

**GIT Department of Computer Engineering
CSE 222 – Spring 2020
Homework 6 Report**

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Q2

1 Class diagrams



2 Problem solutions approach

2.1 MyMergeSort

A public sort method is made that will put it in the list to be sorted and the private method in which the node will be sent is called.

In this method, the list is divided into two and these halves (right and left) are sorted.

A method called the left and right list merge listed is called to join these lists.

The right list and the left list are created according to the determined right, left and middle indexes. These lists are then compared to form an ordered whole list.

2.2 MyQuickSort

A public sort method is made that will put it in the list to be sorted and the private method in which the node will be sent is called.

In this method, firstly the partition method is called to place the pivot in the correct place. After the pivot is in the right place, the operations are repeated for the left part called down. Then it is repeated for the upper part, for the right part.

In the partition part, the elements of the list given with the pivot are compared and if it has a value greater than the pivot, we move it later in the list. If the node has a smaller value, we keep it in its current position.

3 Test cases

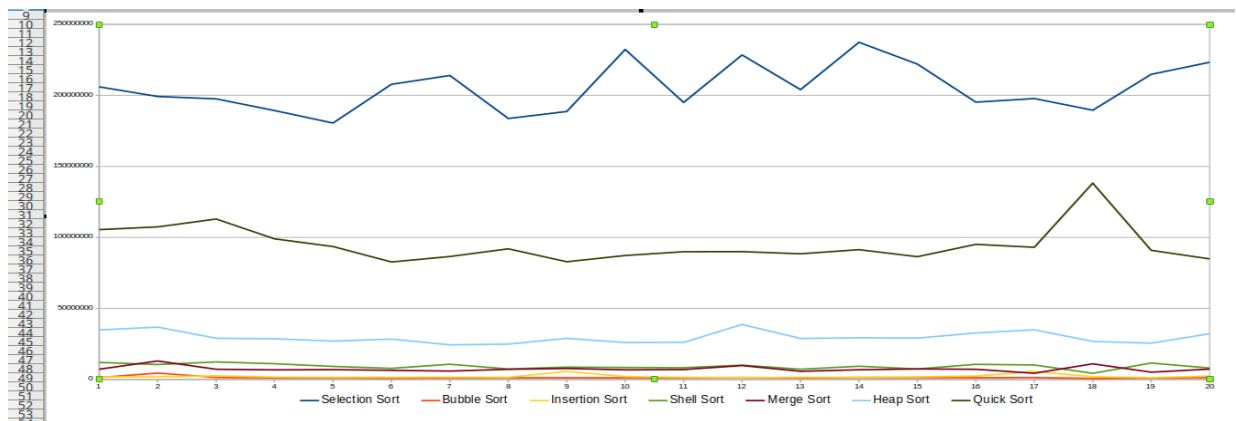
Test Scenario	Number	Test Case	Result (Avg) ns	Expected
MyMergeSort	T1.1	10000	1503154976	
	T1.2	40000	27872345461	
	T1.3	100000	185023945436	
	T1.4	150000	647983424278	
	T1.5	180000	1088292425328	
MyQuickSort	T2.1	10000	1010002238913	
	T2.2	40000	Although it is in order, it takes too long.	
	T2.3	100000	Although it is in order, it takes too long.	
	T2.4	150000	Although it is in order, it takes too long.	
	T2.5	180000	Although it is in order, it takes too long.	
Selection Sort	T3.1	10000	205307167,8	100000000

	T3.2	40000	2376670942,35	1600000000
	T3.3	100000	12889540685,1	10000000000
	T3.4	150000	29271576190,2	22500000000
	T3.5	180000	49900397793,45	32400000000
Bubble Sort	T4.1	10000	1395726,95	100000000
	T4.2	40000	2126180,1	1600000000
	T4.3	100000	4510879,2	10000000000
	T4.4	150000	6607250	22500000000
	T4.5	180000	1827088,55	32400000000
Insertion Sort	T5.1	10000	2180529,7	100000000
	T5.2	40000	2728525,55	1600000000
	T5.3	100000	7248310	10000000000
	T5.4	150000	12015763,25	22500000000
	T5.5	180000	3722481,2	32400000000
Shell Sort	T6.1	10000	9276656,95	90000
	T6.2	40000	14285836,65	847158,248
	T6.3	100000	23426308,4	1600000
	T6.4	150000	36555560,25	4018788,1
	T6.5	180000	33360813,7	4971220,06
Merge Sort	T7.1	10000	7363429,75	30000
	T7.2	40000	18803805,4	184082,4
	T7.3	100000	42422359,85	400000
	T7.4	150000	59365417,6	776413,689

	T7.5	180000	43446453,65	945949,051
Heap Sort	T8.1	10000	29683302,35	30000
	T8.2	40000	54789145,3	184082,4
	T8.3	100000	71208211,15	400000
	T8.4	150000	94878732,65	776413,689
	T8.5	180000	79887368,9	945949,051
Quick Sort	T9.1	10000	94911972,2	100000000
	T9.2	40000	98625731,2	1600000000
	T9.3	100000	152715603,3	10000000000
	T9.4	150000	210726643,2	22500000000
	T9.5	180000	257059110,85	32400000000

4 Running command and results

- N = 10000



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- The graph illustrates the performance of seven sorting algorithms across different input sizes. Selection Sort is the least efficient, while Merge Sort and Heap Sort are the most efficient. The performance of the algorithms generally improves as the number of elements increases, with the exception of Selection Sort, which shows a significant peak at 5 elements.
- | Number of Elements | Selection Sort | Bubble Sort | Insertion Sort | Shell Sort | Merge Sort | Heap Sort | Quick Sort |
|--------------------|----------------|-------------|----------------|-------------|------------|-------------|------------|
| 1 | 2,300,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 2 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 3 | 2,100,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 4 | 2,300,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 5 | 2,700,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 6 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 7 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 8 | 2,300,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 9 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 10 | 2,300,000,000 | 10,000,000 | 5,000,000 | 100,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 11 | 2,300,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 12 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 13 | 2,400,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 14 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 15 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 16 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 17 | 2,200,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 100,000,000 | 5,000,000 |
| 18 | 2,300,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 19 | 2,500,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |
| 20 | 2,400,000,000 | 10,000,000 | 5,000,000 | 10,000,000 | 5,000,000 | 5,000,000 | 5,000,000 |

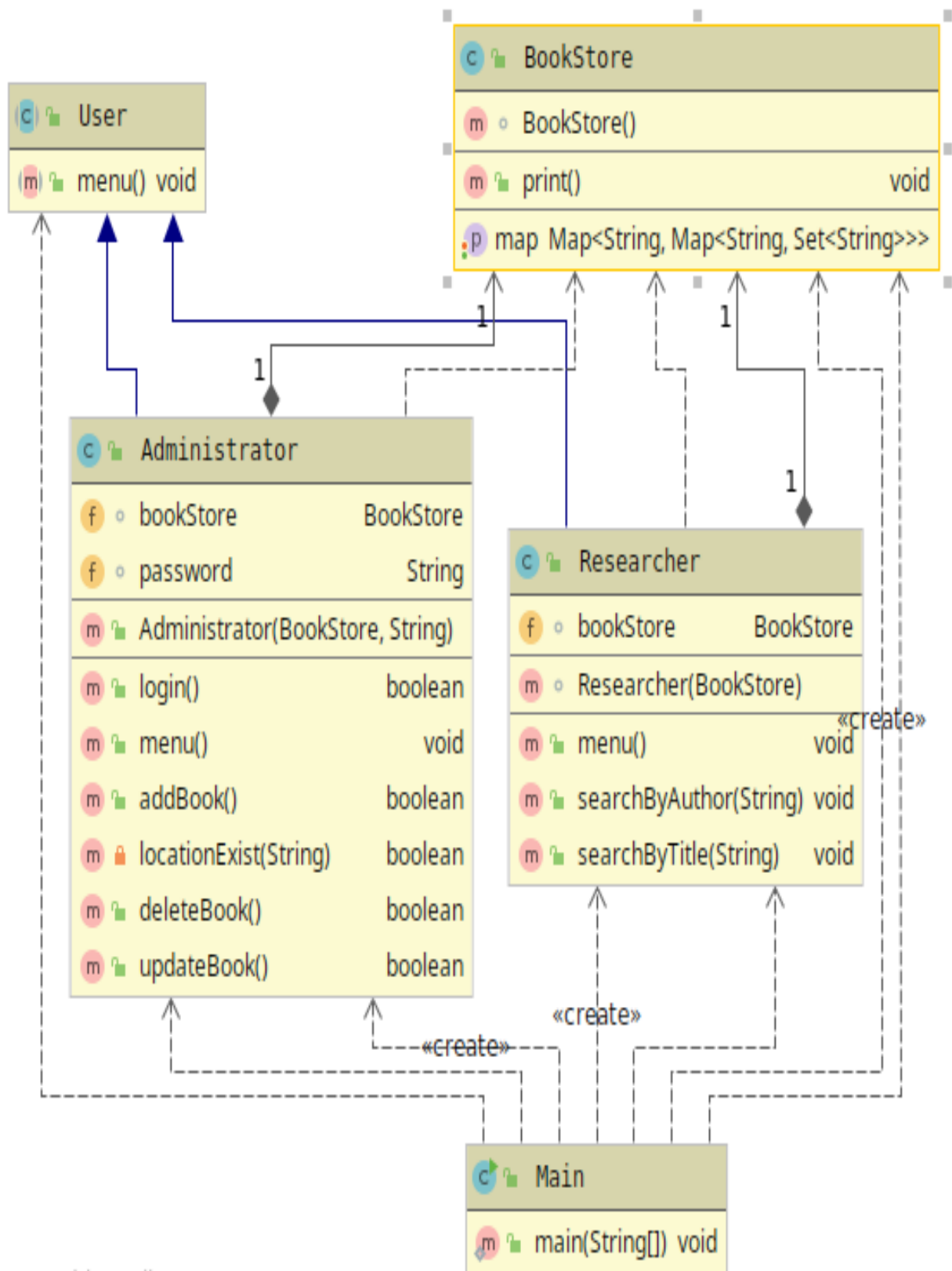
- [illegible]

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- | Input Size | Selection Sort | Bubble Sort | Insertion Sort | Shell Sort | Merge Sort | Heap Sort | Quick Sort |
|------------|----------------|-------------|----------------|------------|------------|-----------|------------|
| 1 | 2350000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 2 | 2250000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 3 | 2200000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 4 | 2350000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 5 | 2700000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 6 | 2300000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 7 | 2350000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 8 | 2400000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 9 | 2300000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 10 | 2400000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 11 | 2350000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 12 | 2300000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 13 | 2450000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 14 | 2300000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 15 | 2300000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 16 | 2350000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 17 | 2250000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 18 | 2350000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 19 | 2550000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |
| 20 | 2450000000 | 0 | 0 | 0 | 100000000 | 100000000 | 100000000 |

- [illegible]

Q3

1 Class diagrams



2 Problem solutions approach

There is a cycle in Main that will proceed step by step according to the users' duties. In this cycle, menu methods derived from the user class of admin, researcher sections are printed and operations are performed according to the options in that menu.

2.1 Administrator

A bookstore class was created to hold book information. In this class, as stated in homework pdf, inner map and set result are kept with a mapping. The first key is the author's name, then the key for the next map is the book name, and the value is the set data structure that holds the locations of the books.

- **Adding a book:** Checks if there is a writer by this name. If there is a writer, it checks whether there is a book, if there is a book, it is looking for a location, if there is a location, the location gives the error already full. Adds to the location of that book if it is empty. If there are no books, he adds that book with location information. If there is no author, a new book, location is added.
- **Deleting a book:** One book is deleted at a time. It checks if there is a writer by this name. If there is a writer, it checks if there is a book, if there is a book, it is looking for a location, if there is a location, a location is deleted, thus reducing the number of books. If there is only one book, all information will be deleted.
- **Book update:** The name of the author to be updated is entered. If it is registered, it is requested to enter a current name. Or enter the name of the book that you want to update, if it is registered, you will be asked to enter a new title. Or, the location you want to update is entered. If it is registered, an update is made by entering the new location.

2.2 Researcher

A user who does not have any authority in the library, but can only view book information.

- **By Author Name:** If there is an author, all the titles of their books are written. And the user is asked to enter one of those books. The locations of the entered book are printed on the screen. If there is a book, status information is also available. Since there is no reserve status, the decision is made according to the status book exists or not.
- **By title of the book:** If there are any books, their positions are printed on the screen and the status becomes available.

3 Test cases

Test Scenario	Number	Test Case	Result
Main Menu	T1.1	Input is not number	Error ! NumberFormatException: For input string: "e"
	T1.2	Input is not available number	Error ! The login screen appears again.
	T1.3	Available number	The selected user's menu appears.
<u>Login as Administrator</u>	T2.1	Valid Password	Admin Menu
	T2.2	Invalid Password	Error! The login screen appears again.
Admin Menu	T3.1	Input is not number	Error ! NumberFormatException: For input string: "e"
	T3.2	Input is not available number	Error ! The login screen appears again.
	T3.3	Available number	The selected user's menu appears.
Add new book	T4.1	If the book is not already registered, all entries are considered valid.	Successful Record
	T4.2	If the book is already registered	location information is added only
	T4.3	If location is used	Location is full ! Not record.
Delete book	T5.1	Registered Book Name	Successful Deletion
	T5.2	Unregistered Book Title	Error : No record! The login screen appears again.
Update book	T6.1.1	Update Unregistered Author Name	The author with this name is not recorded. The login screen appears again.
	T6.1.2	Update Registered Author Name	Successful Update
	T6.2.1	Update Unregistered Book Title	The book with this name is not recorded. The login screen appears again.
	T6.2.2	Update Registered Book Title	Successful Update
	T6.3.1	Update Unregistered Location	No record! The login screen appears again.
	T6.3.2	Update Registered Location	Successful Update

<u>Choosing the researcher from the main menu</u>	T7.1	Input is not number	Error ! NumberFormatException: For input string: "e"		
	T7.2	Input is not available number	Error ! The login screen appears again.		
	T7.3	Available number	The selected researcher's menu appears		
Search book by author name	T8.1	Search Unregistered Author Name	No record ! The login screen appears again.		
	T8.2	Search Registered Author Name	Print Author Name and his/her books		
			Enter book name	T8.2.1 Written on the screen	Print Location
				T8.2.2 Unwritten book on screen	No record !
Search book by book title	T9.1	Search Unregistered Book Title	Status: Not-Available!		
	T9.2	Search Registered Book Title	Print Author Name, Book Title and their locations		

4 Running command and results

- T1.1

```

1. Login as Administrator
2. Login as Researcher
-1. Exit
e
Error ! java.lang.NumberFormatException: For input string: "e"
Process finished with exit code 0

```

- T1.2 – T1.3

```

/usr/lib/jvm/jdk-13.0.2/bin/java -javaagent:/home/wustenblume/Documents/IntelliJ/idea-IU-193.6494.35/li
1. Login as Administrator
2. Login as Researcher
-1. Exit
3
Invalid user !
1. Login as Administrator
2. Login as Researcher
-1. Exit
1
Please enter your password.

```

- T2.1 – T2.2

```

Please enter your password.
a
Invalid Password !
1. Login as Administrator
2. Login as Researcher
-1. Exit
1
Please enter your password.
admin
1. Add new book.
2. Delete book.
3. Update book.
1

```

- T3.1

```

Please enter your password.
admin
1. Add new book.
2. Delete book.
3. Update book.
e
Error ! java.lang.NumberFormatException: For input string: "e"

```

- T3.2

```

Please enter your password.
admin
1. Add new book.
2. Delete book.
3. Update book.
5
Invalid choice !
1. Login as Administrator
2. Login as Researcher
-1. Exit

```

- T3.3

```

Please enter your password.
admin
1. Add new book.
2. Delete book.
3. Update book.
1
Enter author name

```

- T4.1

```

1
Enter author name
Nihan Kaya
Enter book name
Kırgınlık
Enter a location
1c1r
Successful Record!
1. Login as Administrator
2. Login as Researcher
-1. Exit

```

- T4.2

```

1
Enter author name
Nihan Kaya
Enter book name
Kırgınlık
Enter a location
1c2r
Location Added!

```



- T4.3

```

1
Enter author name
Nihan Kaya
Enter book name
Kırgınlık
Enter a location
1c1r
This location is full.

```

- T5.1

```

2
Enter book name
Kırgınlık
Successful Deletion!
1. Login as Administrator
2. Login as Researcher
-1. Exit

```

- T5.2

```

Please enter your password.
admin
1. Add new book.
2. Delete book.
3. Update book.
2
Enter book name
Buğu
No record!
1. Login as Administrator
2. Login as Researcher
-1. Exit

```

- T6.1.1

```

1. Update author name
2. Update book title
3. Update book's locations
1
Enter the old author name.
Orhan Pamuk
The author with this name is not recorded.

```

- T6.1.2

```

3. Update book.
3
1. Update author name
2. Update book title
3. Update book's locations
1
Enter the old author name.
Nihan Kaya
Enter the new author name.
Nihan Kaya New
Successful Update!

```

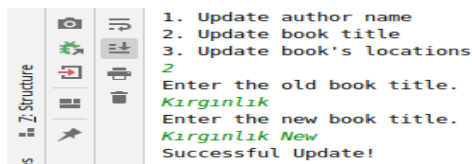
- T6.2.1

```

1. Update author name
2. Update book title
3. Update book's locations
2
Enter the old book title.
Kırgın
No record!

```

- T6.2.2

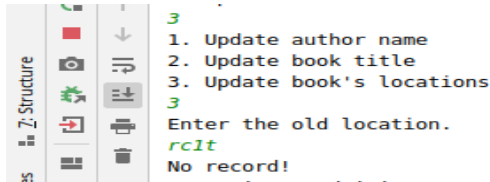


```

1. Update author name
2. Update book title
3. Update book's locations
2
Enter the old book title.
Kırgınlık
Enter the new book title.
Kırgınlık New
Successful Update!

```

- T6.3.1

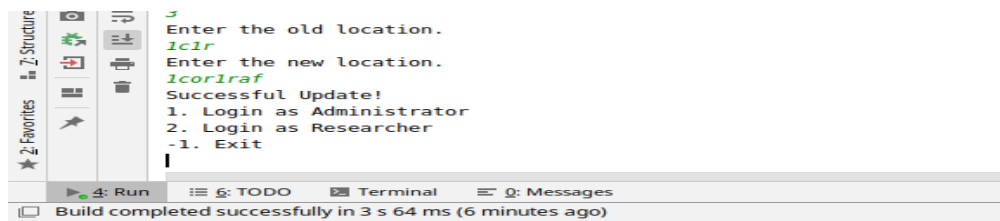


```

3
1. Update author name
2. Update book title
3. Update book's locations
3
Enter the old location.
rc1t
No record!

```

- T6.3.2



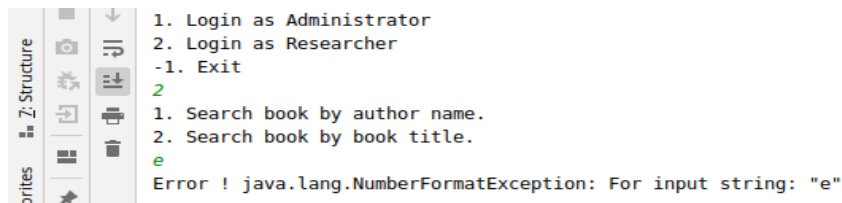
```

3
Enter the old location.
1c1r
Enter the new location.
1cor1raf
Successful Update!
1. Login as Administrator
2. Login as Researcher
-1. Exit
1

```

Build completed successfully in 3 s 64 ms (6 minutes ago)

- T7.1

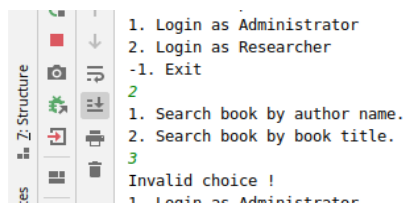


```

1. Login as Administrator
2. Login as Researcher
-1. Exit
2
1. Search book by author name.
2. Search book by book title.
e
Error ! java.lang.NumberFormatException: For input string: "e"

```

- T7.2

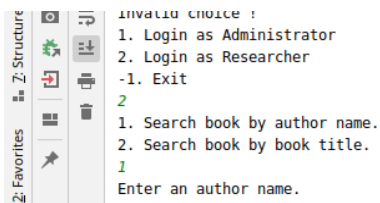


```

1. Login as Administrator
2. Login as Researcher
-1. Exit
2
1. Search book by author name.
2. Search book by book title.
3
Invalid choice !

```

- T7.3

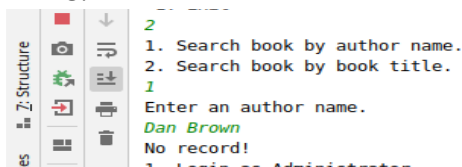


```

Invalid choice !
1. Login as Administrator
2. Login as Researcher
-1. Exit
2
1. Search book by author name.
2. Search book by book title.
1
Enter an author name.
Dan Brown
No record!

```

- T8.1

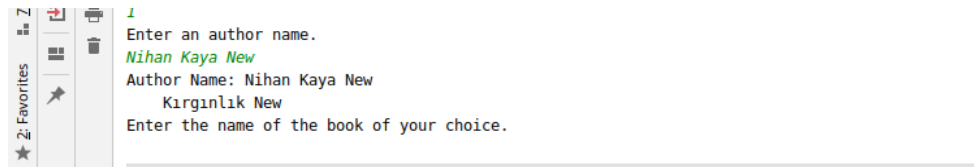


```

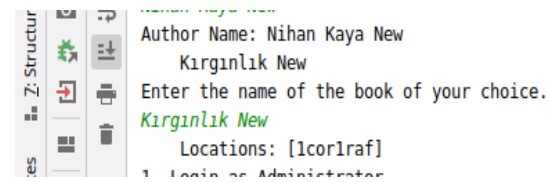
2
1. Search book by author name.
2. Search book by book title.
1
Enter an author name.
Dan Brown
No record!

```

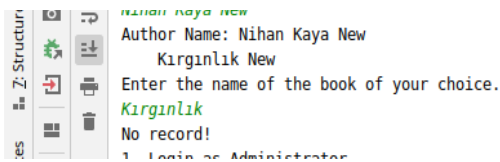
- T8.2



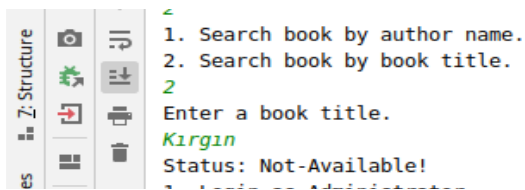
- T8.2.1



- T8.2.2



- T9.1



- T9.2

