c d e q g h
Time taken: 0 milliseconds
```

Linked list – without iterator

1) *If program could not find the file, throws an FileNotFoundException.*

```
Reading ee.txt file and write to the linked list without iterator...
java.io.FileNotFoundException: ee.txt (Sistem belirtilen dosyayı bulamıyor)
Now printing the arrayList...

Time taken: 0 milliseconds
```

2) *If the index is out of the bounds, program throws an IndexOutOfBoundsException.*

```
----------------------
Add 'qqq' to the index -78
java.lang.IndexOutOfBoundsException: -78is out of bound.
a b c d e e l i f f g h
Time taken: 0 milliseconds

----------------------
Add 'ooo' to the index 64
java.lang.IndexOutOfBoundsException: 64is out of bound.
a b c d e e l i f f g h
Time taken: 0 milliseconds
```

3) *If the string which find method is looking for does not exist, program throws an Exception.*

```
----------------------
Lets find the 'eq' on the LinkedList...
java.lang.Exception:  that element is not in this list.
Time taken: 0 milliseconds
```

4) *If the element which is replace method's parameter is not exist on list, Program throws an exception.*

```
Now, replace the x with q
java.lang.Exception: Element x not found.
a b c d e e l i f f g h
Time taken: 0 milliseconds
```

Running Command and Results

1) Array List with iterator

```
----------------------
ARRAY LIST - WITH ITERATOR
Reading bb.txt file and write to the arrayList with iterator...
java.io.FileNotFoundException: bb.txt (Sistem belirtilen dosyayı bulamıyor)
Now printing the arrayList...

Time taken: 0 milliseconds
----------------------
Reading aa.txt file and write to the arrayList with iterator...
Now printing the arrayList...
a b c d e f g h
Time taken: 18 milliseconds
----------------------
Add 'ada' to the index -6
java.lang.IndexOutOfBoundsException: -6 is out of bound.
a b c d e f g h
Time taken: 0 milliseconds
----------------------
Add 'ela' to the index 12
java.lang.IndexOutOfBoundsException: 12 is out of bound.
a b c d e f g h
Time taken: 0 milliseconds
----------------------
Add 'kk' to the index 1
a k k b c d e f g h
Time taken: 0 milliseconds
----------------------
Lets find the 'nesli' on the arrayList...
java.lang.Exception:  that element is not in this list.
Time taken: 0 milliseconds
----------------------
Lets find the 'def' on the arrayList...
def is 5th index
Time taken: 0 milliseconds
----------------------
Now, replace the f with q
a k k b c d e q g h
Time taken: 0 milliseconds
----------------------
Now, replace the x with y
java.lang.Exception: Element x not found.
a k k b c d e q g h
Time taken: 0 milliseconds
----------------------
```

2)Array List without iterator

```
ARRAY LIST - WITHOUT ITERATOR

----------------------


Reading cc.txt file and write to the arrayList without iterator...
java.io.FileNotFoundException: cc.txt (Sistem belirtilen dosyayı bulamıyor)
Now printing the arrayList...

Time taken: 0 milliseconds

----------------------
Lets reading the same file which is aa.txt and write to the arrayList again. But this time without using iterator...

Now printing the arrayList...
a b c d e f g h
Time taken: 0 milliseconds

----------------------
Add 'elif' to the index -9
java.lang.IndexOutOfBoundsException: -9is out of bound.
a b c d e f g h
Time taken: 0 milliseconds

----------------------
Add 'levo' to the index 36
java.lang.IndexOutOfBoundsException: 36is out of bound.
a b c d e f g h
Time taken: 0 milliseconds

----------------------
Add 'nesli' to the index 3
a b c n e s l i d e f g h
Time taken: 0 milliseconds

----------------------
Lets find the 'eq' on the arrayList...
java.lang.Exception:  that element is not in this list.
Time taken: 0 milliseconds

----------------------
Lets find the 'nesli' on the arrayList...
nesli is 3th index
Time taken: 0 milliseconds
```

```
----------------------
Now, replace the t with q
java.lang.Exception: Element t not found.
a b c n e s l i d e f g h
Time taken: 0 milliseconds
----------------------
Now, replace the i with q
a b c n e s l q d e f g h
Time taken: 0 milliseconds
```

3)Linked List with iterator

```
----------------------
LINKED LIST - WITH ITERATOR
----------------------


Reading dd.txt file and write to the linked list with iterator...
java.io.FileNotFoundException: dd.txt (Sistem belirtilen dosyayı bulamıyor)
Now printing the arrayList...

Time taken: 0 milliseconds

----------------------
Reading aa.txt file and write to the LinkedList with iterator...
Now printing the LinkedList...
a b c d e f g h
Time taken: 1 milliseconds

----------------------
Add 'kk' to the index 1
a k k b c d e f g h
Time taken: 0 milliseconds

----------------------
Add 'qew' to the index -45
java.lang.IndexOutOfBoundsException: -45is out of bound.
a k k b c d e f g h
Time taken: 0 milliseconds

----------------------
Add 'yuı' to the index 123
java.lang.IndexOutOfBoundsException: 123is out of bound.
a k k b c d e f g h
Time taken: 0 milliseconds

----------------------
Lets find the 'def' on the LinkedList...
def is 5th index
Time taken: 0 milliseconds

----------------------
Lets find the 'bck' on the LinkedList...
java.lang.Exception:  that element is not in this list.
Time taken: 0 milliseconds

----------------------
Now, replace the f with q
a k k b c d e q g h
Time taken: 0 milliseconds

----------------------
Now, replace the x with q
java.lang.Exception: Element x not found.
a k k b c d e q g h
Time taken: 0 milliseconds
```

4)Linked List without iterator

```
----------------------
LINKED LIST - WITHOUT ITERATOR
----------------------


----------------------

Reading ee.txt file and write to the linked list without iterator...
java.io.FileNotFoundException: ee.txt (Sistem belirtilen dosyayı bulamıyor)
Now printing the arrayList...

Time taken: 0 milliseconds

----------------------
Lets reading the same file which is aa.txt and write to the LinkedList again.But this time without using iterator...
Now printing the LinkedList...
a b c d e f g h
Time taken: 0 milliseconds

----------------------
Add 'elif' to the index 5
a b c d e e l i f f g h
Time taken: 0 milliseconds

----------------------
Add 'qqq' to the index -78
java.lang.IndexOutOfBoundsException: -78is out of bound.
a b c d e e l i f f g h
Time taken: 0 milliseconds

----------------------
Add 'ooo' to the index 64
java.lang.IndexOutOfBoundsException: 64is out of bound.
a b c d e e l i f f g h
Time taken: 0 milliseconds

----------------------
Lets find the 'eq' on the LinkedList...
java.lang.Exception:  that element is not in this list.
Time taken: 0 milliseconds

----------------------
Lets find the 'cde' on the LinkedList...
eq is 2th index
Time taken: 0 milliseconds
```

```
----------------------
Now, replace the x with q
java.lang.Exception: Element x not found.
a b c d e e l i f f g h
Time taken: 0 milliseconds

----------------------
Now, replace the i with q
a b c d e e l q f f g h
Time taken: 0 milliseconds

----------------------
```