Gebze Technical University

CSE222 – Data Structures and Algorithms
HW6 - Part3

Subject : Map , Set , Hashmap ,Hashtable

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*Problem Description :

Design a library automation system. The system has two types of users: administrators who can update information and users who browse books.
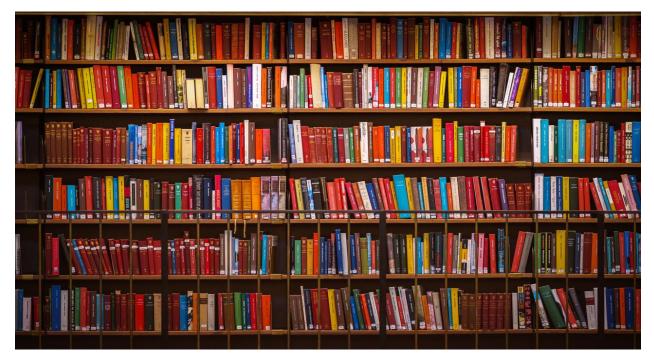
Book search is a public feature. To update the information, administrators have to enter the system with a password (a single general password is sufficient).

While designing this system, realize the following: In the system, for each book, the name of the author, the title of the book, the location of the book (for example, if a book on the 5th shelf in the 3r^d corridor, such as "c3s5.1534" can be used) should be stored. Information about the books should be stored in nested map and set data structures. For the outermost map, the author name is used as a key, the value is another map whose keys are book names. In the inner map, the values are sets showing the location (or locations if there is more than one copy) of that book.

The system should include at least the following functionality:

1. When searching by author name, all books of the author in the library will be listed on the screen. Then, whichever book the user chooses, the location(s) of that book will be displayed.

2. When searching by book title, author name, location and status will be shown.

When the administrator enters the system with a password, he will be able to add books, delete books, update information.

*Solution Approach :

There are several new type of data structures that we learnt in our lecture. These are **Set , Map , HashMap , Hashtable** . These structures have some properties that set apart from others. In terms of time complexity and asymptotic notations , we can say that these are more efficient than others.

In worst case scenario , working like array even like binary tree which is in worst case too. When we evaluate the average case , these are much more efficient than the others.

Hash table		
Type	Unordered associative array	
Invented	1953	
Time complexity in big O notation		
Algorithm	Average	Worst Case
Space	$O(n)$[1]	$O(n)$
Search	$O(1)$	$O(n)$
Insert	$O(1)$	$O(n)$
Delete	$O(1)$	$O(n)$

Library Automation System has some implementation detail like using what structures for keeping data and where they are kept.

I designed a **SystemStorage** class that contains data in entire system. The biggest storage is ;

Map< String , Map < String , Set<String > > >

*Note : There is an extra container for keeping the status data , I choose as LinkedList.

For assigning the new location to added book is made automatically by the system. System has two properties to calculate new location to given book. These are **shelf per corridor** and **book per shelf**. These are declared as static final at the code side. You can change them easily by change the value of these variable on source code.

*Note : Do not forget that addition of new book always assigns a new unique location for that book. You can change these location whenever you want with **no restriction**. You can check the actual location of all book with the **title** of the book or **list all the book** in the system.

Default status of the book , which is added to system, is assigned as **Available**. It can be changed later with **no restriction**.

*Test Cases:

Test ID	Scenario	Test Data	Expected Result	Actual Result	Pass / Fail
T01	Login as Administrator	Password	If password is correct , admin will be accepted otherwise return back to menu	Expected result has been occurred.	Pass
T02	Add a new book	Enter the author name : Nevzat Enter the title : A	Given book will be created. *Location automatically assigned. *Status automatically assigned.	Expected result has been occurred.	Pass
T03	Add a new book	Enter the author name : Nevzat Enter the title : B	Given book will be created. *Location automatically assigned. *Status automatically assigned.	Expected result has been occurred.	Pass
T04	Add a new book	Enter the author name : Nevzat Enter the title : C	Given book will be created. *Location automatically assigned. *Status automatically assigned.	Expected result has been occurred.	Pass
T04	Add a new book	Enter the author name : Burak Enter the title : D	Given book will be created. *Location automatically assigned. *Status automatically assigned.	Expected result has been occurred.	Pass
T05	Search by author name	Enter the name of the author : Nevzat Title of the book : A Title of the book : B Title of the book : C Enter the title : B	Location of the book: c1s1.2	Expected result has been occurred.	Pass
T06	Search by title of the book	Enter the title of the book : B	Name of the author : Nevzat Title of the book : B Location of the book : c1s1.2 Current Status : Available	Expected result has been occurred.	Pass

T07	List all book in library	Entire books in the system.	======All-Book====== ---------------------- Name of the author : Nevzat Title of the book : A Location of the book : c1s1.1 Current Status : Available ---------------------- Name of the author : Nevzat Title of the book : B Location of the book : c1s1.2 Current Status : Available ---------------------- Name of the author : Nevzat Title of the book : C Location of the book : c1s1.3 Current Status : Available ---------------------- Name of the author : Burak Title of the book : D Location of the book : c1s1.4 Current Status : Available =====================	Expected result has been occurred.	Pass
T08	Login as Administrator	Password	If password is correct , admin will be accepted otherwise return back to menu	Expected result has been occurred.	Pass
T09	Delete book	Enter the author name : Nevzat Enter the title : B Enter the location : c1s1.2	**Book has been removed.	Expected result has been occurred.	Pass
T10	Delete book	Enter the author name : Nevzat Enter the title : A Enter the location : c1s1.1	**Book has been removed.	Expected result has been occurred.	Pass
T11	Quit(Admin menu)		Go back to main menu.	Expected result has been occurred.	Pass

T12	Search by author name	Enter the name of the author : Nevzat Title of the book : C Enter the title : C	Location of the book : c1s1.3	Expected result has been occurred.	Pass
T13	Login as Administrator	Password	If password is correct , admin will be accepted otherwise return back to menu	Expected result has been occurred.	Pass
T14	Update book	Enter the author name : Burak Enter the title : D Enter the location : c1s1.4	Update menu opens	Expected result has been occurred.	Pass
T15	Edit author name of the book.	Enter new author name : Koffman	Name of the author of given book changes	Expected result has been occurred.	Pass
T16	Edit title of the book.	Enter new book title : Data Structures	Title of the book changes	Expected result has been occurred.	Pass
T17	Edit location of the book.	Enter the new location : c1s1.8	Location of the book changes.	Expected result has been occurred.	Pass
T18	Edit status of the book.	Status of the given book.	Changes the given book status with its reverse.	Expected result has been occurred.	Pass
T19	Quit(update menu)		Go back to admin menu.	Expected result has been occurred.	Pass
T20	Quit(admin menu)		Go back to main menu.	Expected result has been occurred.	Pass
T21	Search by author name	Enter the name of the author : Koffman Title of the book : Data Structures Enter the title : Data Structures	Location of the book : c1s1.8	Expected result has been occurred.	Pass
T22	Search by title of the book	Enter the title of the book : Data Structures	Name of the author : Koffman Title of the book : Data Structures Location of the book : c1s1.8 Current Status : Rented by someone	Expected result has been occurred.	Pass

T22	Search by author name	Enter the name of the author : WrongAuthor	There is no book written by given author .	Expected result has been occurred.	Pass
T23	Search by title of the book	Enter the title of the book : WrongTitle	Book with given title does not exist.	Expected result has been occurred.	Pass
T24	Login as Administrator	Wrong Password	Password is wrong ! Go back to main menu. Enter the password : WrongPassword **Invalid password !	Expected result has been occurred.	Pass
T25	Login as Administrator	Password	If password is correct , admin will be accepted otherwise return back to menu	Expected result has been occurred.	Pass
T26	Add book	Enter the author name : WrongName Enter the title : WrongTitle Enter the location : WrongLocation	**There is no book to delete with matched given property.	Expected result has been occurred.	Pass
T27	Delete book	Enter the author name : WrongName Enter the title : Data Structures Enter the location : c1s1.8	**There is no book to delete with matched given property.	Expected result has been occurred.	Pass
T28	Update book	Enter the author name : WrongName Enter the title : WrongTitle Enter the location : WrongLocation	There is no book with given property.	Expected result has been occurred.	Pass
T29	Update book	Enter the author name : Koffman Enter the title : Data Structures Enter the location : WrongLocation	There is no book with given property.	Expected result has been occurred.	Pass
T30	Quit(admin menu)		Go back to admin menu.	Expected result has been occurred.	Pass

T31	List all book in library	Entire books in the system.	======All-Book====== --------------------- Name of the author : Nevzat Title of the book : C Location of the book : c1s1.3 Current Status : Available --------------------- Name of the author : Koffman Title of the book : Data Structures Location of the book : c1s1.8 Current Status : Rented by someone ====================	Expected result has been occurred.	Pass
T32	Login as Administrator	Password	If password is correct , admin will be accepted otherwise return back to menu	Expected result has been occurred.	Pass
T33	Update book	Enter the author name : Nevzat Enter the title : C Enter the location : c1s1.3	Update menu opens	Expected result has been occurred.	Pass
T34	Edit status of the book	Status of the given book.	Changes the given book status with its reverse.	Expected result has been occurred.	Pass
T35	Quit(update menu)		Go back to admin menu.	Expected result has been occurred.	Pass
T36	Quit(admin menu)		Go back to main menu.	Expected result has been occurred.	Pass
T37	Search by author name	Enter the name of the author : Koffman Title of the book : Data Structures Enter the title : Data Structures	Location of the book : c1s1.8	Expected result has been occurred.	Pass

| T37 | List all book in library | Entire books in the system. | ======All-Book======

Name of the author : Koffman
Title of the book : Data Structures
Location of the book : c1s1.8
Current Status : Rented by someone

Name of the author : Nevzat
Title of the book : C
Location of the book : c1s1.3
Current Status : Rented by someone

==================== | Expected result has been occurred. | Pass |
| T38 | Quit(main menu) | | Quit the system | Expected result has been occurred. | Pass |

*Class Diagram:

*Attached to the assignment file as png.

*Running Command and Result:

*Attached to the assignment file as txt.