GIT Department of Computer Engineering CSE 222/505 - Spring 2020 Homework 7 Report

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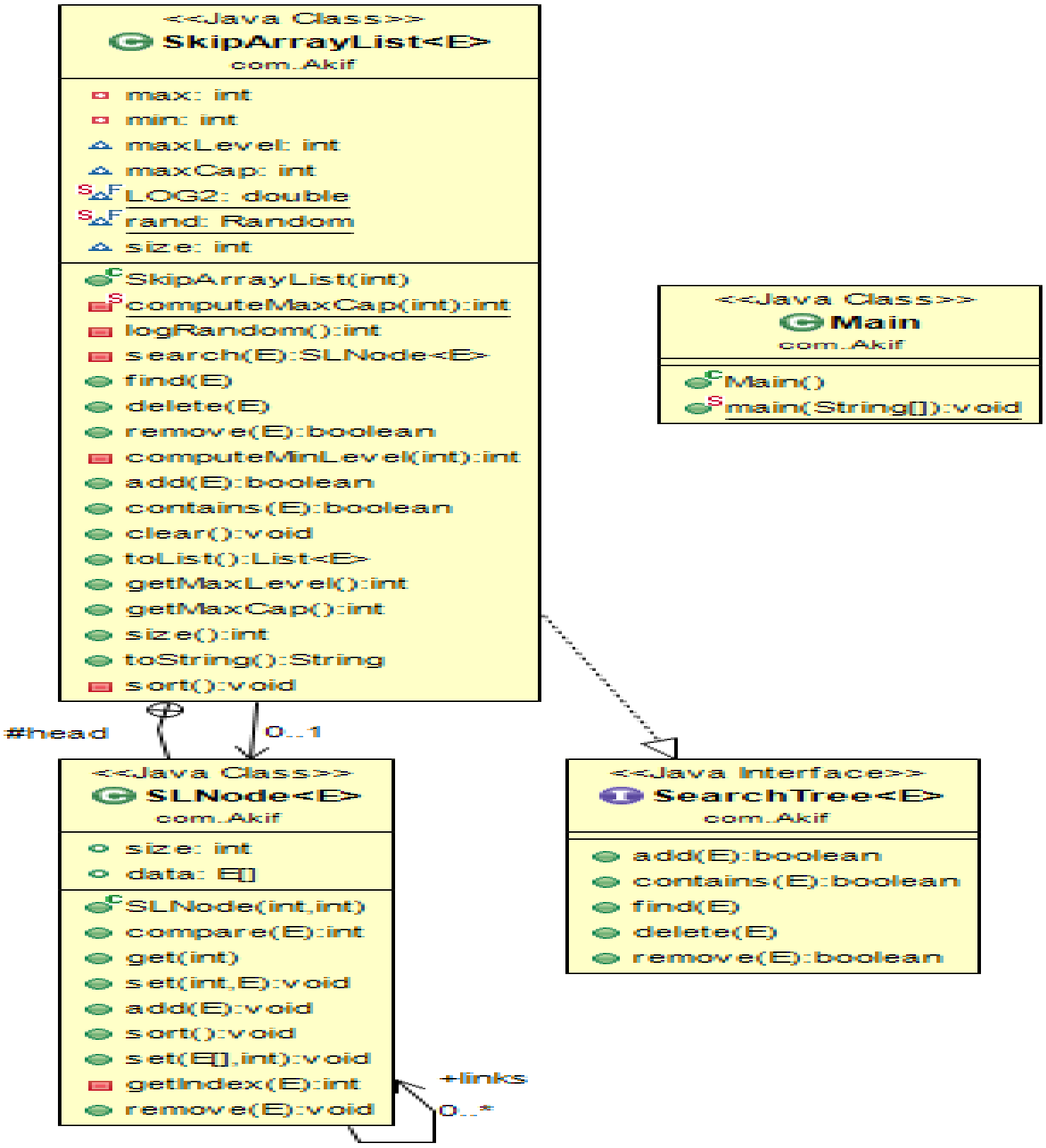
Q2 REPORT

1. CLASS DIAGRAMS



2. PROBLEM SOLUTION APPROACH

My Problem solution steps are;

– Specify the problem requirements
– Analyze the problem
– Design an algorithm and Program
– Implement the algorithm
– Test and verify the program
– Maintain and update the program

1) **Specify the problem requirements :** I understand the problem.
2) **Analyze the problem :** I identify;
   – Input data
   – Output data
   – Additional requirements and constraints

3) **Design an algorithm and Program :** I divide the problem into sub-problems. I listed major steps (sub-problems). I break down each step into a more detailed list. To do these We have to divide this big project into small pieces.

⟹ **Implement the algorithm :** I wrote the algorithm in Java by converting each step into statements of Java (classes ,methods etc.)

Firstly, I wrote the **search interface** from the book.

After I wrote **SkipArrayList** class where each node in the lowest-level list keeps several elements instead of just one element as in a B-tree node.

I determine the maximum and the minimum number of elements in a node during the construction of the this class by giving **order** number.

But since adding and removing properly from this list is not easy, I wrote add and remove operations for this class but **they don't work as expected**. Some elements are not sorted and also the number of elements at each node should be larger than the minimum, except in the case of one node skip list doesn't satisfy. The other rules works as expected such as determining level of a node.

4) **Test and verify the program:** To test program I wrote the Main class and main method in this class I add and remove some numbers and I print the result.
5) **Maintain and update the program :** I keep the program up-to-date

3. TEST CASES

Test ID	Test Case	Test Steps	Test Data	Expected Results	Actual Results	Pass/Fail
T1	The maximum and the minimum number of elements in a node should be specified during the construction of the data structure.	Create object of list by giving an order number bigger than 3.	5	The list created successfully.	As Expected	Pass
T2	The number of elements at each node should be smaller than the maximum. The number of elements at each node should be larger than the minimum, except in the case of one node skip list.	Add new elements to the list	20,30,8,47,18	The list created successfully.	Not Expected	Fail
T3	Insertion of the new element should be into the corresponding node. It may need to split the node when it is necessary.	Add new elements to the list	39,40,98	The list created successfully.	Not Expected	Fail
T4	After a deletion operation, the number of elements in a node may become smaller than the minimum. In that case, It should combine the node with its predecessor or successor.	Delete elements from list	30,18	The list created successfully.	Not Expected	Fail
T5	Print the List in a good Shape.	Call toString method of the list		All List has printed in a good shape.	As Expected	Pass

4. RUNNING AND RESULTS

Test ID	Test Result

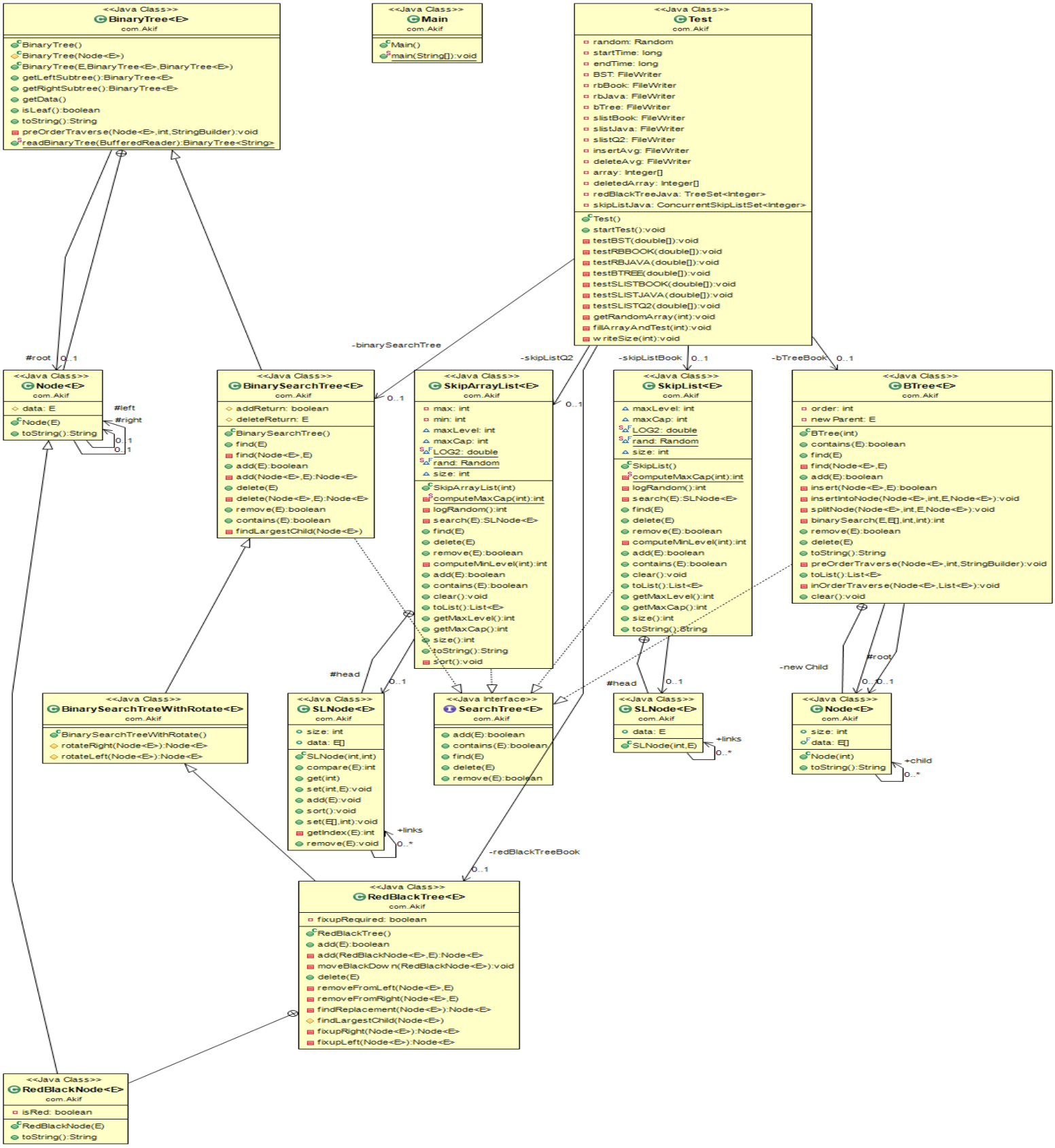
T1	`public static void main(String[] args) {`
	`SkipArrayList<Integer> skipList = new SkipArrayList<> ( order: 5);`
	
	`***Skip List information***`
	`Order: 5`
	`Maximum number of elements in a node: 4`
	`Minimum number of elements in a node: 2`
	`Maximum level of the list: 2`
	`Maximum Capacity of the list: 3`

T2	`Level 0:[8, 20, 30, 47], [18, null, null, null],` `Level 1:[18, null, null, null],`
T3	`Level 0:[8, 20, 30, 47], [18, 39, 40, 98],` `Level 1:[18, 39, 40, 98],`
T4	`Level 0:[8, 20, 47, 47], [18, 39, 40, 98],` `Level 1:[18, 39, 40, 98],`

T5	`Level 0:[5, null, null, null], [8, 20, 45, 47], [10, null, null, null], [18, 39, 40, 98],`
	`Level 1:[18, 39, 40, 98],`
	`Level 2:`

Q3 REPORT

1. CLASS DIAGRAMS



2. PROBLEM SOLUTION APPROACH

My Problem solution steps are;

– Specify the problem requirements
– Analyze the problem
– Design an algorithm and Program
– Implement the algorithm
– Test and verify the program
– Maintain and update the program

1) **Specify the problem requirements :** I understand the problem.
2) **Analyze the problem :** I identify;
   – Input data
   – Output data
   – Additional requirements and constraints
3) **Design an algorithm and Program :** I divide the problem into sub-problems. I listed major steps (sub-problems). I break down each step into a more detailed list. To do these We have to divide this big project into small pieces.

➡ **Implement the algorithm :** I wrote the algorithm in Java by converting each step into statements of Java (classes ,methods etc.)

Firstly, I wrote the data structures from book.

Then, I start to write **test class** to compare data structures with different size numbers to compare running time.

Then, I applied this process using loop structure;

Insert a collection of randomly generated numbers. Perform this operation 10 times for 10.000, 20.000, 40.000 and 80.000 random numbers (10 times for each). So, I have 10 instances of each data structure for each 4 different sizes. There are 240 data structure in total.(by using loop not real).

Lastly, I did this and I wrote file the results;

- Compared the run-time performance of the insertion operation for the data structures. Inserted 10 extra random numbers into the structures I built. Measured the running time and calculated the average running time for each data structure and four different problem size.

- Compared the run-time performance of the deletion operation for the data structures. Performed 10 successful deletion operations from the structures I built. Measured the running time and calculated the average running time for each data structure and four different problem size.

Compared the running times and their increase by drawing **graph** in excel.

4) **Test and verify the program:** To test program I wrote the **Test class**. In this class I did all test procedure that mentioned before and I saved the result to the **files**.

   Since B-tree implementation in the book doesn't have delete operation, **I didn't test B-Tree Delete operation.**

5) **Maintain and update the program :** I keep the program up-to-date

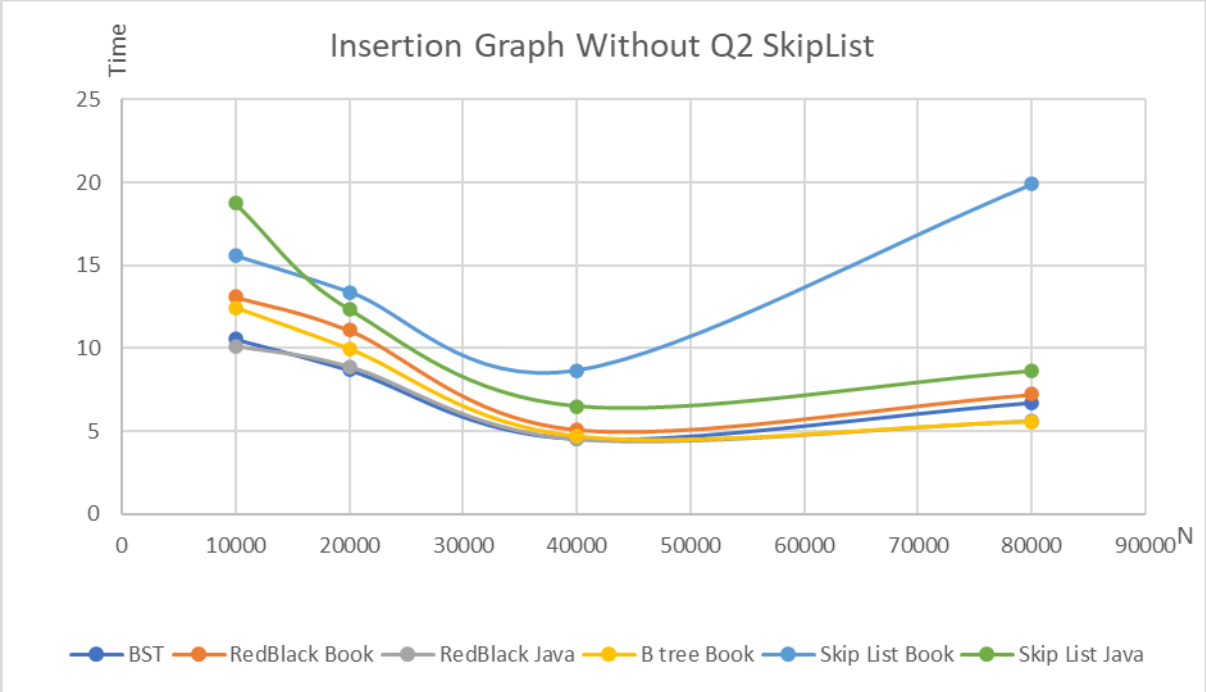
3. TEST CASES

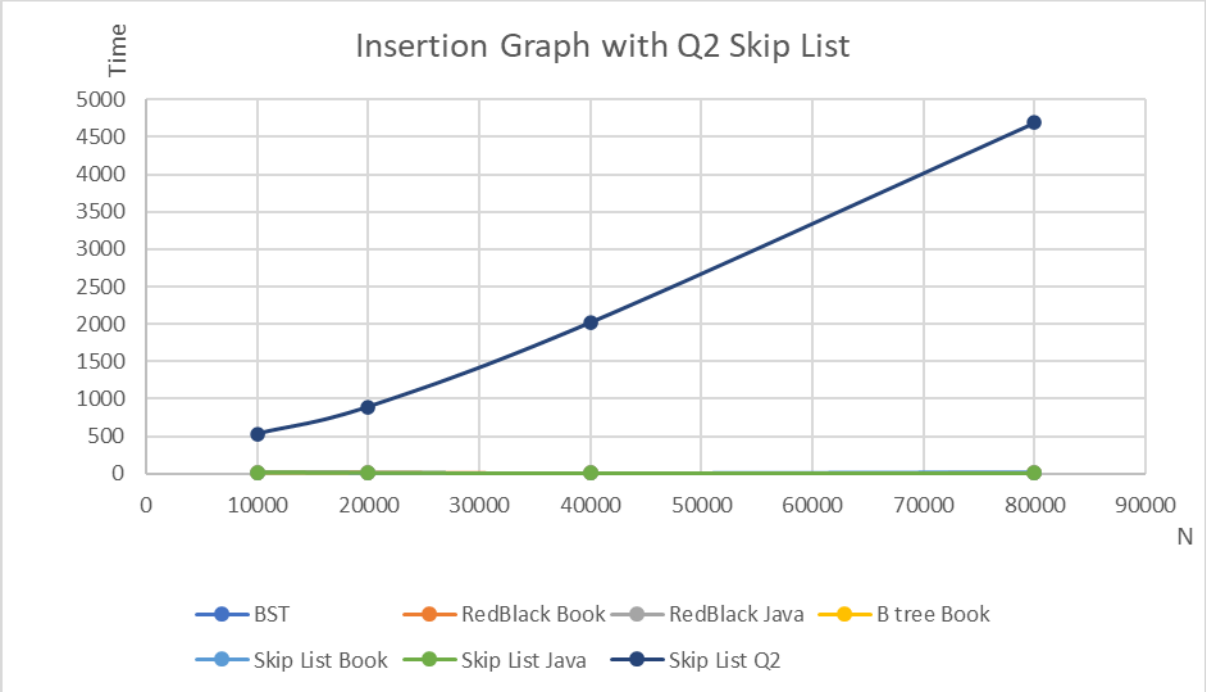
Test ID	Test Case	Test Steps	Test Data	Expected Results	Actual Results	Pass/Fail
T1	Test Regular binary search tree	1) Create Random Numbers 2) Insert and Delete 3) Verify that data structures are built correctly	10.000, 20.000, 40.000 and 80.000 random numbers	The test is successful	As Expected	Pass
T2	Test Red-Black tree implementation in the book	1) Create Random Numbers 2) Insert and Delete 3) Verify that data structures are built correctly	10.000, 20.000, 40.000 and 80.000 random numbers	The test is successful	As Expected	Pass
T3	Test Red Black tree implementation in java	1) Create Random Numbers 2) Insert and Delete 3) Verify that data structures are built correctly	10.000, 20.000, 40.000 and 80.000 random numbers	The test is successful	As Expected	Pass
T4	Test B-tree implementation in the book(Just Insertion)	1) Create Random Numbers 2) Insert and Delete 3) Verify that data structures are built correctly	10.000, 20.000, 40.000 and 80.000 random numbers	The test is successful	As Expected	Pass
T5	Test Skip list implementation in the book	1) Create Random Numbers 2) Insert and Delete 3) Verify that data structures are built correctly	10.000, 20.000, 40.000 and 80.000 random numbers	The test is successful	As Expected	Pass
T6	Test Skip list implementation in java	1) Create Random Numbers 2) Insert and Delete 3) Verify that data structures are built correctly	10.000, 20.000, 40.000 and 80.000 random numbers	The test is successful	As Expected	Pass
T7	Test Skip list in question Q2	1) Create Random Numbers 2) Insert and Delete 3) Verify that data structures are built correctly	10.000, 20.000, 40.000 and 80.000 random numbers	The test is successful	As Expected	Pass

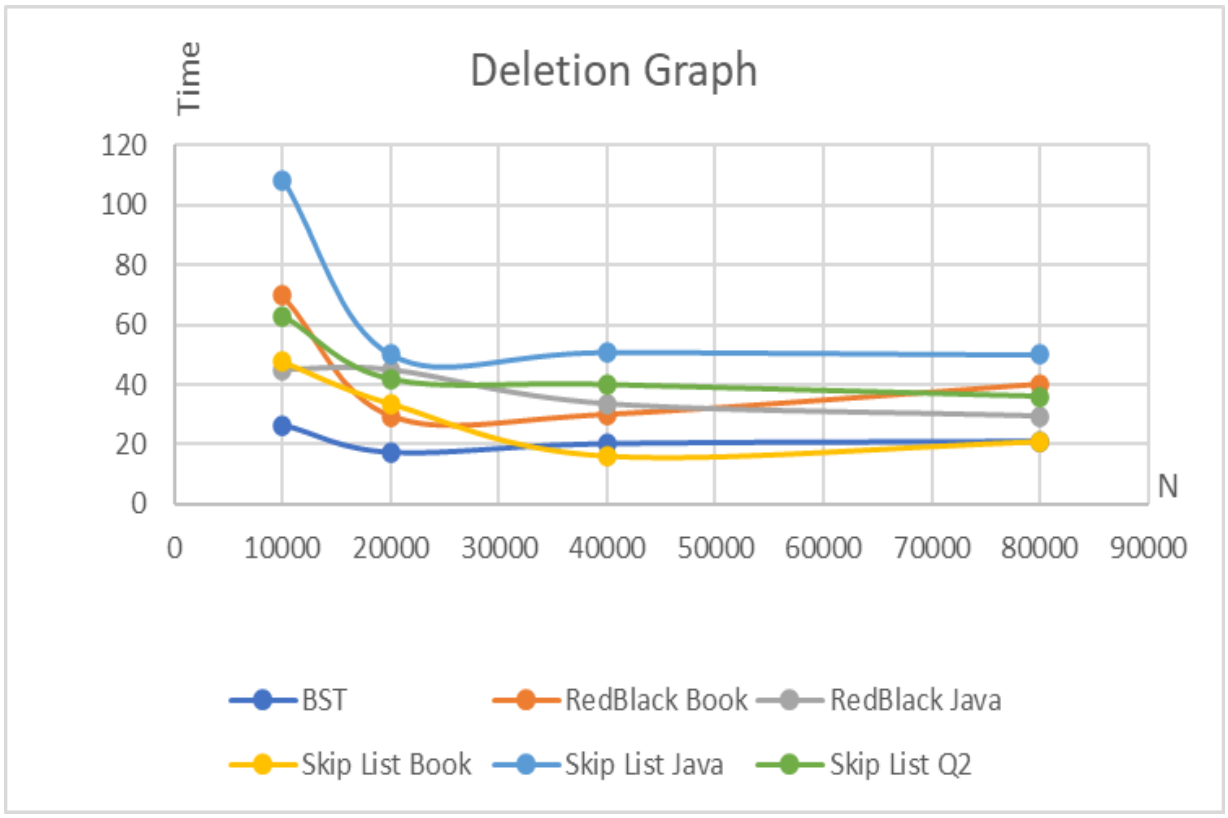
4. RUNNING AND RESULTS

Test ID	Test Result
T1	***ARRAY SIZE = 10000*** ---------- BST add avg: 10,54 microsecond(us) BST delete avg: 26,51 microsecond(us) ----------
T2	***ARRAY SIZE = 10000*** ---------- RedBlack Book add avg: 13,10 microsecond(us) RedBlack Book delete avg: 69,72 microsecond(us) ----------
T3	***ARRAY SIZE = 10000*** ---------- RedBlack java add avg: 10,13 microsecond(us) RedBlack java delete avg: 45,03 microsecond(us) ----------
T4	***ARRAY SIZE = 10000*** ---------- B-Tree Book add avg: 12,44 microsecond(us) B-Tree delete avg: 0,20 microsecond(us) ----------
T5	***ARRAY SIZE = 10000*** ---------- Skip List Book add avg: 15,58 microsecond(us) Skip List Book delete avg: 47,46 microsecond(us) ----------
T6	***ARRAY SIZE = 10000*** ---------- Skip List java add avg: 18,76 microsecond(us) Skip List java delete avg: 108,30 microsecond(us) ----------
T7	***ARRAY SIZE = 10000*** ----------

```
Skip List Q2  add avg: 528,09 microsecond(us)
Skip List Q2  delete avg: 62,96 microsecond(us)
-------------------------------------------------
```

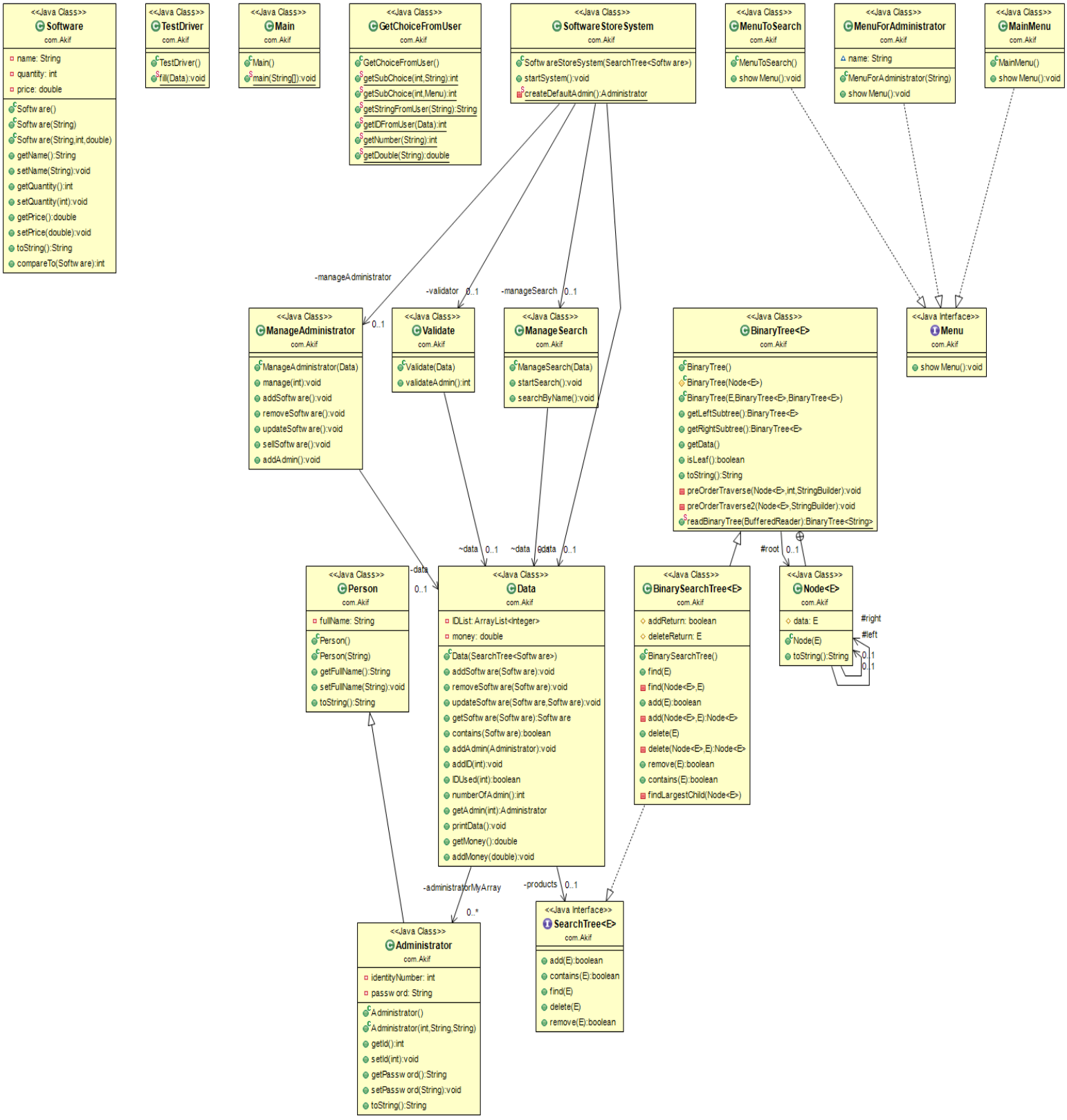





Deletion Graph
Time
120
100
80
60
40
20
0
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
N
BST
RedBlack Book
RedBlack Java
Skip List Book
Skip List Java
Skip List Q2

Q4 REPORT

2. CLASS DIAGRAMS



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3) **Design an algorithm and Program :** I divide the problem into sub-problems. I listed major steps (sub-problems). I break down each step into a more detailed list. To do these We have to divide this big project into small pieces.

⟹ **Implement the algorithm :** I wrote the algorithm in Java by converting each step into statements of Java (classes ,methods etc.)

Firstly, I wrote the **Data class** to keep all data about the system. In this class I stored the information about the software in **SearchTree interface** and I write operation about the data in this class by using only SearchTree interface methods such as insert, delete etc. Then I wrote all the classes about the system such as Software, SoftwareStoreSystem, TestDriver and Menu classes.

To perform admin operations, I wrote the **ManageAdministrator** class. In this class I wrote operations about the admin of System.

To perform search operations, I wrote the **ManageSearch** class. In this class I wrote operations about the search for user. I did search **only with software name** because we can use only search tree interface methods and by using these we have to search according to software **compareTo method** and my compare to method compares the software with names so only name search is possible in this case.

To validate password of the admin I wrote **validate** class.

To show related menu to the user I wrote **menu** interface and helper menu classes.

4) **Test and verify the program:** To test program I wrote the **TestDriver** class. In this class I fill the sotfware(tree) from a **file(software.txt)** after filling operation in **SoftwareStoreSystem** in **startSystem** method I showed the main menu to the user I did operations based on user's choice. **To test program I used BinarySearchTree** class from the book. You can change it from **Main class** while testing.
5) **Maintain and update the program :** I keep the program up-to-date.

3. TEST CASES

Test ID	Test Case	Test Steps	Test Data	Expected Results	Actual Results	Pass/Fail
T1	Test Admin Login	1) Run program 2) Go to Admin Panel 3) Enter Password	"171044098"	Admin should Login into Application.	As Expected	**Pass**
T2	Test Add Software	1) Run program 2) Go to Admin Panel 3) Enter Password 4) Enter 1 5) Enter Information	Quartus 13.1 3 150,75	The Software has added.	As Expected	**Pass**
T3	Test Delete Software	1) Run program 2) Go to Admin Panel 3) Enter Password 4) Enter 2 5) Enter Information	Adobe Photoshop 6.2 y	The Software has deleted.	As Expected	**Pass**
T4	Test Update Software	1) Run program 2) Go to Admin Panel 3) Enter Password 4) Enter 3 5) Enter Information	Adobe Flash 4.0 Adobe Flash 4.2 3 15,75	The Software has updated.	As Expected	**Pass**
T5	Test Sell Software	1) Run program 2) Go to Admin Panel 3) Enter Password 4) Enter 4 5) Enter Information	Norton 5.5 2	The Software has sold.	As Expected	**Pass**
T6	Test Add an Admin	1) Run program 2) Go to Admin Panel 3) Enter Password 4) Enter 5 5) Enter Information	akif kartal 123 456	The admin has added.	As Expected	**Pass**

T7	Test Search by Software name	1) Run program 2) Go to Search Panel 3) Enter 1 4) Enter Information	Norton 4.5	Properties of the software will be shown.	As Expected	**Pass**
T8	Test Show Daily Income	1) Run program 2) Go to Admin Panel 3) Enter Password 4) Enter 7		Total money from selling will be shown.	As Expected	**Pass**
T9	Test Print all Data	1) Run program 2) Go to Admin Panel 3) Enter Password 4) Enter 6		All Software has printed in a good shape.	As Expected	**Pass**
T10	Program should automatically create a data structure including the following software packages; Adobe Photoshop 6.0, Adobe Photoshop 6.2, Norton 4.5, Norton 5.5, Adobe Flash 3.3, Adobe Flash 4.0.	1) Run program 2) Go to Search Panel 3) Enter 2		All Software has printed in a good shape.	As Expected	**Pass**

4. RUNNING COMMAND AND RESULTS

Test ID	Test Result

T1	```
	--- 	
	  Welcome to Software Store
	--- 	
	  NOTE : Default Admin Information;
	       Password : 171044098
	--- 	
	  Please choose one of the option ?
	--- 	
	  [1] Go to Admin Panel
	--- 	
	  [2] Go to Search Panel
	--- 	
	  [0] Exit.
	--- 	
	Answer: 1
	Enter your Password: 171044098
	--- 	
	  Welcome Administrator Default
	--- 	
	  What Do you want to do ?
	--- 	
	  [1] Add a Software
	--- 	
	  [2] Delete a Software
	--- 	
	  [3] Update a Software
	--- 	
	  [4] Sell a Software
	--- 	
	  [5] Add an Admin
	--- 	
	  [6] Print All Software
	--- 	
	  [7] Show Daily Income
	--- 	
	  [0] Main Menu.
	--- 	
	``

T2

```
-------------------------------------------
   Welcome Administrator Default
-------------------------------------------
   What Do you want to do ?
-------------------------------------------
   [1] Add a Software
-------------------------------------------
   [2] Delete a Software
-------------------------------------------
   [3] Update a Software
-------------------------------------------
   [4] Sell a Software
-------------------------------------------
   [5] Add an Admin
-------------------------------------------
   [6] Print All Software
-------------------------------------------
   [7] Show Daily Income
-------------------------------------------
   [0] Main Menu.
-------------------------------------------
Answer: 1
Enter Name(including version) of the software: Quartus 13.1
Enter quantity of software: 3
Enter price of software: 150,75
Software has added.
-------------------------------------------
```

```
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.0', quantity= 4, price= 10.5$ }
Software{Name= 'Adobe Photoshop 6.2', quantity= 2, price= 300.0$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Norton 5.5', quantity= 8, price= 22.75$ }
Software{Name= 'Quartus 13.1', quantity= 3, price= 150.75$ }
```

T3

```
-------------------------------------------
   Welcome Administrator Default
-------------------------------------------
   What Do you want to do ?
-------------------------------------------
   [1] Add a Software
-------------------------------------------
   [2] Delete a Software
-------------------------------------------
   [3] Update a Software
-------------------------------------------
   [4] Sell a Software
-------------------------------------------
   [5] Add an Admin
-------------------------------------------
   [6] Print All Software
-------------------------------------------
   [7] Show Daily Income
-------------------------------------------
   [0] Main Menu.
-------------------------------------------
Answer: 2
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.0', quantity= 4, price= 10.5$ }
Software{Name= 'Adobe Photoshop 6.2', quantity= 2, price= 300.0$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Norton 5.5', quantity= 8, price= 22.75$ }
Software{Name= 'Quartus 13.1', quantity= 3, price= 150.75$ }

Enter a Software name to delete: Adobe Photoshop 6.2
This software will be remove completely.
To decrement quantity please use update option!
Are you Sure(y/n): y
Software has removed from System.
-------------------------------------------
```

```
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.2', quantity= 3, price= 15.75$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Norton 5.5', quantity= 8, price= 22.75$ }
Software{Name= 'Quartus 13.1', quantity= 3, price= 150.75$ }
```

T4

```
-------------------------------------------
   Welcome Administrator Default
-------------------------------------------
   What Do you want to do ?
-------------------------------------------
   [1] Add a Software
-------------------------------------------
   [2] Delete a Software
-------------------------------------------
   [3] Update a Software
-------------------------------------------
   [4] Sell a Software
-------------------------------------------
   [5] Add an Admin
-------------------------------------------
   [6] Print All Software
-------------------------------------------
   [7] Show Daily Income
-------------------------------------------
   [0] Main Menu.
-------------------------------------------
Answer: 3
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.0', quantity= 4, price= 10.5$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Norton 5.5', quantity= 8, price= 22.75$ }
Software{Name= 'Quartus 13.1', quantity= 3, price= 150.75$ }

Enter a Software name to update: Adobe Flash 4.0
Enter new information about the software.
Enter Name(including version) of the software: Adobe Flash 4.2
Enter quantity of software: 3
Enter price of software: 15,75
Software has updated.
-------------------------------------------
```

```
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.2', quantity= 3, price= 15.75$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Quartus 13.1', quantity= 3, price= 150.75$ }
Software{Name= 'Norton 5.5', quantity= 6, price= 22.75$ }
```

T5

```
-------------------------------------------
   Welcome Administrator Default
-------------------------------------------
   What Do you want to do ?
-------------------------------------------
   [1] Add a Software
-------------------------------------------
   [2] Delete a Software
-------------------------------------------
   [3] Update a Software
-------------------------------------------
   [4] Sell a Software
-------------------------------------------
   [5] Add an Admin
-------------------------------------------
   [6] Print All Software
-------------------------------------------
   [7] Show Daily Income
-------------------------------------------
   [0] Main Menu.
-------------------------------------------
Answer: 4
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.2', quantity= 3, price= 15.75$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Norton 5.5', quantity= 8, price= 22.75$ }
Software{Name= 'Quartus 13.1', quantity= 3, price= 150.75$ }

Enter a Software name to sell: Norton 5.5
How many do you want to sell: 2
The quantity of package is updated.
-------------------------------------------
```

```
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.2', quantity= 3, price= 15.75$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Quartus 13.1', quantity= 3, price= 150.75$ }
Software{Name= 'Norton 5.5', quantity= 6, price= 22.75$ }
```

T6

```
-------------------------------------------
   Welcome Administrator Default
-------------------------------------------
   What Do you want to do ?
-------------------------------------------
   [1] Add a Software
-------------------------------------------
   [2] Delete a Software
-------------------------------------------
   [3] Update a Software
-------------------------------------------
   [4] Sell a Software
-------------------------------------------
   [5] Add an Admin
-------------------------------------------
   [6] Print All Software
-------------------------------------------
   [7] Show Daily Income
-------------------------------------------
   [0] Main Menu.
-------------------------------------------
Answer: 5
Enter a full Name: akif kartal
Enter your ID as Number: 123
Enter a password: 456
Your Administrator has added Successfully!
```

T7

```
-------------------------------------------
   Welcome to Search Screen
-------------------------------------------
   Please choose one of the option ?
-------------------------------------------
   [1] Search by Software name
-------------------------------------------
   [2] Print All Software
-------------------------------------------
   [0] Main Menu.
-------------------------------------------
Answer: 1
Enter a Software name to search: Norton 4.5
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
-------------------------------------------
```

T8		``` --- Welcome Administrator Default --- What Do you want to do ? --- [1] Add a Software --- [2] Delete a Software --- [3] Update a Software --- [4] Sell a Software --- [5] Add an Admin --- [6] Print All Software --- [7] Show Daily Income --- [0] Main Menu. --- Answer: 7 Total money from selling: 45,50$ --- ```	

```
-------------------------------------------
   Welcome Administrator Default
-------------------------------------------
   What Do you want to do ?
-------------------------------------------
   [1] Add a Software
-------------------------------------------
   [2] Delete a Software
-------------------------------------------
   [3] Update a Software
-------------------------------------------
   [4] Sell a Software
-------------------------------------------
   [5] Add an Admin
-------------------------------------------
```


T9

File - Main

```
   [6] Print All Software
-------------------------------------------
   [7] Show Daily Income
-------------------------------------------
   [0] Main Menu.
-------------------------------------------
Answer: 6
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.2', quantity= 3, price= 15.75$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Quartus 13.1', quantity= 3, price= 150.75$ }
Software{Name= 'Norton 5.5', quantity= 6, price= 22.75$ }
```

T10

```
-------------------------------------------
   Welcome to Software Store
-------------------------------------------
   NOTE : Default Admin Information;
        Password : 171044098
-------------------------------------------
   Please choose one of the option ?
-------------------------------------------
   [1] Go to Admin Panel
-------------------------------------------
   [2] Go to Search Panel
-------------------------------------------
   [0] Exit.
-------------------------------------------
Answer: 2
-------------------------------------------
   Welcome to Search Screen
-------------------------------------------
   Please choose one of the option ?
-------------------------------------------
   [1] Search by Software name
-------------------------------------------
   [2] Print All Software
-------------------------------------------
   [0] Main Menu.
-------------------------------------------
Answer: 2
Software{Name= 'Adobe Photoshop 6.0', quantity= 5, price= 250.0$ }
Software{Name= 'Adobe Flash 3.3', quantity= 3, price= 8.1$ }
Software{Name= 'Adobe Flash 4.0', quantity= 4, price= 10.5$ }
Software{Name= 'Adobe Photoshop 6.2', quantity= 2, price= 300.0$ }
Software{Name= 'Norton 4.5', quantity= 3, price= 15.8$ }
Software{Name= 'Norton 5.5', quantity= 8, price= 22.75$ }

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