Gebze Technical University
Computer Engineering

CSE 222
2017 Spring

HOMEWORK 2 REPORT

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Course Assistant:

1. System Requirements

Ubuntu 15.10 64 bit system and java 1.8 version are used.

2. Use Case Diagrams

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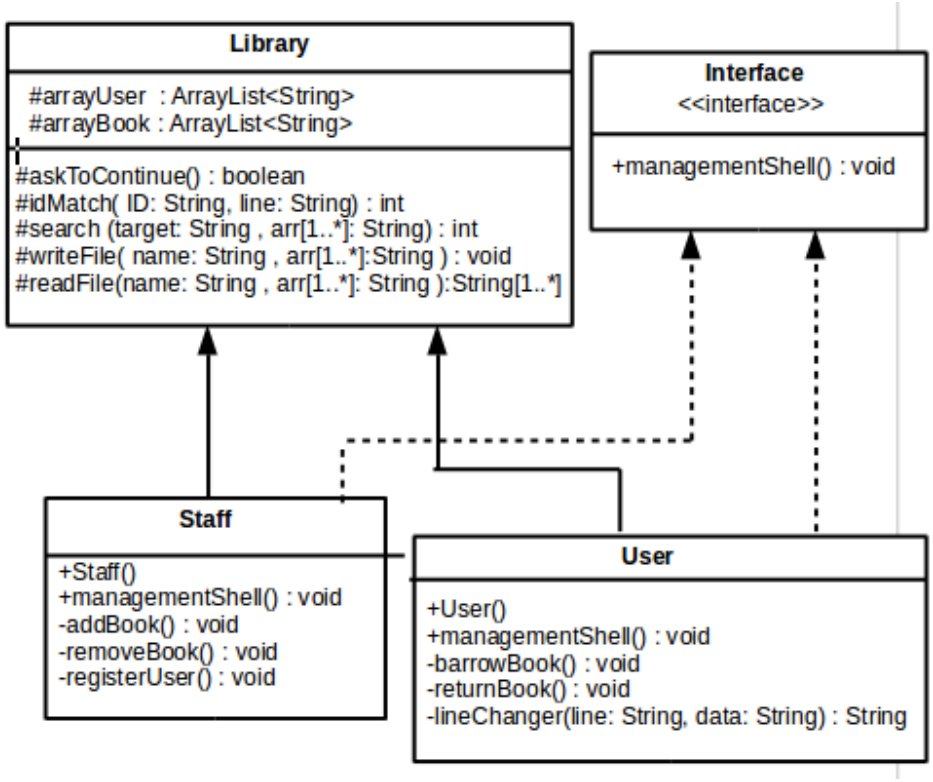
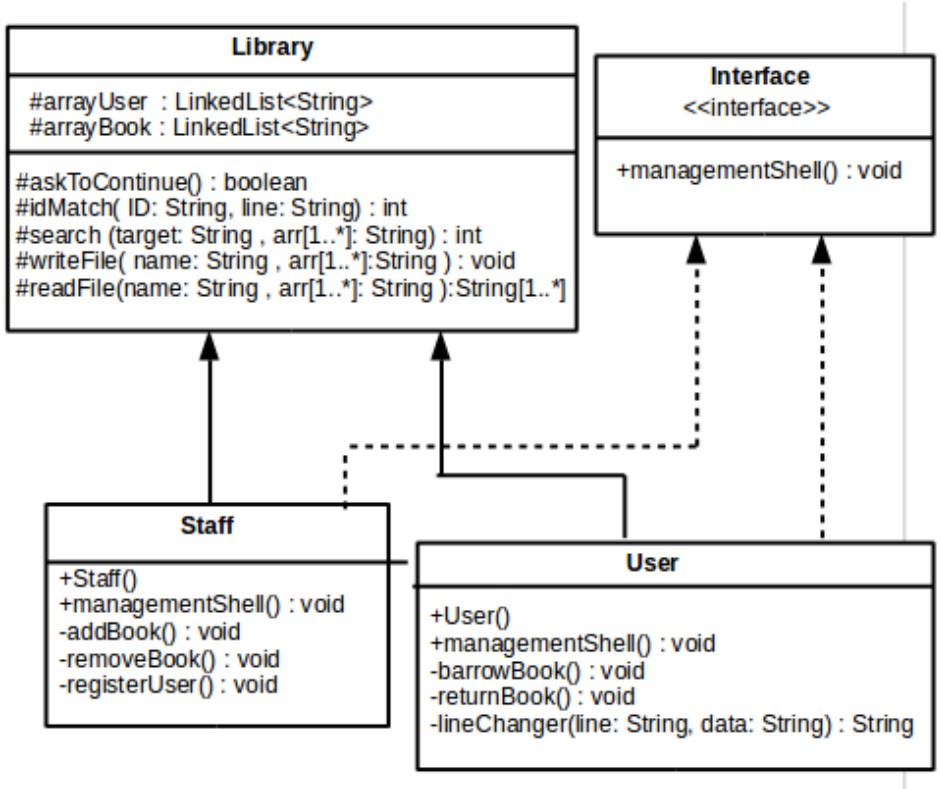
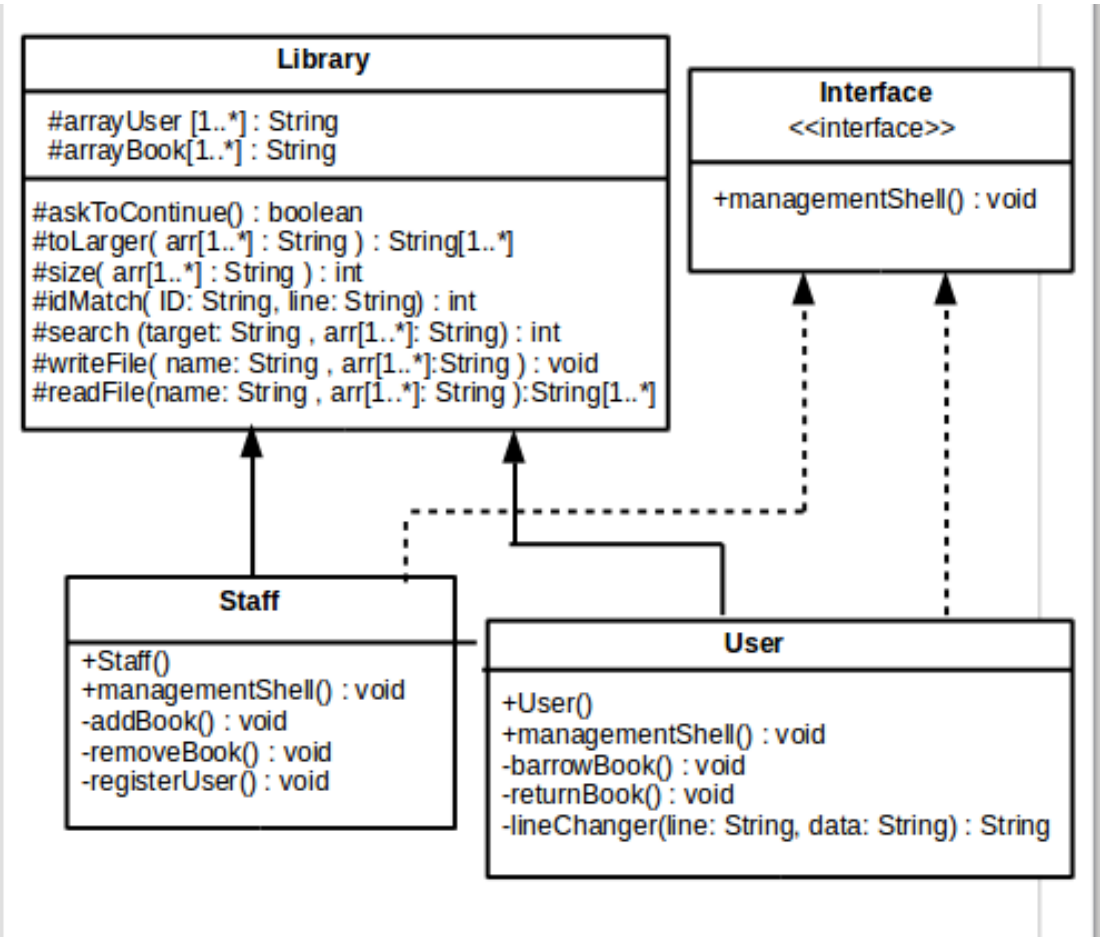
3. Class Diagrams







4. Other Diagrams

-

5. Problem Solutions Approach

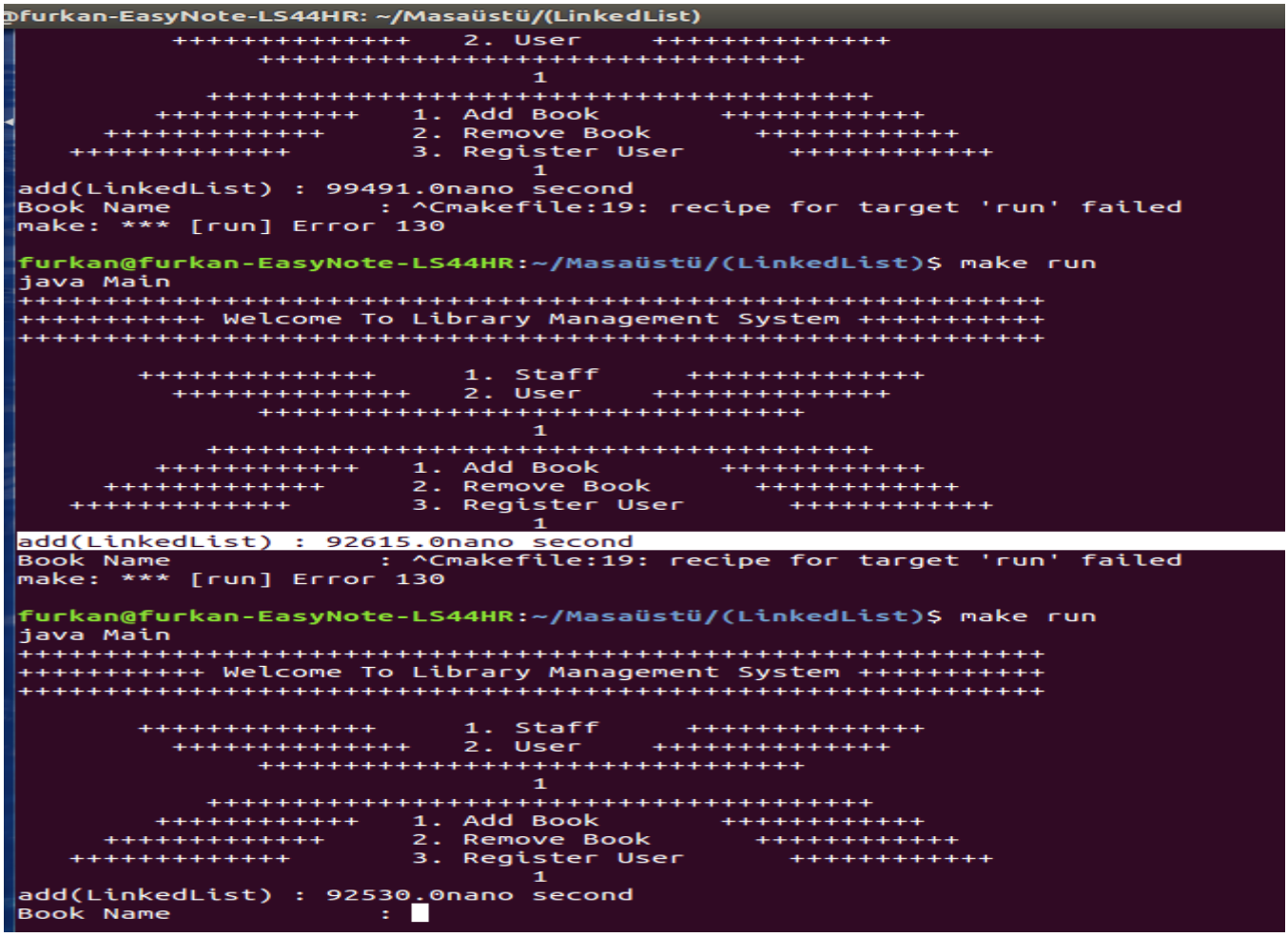
If there is same name more than one, process continue with ID number (book ID, person ID).Except this situation, process continue with just name(book name, person name).Every function that we see on screen is between 2 functions (readFile and writeFile). Any function start with readFile and end with writeFile. readFile, if there is file that is opened previosly, read datas from it to local array. writeFile , write datas from local array to file.

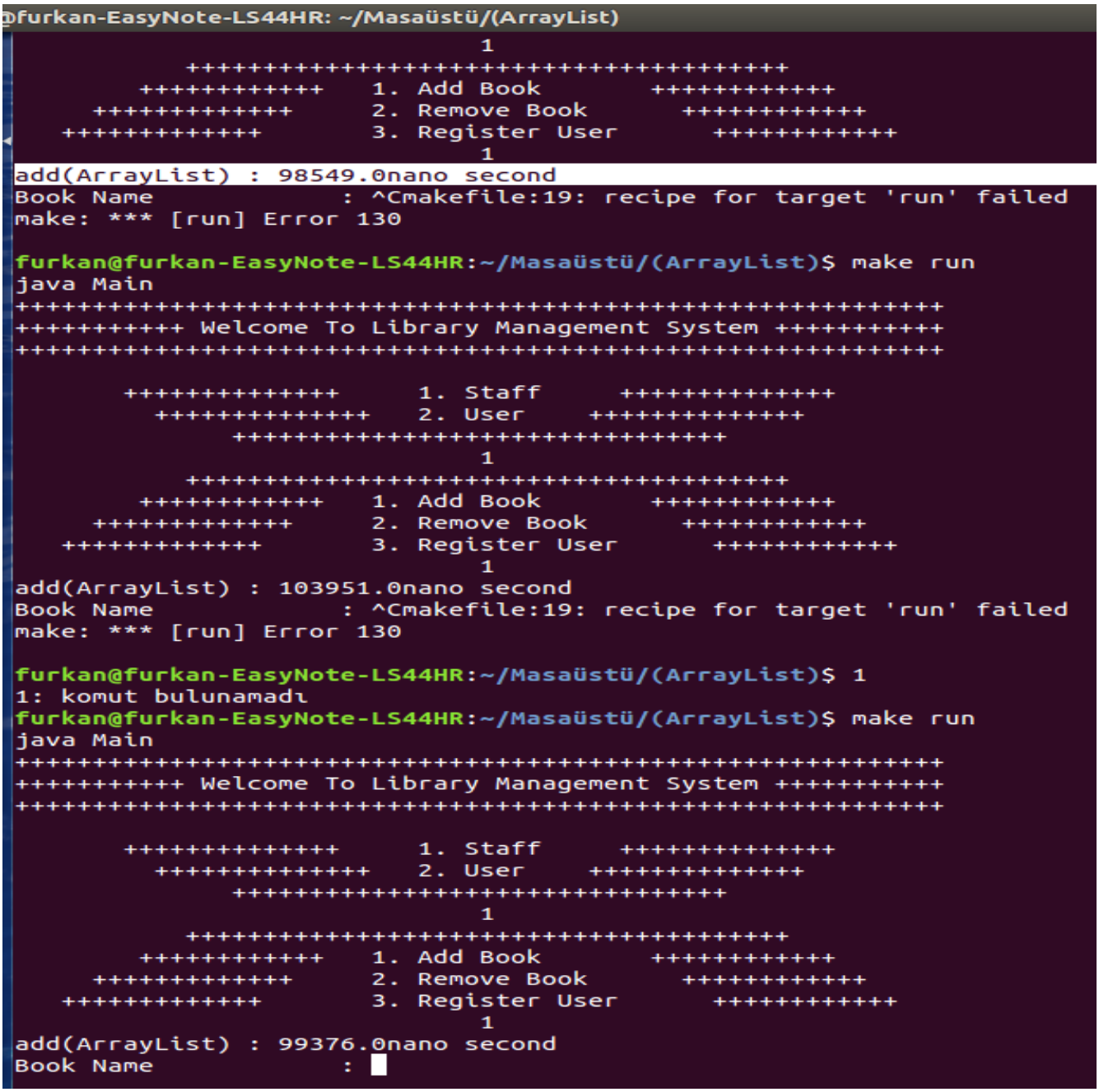
6. Test Cases

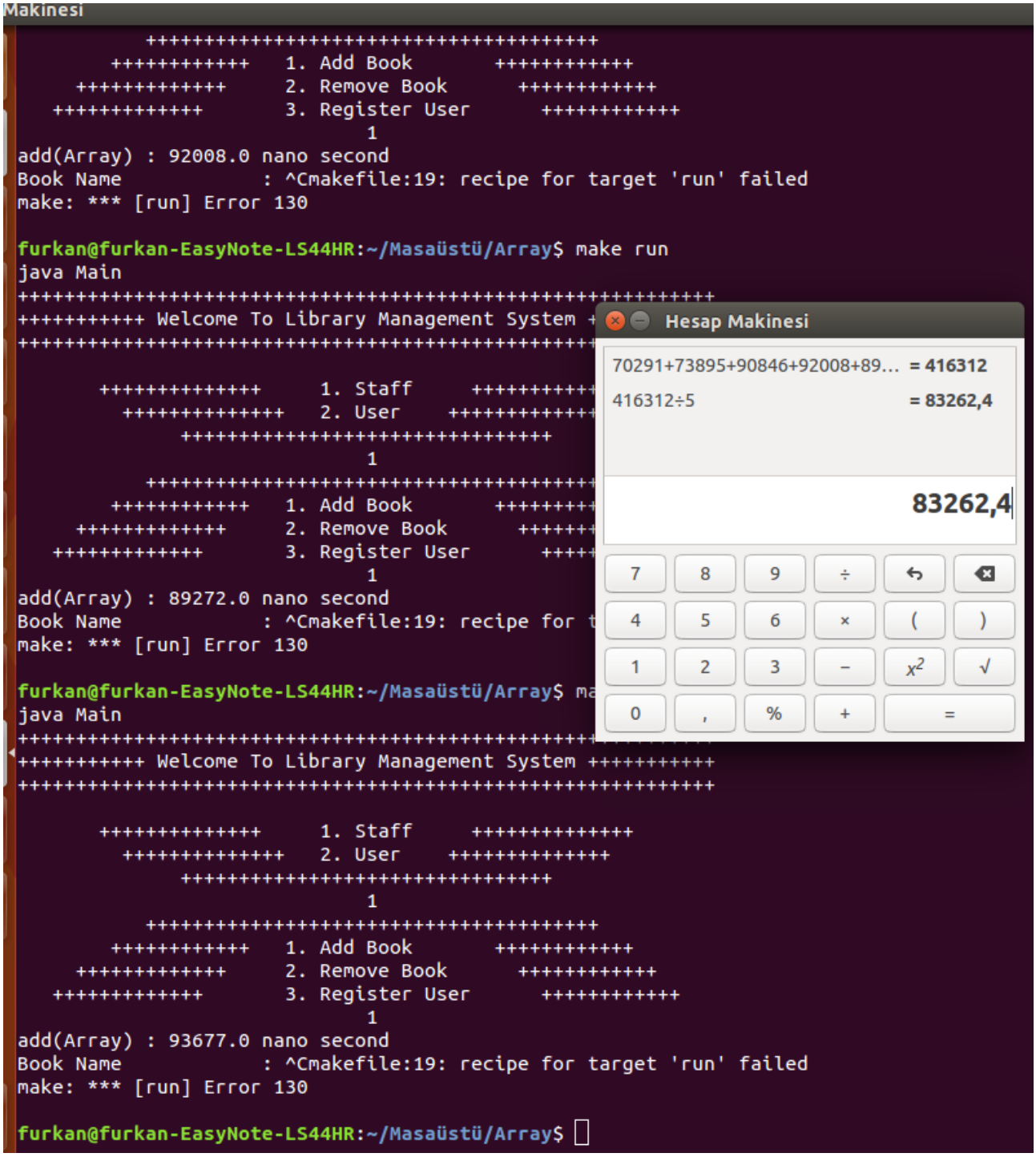
directories/..../.../ make then directories/..../.../ make run on Terminal

7. Running and Results

I use timer for add function of both LinkedList and ArrayList.I reliaze that LinkedList add is a little faster than ArrayList add.Because when you insert a new element and the array is full, you need to create a new array with more size. The LinkedList just add a new node next to the last.Same function in my array runs avarage 83242,6 nanosecond.It looks like the fastest but my array runs more unbalanced.


@furkan-EasyNote-LS44HR: ~/Masaüstü/(LinkedList)
++++++++++++++ 2. User ++++++++++++++
++++++++++++++++++++++++++++++++++
1
++
++++++++++++ 1. Add Book ++++++++++++
++++++++++++++ 2. Remove Book ++++++++++++++
++++++++++++++ 3. Register User ++++++++++++
1
add(LinkedList) : 99491.0nano second
Book Name : ^Cmakefile:19: recipe for target 'run' failed
make: *** [run] Error 130
furkan@furkan-EasyNote-LS44HR:~/Masaüstü/(LinkedList)$ make run
java Main
++
++++++++++++ Welcome To Library Management System ++++++++++++
++
++++++++++++++ 1. Staff ++++++++++++++
++++++++++++++ 2. User ++++++++++++++
++++++++++++++++++++++++++++++++++
1
++
++++++++++++ 1. Add Book ++++++++++++
++++++++++++++ 2. Remove Book ++++++++++++++
++++++++++++++ 3. Register User ++++++++++++
1
add(LinkedList) : 92615.0nano second
Book Name : ^Cmakefile:19: recipe for target 'run' failed
make: *** [run] Error 130
furkan@furkan-EasyNote-LS44HR:~/Masaüstü/(LinkedList)$ make run
java Main
++
++++++++++++ Welcome To Library Management System ++++++++++++
++
++++++++++++++ 1. Staff ++++++++++++++
++++++++++++++ 2. User ++++++++++++++
++++++++++++++++++++++++++++++++++
1
++
++++++++++++ 1. Add Book ++++++++++++
++++++++++++++ 2. Remove Book ++++++++++++++
++++++++++++++ 3. Register User ++++++++++++
1
add(LinkedList) : 92530.0nano second
Book Name :


@furkan-EasyNote-LS44HR: ~/Masaüstü/(ArrayList)
1
1. Add Book
2. Remove Book
3. Register User
1
add(ArrayList) : 98549.0nano second
Book Name : ^Cmakefile:19: recipe for target 'run' failed
make: *** [run] Error 130
furkan@furkan-EasyNote-LS44HR:~/Masaüstü/(ArrayList)$ make run
java Main
++++++++++ Welcome To Library Management System ++++++++++
1. Staff
2. User
1
1. Add Book
2. Remove Book
3. Register User
1
add(ArrayList) : 103951.0nano second
Book Name : ^Cmakefile:19: recipe for target 'run' failed
make: *** [run] Error 130
furkan@furkan-EasyNote-LS44HR:~/Masaüstü/(ArrayList)$ 1
1: komut bulunamadı
furkan@furkan-EasyNote-LS44HR:~/Masaüstü/(ArrayList)$ make run
java Main
++++++++++ Welcome To Library Management System ++++++++++
1. Staff
2. User
1
1. Add Book
2. Remove Book
3. Register User
1
add(ArrayList) : 99376.0nano second
Book Name :


Makinesi
1. Add Book
2. Remove Book
3. Register User
1
add(Array) : 92008.0 nano second
Book Name : ^Cmakefile:19: recipe for target 'run' failed
make: *** [run] Error 130
furkan@furkan-EasyNote-LS44HR:~/Masaüstü/Array$ make run
java Main
++++++++++ Welcome To Library Management System +
1. Staff
2. User
1
add(Array) : 89272.0 nano second
Book Name : ^Cmakefile:19: recipe for t
make: *** [run] Error 130
furkan@furkan-EasyNote-LS44HR:~/Masaüstü/Array$ ma
java Main
++++++++++ Welcome To Library Management System ++++++++++
1. Staff
2. User
1
1. Add Book
2. Remove Book
3. Register User
1
add(Array) : 93677.0 nano second
Book Name : ^Cmakefile:19: recipe for target 'run' failed
make: *** [run] Error 130
furkan@furkan-EasyNote-LS44HR:~/Masaüstü/Array$
Hesap Makinesi
70291+73895+90846+92008+89... = 416312
416312÷5 = 83262,4
83262,4
7 8 9 ÷
4 5 6 × ( )
1 2 3 − x² √
0 , % + =

Questions

Q1) 1- `for (int i=0; i<n-1; i++) {`
`for (int j=i+1; j<n; j++) {`
3 simple statements
`}`
`}`

$3(n-1) + 3(n-2) + \dots + 3(2) + 3(1)$
↳ $3\left(\frac{n^2-n}{2}\right)$
↳ $1,5n^2 - 1,5n \Rightarrow O(n^2)$

$\Omega(n^2) \leq \Theta(n^2) \leq O(n^2)$
↳ $\Theta(n^2)$

2-
```
public static int length (string str) {
    if (str == null || str.equals(""))
        return 0;
    else
        return 1 + length (str.substring(1));
}
```

$T(n) = 1 + T(n-1)$
$T(n-1) = 1 + T(n-2)$
$T(n-2) = 1 + T(n-3)$
$T(n-k) = 1 + T(n-k-1)$
$T(n) = k+1 + T(n-k-1)$

Tamamen n'e bağlı.
her halükarda n kere çalışacak
$T(n) = \Theta(n)$

Q2)
```
SOME-FUNCTION (A)
n ← length [A]
for j ← 1 to n-1
    do smallest ← j                    -> (n-1) kere (ds döngüye bağlı)
    for i ← j+1 to n                   -> (n-1) + (n-2) + (n-3) + ... + 2 + 1
        do if A[i] < A[smallest]       -> n(n-1)/2
            then smallest ← i
    exchange A[j] ↔ A[smallest]        (n-1) kere (ds döngüye bağlı)
```

1) Kabarcık böyüye sıralama yapıyor.

2) Best Case

$\frac{n(n-1)}{2} + n-1 + n-1 = \Omega(n^2)$

Worst Case

$\frac{n(n-1)}{2} + n-1 + n-1 = O(n^2)$

$\Theta(n^2)$

4) 3) If $T(n) = \Theta(g(n))$, $0 \le c_1 g(n) \le T(n) \le c_2 g(n)$ for $n \ge n_0$

$0 \le T(n) \le c_2 g(n)$ for $n \ge n_0$, $T(n) = O(g(n))$ ⇒ Worst case $O(n)$

$0 \le c_1 g(n) \le T(n)$ for $n \ge n_0$, $T(n) = \Omega(g(n))$ ⇒ Best case $\Omega(n)$

4) 1)

```
public static int[] sort(int arr[], int index) {
    if (index == arr.length())
        return arr;
    }
    else {
        int j;
        j = index;
        while (j > 0 && arr[j] < arr[j-1]) {
            int temp;
            temp = arr[j-1];
            arr[j-1] = arr[j];
            arr[j] = temp;
            j--;
        }
        sort(arr, index+1);
    }
}
```

↳ 0 veya 1 ile sonlanır

2)

Best Case

Array sıralı ise

$1 + 2 + \dots + (n-1) + (n-1)$

$\frac{n^2-n}{2} = 0.5n^2 - 0.5n = \Omega(n^2)$

Worst Case

$5(1) + 5(2) + \dots + 5(n-2) + 5(n-1)$

$5\left(\frac{n^2-n}{2}\right) = 2.5n^2 - 2.5n = O(n^2)$

3)

$\Omega(n^2) \le \Theta(n^2) \le O(n^2)$

$\Theta(n^2)$

Q5) (1-) $f(n) = n^{0.1}$, $g(n) = (\log n)^{10}$

$f(n) = \Omega(g(n))$

$f = \Omega(g)$ => $f(n)$ is not dominated by $g(n)$

$n^{0.1} = \Omega(\log n)^{10}$

(2-) $f(n) = n!$, $g(n) = 2^n$

↳ matches $f(n) = \Theta(g(n))$

$n! = \Theta(n \log n)$ => $n! > \sqrt{2\pi n}\left(\frac{n}{e}\right)^n$

$f = \Omega(g)$ => $f(n)$ is not dominated by $g(n)$

$n! = \Omega(2^n)$

(3) $f(n) = (\log n)^{\log n}$, $g(n) = 2^{(\log_2 n)^2}$

$f(n) = n^{\log \log n}$ $\quad g(n) = \left(2^{\log_2 n}\right)^{\log_2 n} = n^{\log_2 n}$

$f(n) = O(g(n))$ => $(\log n)^{\log n} = O(2^{(\log_2 n)^2})$