Fall 2022– CS 203 Object-Oriented Programming

Homework # 5: Project Report

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Introduction

This project is designed to implement a simple management system used in a small size bookstore.
The main functional specifications of the program are summarized like as below:

1) Display a list of all the books, the customers, and the current rental list.
2) Search and filter the list of each view.
   - In Book View: Search then return a particular list by the target book title.
   - In Customer View: Search then return a particular list by the target customer's name.
   - In Rental View: Search then return a particular list by the target customer's last name.
3) Display individual description for book, customer, or rental respectively, by selecting from a menu item of the selected row item.
4) Rent a book
5) Retrieve a book from a customer.

Primarily, the program has devised to accomplish the goals that are required from Homework 5. Therefore, ultimate purpose of this program aims to demonstrate the ability to apply OOP concepts that have learned in CS203 class, the ability to build a completely executable GUI program as well as its regarding basic programming skill.

This project has solely conducted with no collaborations.

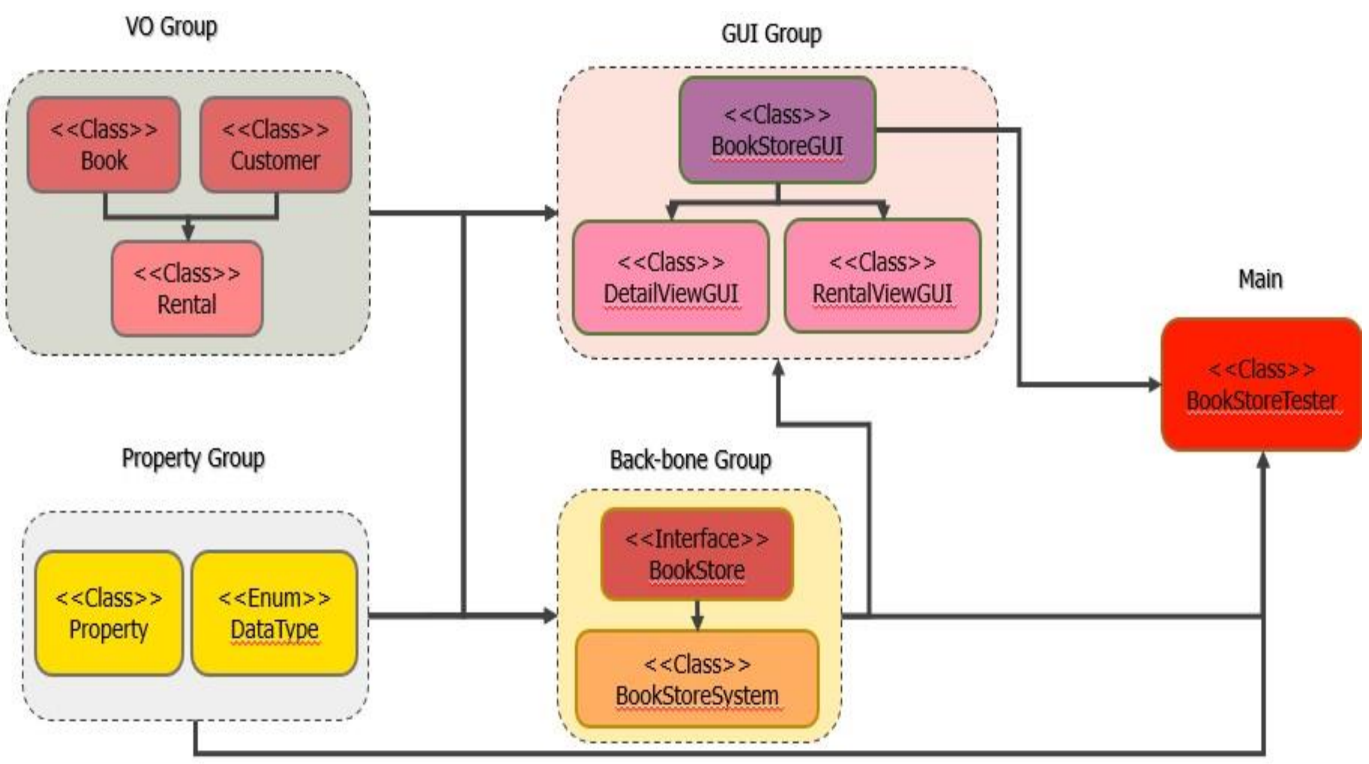
Code Explanation

1) Summary

   This project includes 1 Interface, 1 Back-bone class implemented the interface, 3 Value Object classes, 1 Property class, 1 Enum, 3 GUI classes, and 1 Main class that triggers an execution of the program comprehensively. OOP is applied to the project such as using override methods, implementing interface so to inherit by its child class and clarifying that abstract methods to be implemented within its child class, and using polymorphism so to utilize the class methods but to restrain access some of its peculiar methods from first level class (main class or main function). Primarily, the program is a GUI program that utilizes Swing properties from the JAVA framework. Internally, the program can be distinguishable as UI part and back-bone part and designed as to interact with each part so to completely function.

2) Structure and hierarchy nature of implemented classes

The structure of the project is like as below:



a) Value Object (VO) Group

Basically, Value Object (VO) group is a class group including the object classes that each represents core object unit utilized in the system. Therefore, these classes are generally used both in the GUI group and in the Back-bone group. VO classes are used as independently, but since Rental class is a combination of other two VO classes, Rental class is regarded as inheritance class of Book class and Customer class.

b) Property Group

Meanwhile, the classes classified as Property Groups are also commonly used, however, these classes are not classified as VO group since they only represent singular concepts by their attributes. This type of classes contains preset values that will be utilize while program running. Each class in Property Groups are independently utilized in the program.

c) Back-bone Group

For the Back-bone group, Interface 'BookStore' Class defines the abstract functions to be implemented and 'BookStoreSystem' implements those functions by implementing the 'BookStore' interface. Since no significant hierarchy observed from given data, other inheritance will not apply but 'BookStoreSystem' class utilized List<T> properties to grouping data by book, customer, and rent respectively. ‘BookStoreSystem’ is designed as a Singleton class, so only one class instance will be used for the whole program. Since ‘BookStore’ interface will encapsulate this class, its peculiar functions will not be reveals from GUI class level. The main role of this group is to manipulate VO data and its regarding attributes that are triggered from GUI classes.

d) GUI Group

The GUI group consists of 1 Main-GUI class ‘BookStoreGUI’ and 2 Sub-GUI classes ‘DetailViewGUI’, ‘RentalViewGUI’. The Main-GUI class will be called from the main function in the program, while the Sub-GUI classes are called within Main-GUI class by triggered events. Therefore, ‘BookStoreGUI’ serves as the parent component for the other GUI classes. Within its event handlers, ‘BookStoreGUI’ will internally call the functions of Back-bone group for the data manipulation so to process user request. The other GUI class each represents a Pop-up window. ‘DetailViewGUI’ class displays the detail description of selected row item from given data view. For example, if user selected menu item ‘View Detail’ from Book view table, the GUI class will display the detail information of the selected ‘Book’ object from its window. Meanwhile, ‘RentalViewGUI’ will displays a view as customer selection mode for the selected book view. Unlike ‘DetailViewGUI’, ‘RentalViewGUI’ only appears in Book view table.

e) Main Class

This main class ‘BookStoreTester’ is responsible for entire program running. That is, the overall program will be executed only within this main class. Initially, this class checks and loads and data from files. If everything is in order, the class will call the main GUI to execute.

3) The way of working as a whole project.

a) From the ‘BookStoreTester’ class, main () function will be executed. The main function will initiate ‘Property’ Class and ‘BookStore(or BookStoreSystem)’ Class, then checkup whether the data from a given file paths can be read properly. If so, the function will initiate ‘BookStoreGUI’ to execute the GUI program. If not, function will terminate the process to avoid unnecessary execution further.

b) Initially, the main GUI will display Book View by the default. However, user can change the view by clicking a target data view button above the list table.

c) The list table will display a list of the current data view. By selecting, and right clicking a certain data row, user can retrieve a menu item list. Composition of menu items can differ from each data type view. For example, the rent menu item only appears in Book View, while the retrieve menu only appears in Rental View. By selecting these menu items, user can trigger desire events that is expected from the property of each menu items.

d) From list table, user can select the desire row data to display its detail description by right clicking and selecting a menu item ‘View Detail’. After selecting, new window frame will be shown to display a detail description of the selected data. Since description is exclusive to the selected data row, the format of description will differ from each data type view.

e) Rent event can only occur from Book View. As well as the case of d), the event window can be shown by right clicking but selecting a menu item ‘Rent This Book’. The appeared window shows available customer lists in combo box form, and user can choose one of them to trigger rent event. In case of stock shortages and duplicates, the system will occur warning dialog window instead of processing the rent event. When the event completed successfully, the dialog window will show to inform the user that the rent has completed successfully. The table will be refreshed after the rent event in order to reflect changes to the view.

f) Retrieve event can only occur from Rental View. As well as the case of d), the event window can be shown by right clicking but selecting a menu item ‘Return This Book’. The appeared window will ask a user to confirm retrieving the book that is selected. If the user has confirmed, the system will process the retrieving event then open a dialog window that informs the user of completion and its detail information.

g) Below the list table, there exists a search bar and related buttons that enable a user to retrieve a specific list by input keywords. Actual properties for keywords also differ depending on the current data type view. For example, a given keyword will be compared with a book title from the book list in Book View. On the other hand, the keyword will be compared with a full name of customer in Customer View while the keyword will be compared with a last name only in Rental View.

h) Before closing the window, the message window will be shown to ask user whether to reflect the changes in data list to the database files. If choose to update, the system will backup the original files by modified name first, then write the updated information from data lists from a ‘BookStoreSystem’ class to the database files. After all these operations or just choose not to save the any modifications, the system will terminate the program totally.

4) Attributes and functions of each class.

a) [Main] Class ‘BookStoreTester’
* Starting point of the program and contains the main () function only.
* Only local variables exist in this class.

Name	Type	Parameter	Return	Description
main	Static Method	String[] args	None	Main function of the program

b) [VO Group] Class ‘Book’
   * Class that represent a book object.
   * Only defines attributes, constructor, general getters and setters, and toString().

Name	Type	Parameter	Return	Description
bNo	int	* These are attributes (or Properties)		Book’s identifier number
title	String			Book’s title
author	String			Book’s author
Page	int			Book’s number of pages
publisher	String			Book’s publisher
year	int			Book’s published year
Copy	int			Total number of possessions of book
category	String			Current available copies of book
inventory	int			List of the departments
Book	Constructor Method	int bNo, String title, String author, int page, String publisher, int year, int copy, String category	None	Instantiate and set values to corresponding attributes * Inventory attribute will be assigned by int copy initially.
getBookNo	Implemented Method	None	String bNo	Assessor of bNo
getTitle	Implemented Method	None	String title	Assessor of title
getAuthor	Implemented Method	None	String author	Assessor of author
getNumOfPages	Implemented Method	None	int page	Assessor of page
getPublisher	Implemented Method	None	String publisher	Assessor of publisher
getYearPublished	Implemented Method	None	int year	Assessor of year
getNumOfCopies	Implemented Method	None	int copy	Assessor of copy
getCategory	Implemented Method	None	String category	Assessor of category
getInventory	Implemented Method	None	int inventory	Assessor of inventory
setInventory	Implemented Method	int inventory	None	Mutator of inventory
toString	Override Method	None	String toString	Return predesigned string utilizing its attributes

c) [VO Group] Class ‘Customer’
* Class that represent a customer object.
* Only defines attributes, constructor, general getters and setters, and toString().

Name	Type	Parameter	Return	Description
cNo	int	* These are attributes (or Properties)		Customer’s identifier number
fName	String			Customer’s first name
lName	String			Customer’s last name
email	String			Customer’s email address
pNum	String			Customer’s phone number
address	String			Customers’ home address
nRentals	int			Total number of rentals by customer
Customer	Constructor Method	int cNo, String fName, String lName, String email, String pNum, String address, int nRentals	None	Instantiate and set values to corresponding attributes
getCustomerNo	Implemented Method	None	int cNo	Assessor of cNo
getFirstName	Implemented Method	None	String fName	Assessor of fName
getLastName	Implemented Method	None	String lName	Assessor of lName
getEmail	Implemented Method	None	String email	Assessor of email
getPhoneNumber	Implemented Method	None	String pNum	Assessor of pNum
getAddress	Implemented Method	None	String address	Assessor of address
getNumOfRentals	Implemented Method	None	int nRentals	Assessor of nRentals
setNumOfRentals	Implemented Method	int nRentals	None	Mutator of nRentals
toString	Override Method	None	String toString	Return predesigned string utilizing its attributes

d) [VO Group] Class ‘Rental’
* Class that represent a customer object.
* Only defines attributes, constructor, general getters and setters, and toString().
* This class is a combination class of Customer class and Book class.
* Identifier of this class is a combination of a book number and a customer number that represent a renter and rented book.
* Comparable<Rental> interface has implemented to be utilized for sort operations.

Name	Type	Parameter	Return	Description
rNo	String	* These are attributes (or Properties)		Rental's identifier number combination
customer	Customer			Book which was rent by customer
book	Book			Customer who rent a book
Rental	Constructor Method	Customer customer, Book book	None	Instantiate and set values to corresponding attributes * rNo will be assigned as '{bNo}:{cNo}'
getRentelNo	Implemented Method	None	String rNo	Assessor of rNo
getCustomer	Implemented Method	None	Customer customer	Assessor of customer
getBook	Implemented Method	None	Book book	Assessor of book
toString	Override Method	None	String toString	Return predesigned string utilizing its attributes
compareTo	Override Method	Rental rental	int compareTo	Returns -1 if the comparison is bigger, 1 if the comparison is smaller, and returns 0 if they are the same.

e) [Property Group] Class 'Property'
   * Class that represent a customer object.
   * Only defines attributes, constructor, general getters and setters, and toString().
   * This class is a combination class of Customer class and Book class.

Name	Type	Parameter	Return	Description
databases	Map<DataType, String>	* These are attributes (or Properties)		File name list by data type
sizes	Map<String, int[]>			Size configuration list by frame type
labels	Map<String, String>			Label text list by label type
colors	Map<String, Color>			color list by type of components
fonts	Map<String, Font>			Font list by type of components
toolTips	Map<DataType, String>			Tool tip list by data type
tableHeaders	Map<DataType, String[]>			Table header list by data type
dataBaseHeaders	Map<DataType, String[]>			File header list by data type
SingletonHelper	Static Class	None	None	Static class that has class 'Property' as a static final attribute. * Singleton application
getInstance	Property	None	Property instance	Returns the class instance. * Singleton application
Property	Constructor Method	None	None	Instantiate and set values to corresponding attributes * The attributes values have been within this class.
getDatabase	Implemented Method	DataType dataType	String database	Assessor of the database path by given data type.

getSize	Implemented Method	String type	Int [] size	Assessor of the size configuration by given component type.
getLabel	Implemented Method	String type	String label	Assessor of the label by given label type.
getColor	Implemented Method	String type	String color	Assessor of the color by given component type.
getFont	Implemented Method	String type	String font	Assessor of the font by given text type.
getToolTip	Implemented Method	DataType dataType	String toolTip	Assessor of the tooltip placement by given data type.
getTableHeader	Implemented Method	DataType dataType	String [] tableHeader	Assessor of the table header by given data type.
getDataBaseHeader	Implemented Method	DataType dataType	String [] dataBaseHeader	Assessor of the database header by given data type.
setDataBaseHeader	Implemented Method	DataType dataType, String [] columns	None	Mutator of dataBaseHeaders

f) [Property Group] Enum 'DataType' (Skip detail explanations)
* This is Enum Class that indicates data type of view.
* This enum class has 3 attributes: BOOK, CUSTOMER, RENTAL
* This enum class is mainly used for view modifications or data identifications.

g) [Back-bone Group] Interface 'BookStore' (Skip detail explanations)
* This is Interface that defines functions to be implemented and that are externally used in GUI groups.
* This class 'BookStoreSystem' will implements this interface.
* This interface encapsulates some internal functions that are included in class 'BookStoreSystem'.

h) [Back-bone Group] Class 'BookStoreSystem'
* The main back-bone system class of the program.
* Mainly, contains data manipulation functions regarding to handle events that user requested through UI components (Or GUI class).
* In the program, 'BookStoreSystem' will not be initiated directly, since this class is Singleton and is encapsulated by interface 'BookStore'.
* Exception means the denoted exceptions are thrown by the corresponding method. Each exception information will be noted below the table as (*[corresponding number])

Name	Type	Parameter	Return	Description
absolutefilePath	String	* These are attributes (or Properties)		Absolute path of file as String value
bookList	List<Book>			Current book list
customerList	List<Customer>			Current customer list
rentalList	List<Rental>			Current rental list
curDataType	DataType			Current data view type

refreshData	boolean			Whether refreshing data has requested
prop	Property			Property instance
SingletonHelper	Static Class	None	None	Static class that has class 'BookStoreSystem' as a static final attribute. * Singleton application
getInstance	Property	None	BookStoreSystem instance	Return the class instance. * Singleton application
BookStoreSystem	Constructor Method	None	None	Instantiate attributes.
getFilePath (*1)	Implemented Method	String fileName	None	Get and set absolute file path to the class variable.
loadBookList (*2)	Implemented Method	String database	None	Load and save the book data to the corresponding list.
loadCustomerList (*2)	Implemented Method	String database	None	Load and save the customer data to the corresponding list.
backUpFile (*1)	Implemented Method	String database	None	Back up the original file.
savebookListToDB (*2)	Implemented Method	String database	None	Save to the corresponding file from the book data list.
saveCustomerListToDB (*2)	Implemented Method	String database	None	Save to the corresponding file from the customer data list.
findBookByNo	Implemented Method	int bNo	Book book/ null	Find the book by its identifier number.
findCustomerByNo	Implemented Method	int cNo	Customer customer/ null	Find the customer by its identifier number.
findRentalByNo	Implemented Method	int rNo	Rental rental/ null	Find the rental by its identifier number String.
setCurDataType	Inherited Method	DataType dataType	None	Mutator of dataType
getCurDataType	Inherited Method	None	DataType dataType	Assessor of dataType .
hasRequestRefresh	Inherited Method	None	boolean	Assessor of refreshData
requestRefresh	Inherited Method	boolean refreshData	None	Mutator of refreshData
setUpDatabase	Inherited Method	String bookDatabase, String customerDatabase, String type	boolean result	Load and save data that are retrieved from given file paths. Returns if the process was successful or not.
getData	Inherited Method	String no, DataType dataType	T data * Generic Object	Identify the object by given data type information then return as correspondent object type.

getDataList	Inherited Method	DataType dataType	List<T> dataList * Generic List	Identify the list by given data type information then return as correspondent listt type.
getBookList	Inherited Method	None	List<Book> bookList	Assessor of bookList
getCustomerList	Inherited Method	None	List<Customer> customerList	Assessor of customerList
getRentalList	Inherited Method	None	List<Rental> rentalList	Assessor of rentalList
findBookByTitle	Inherited Method	String title	List<Book> books	Return a book list that filtered by given book title name.
findCustomersByName	Inherited Method	String name	List<Customer> customers	Return a customer list that filtered by given customer's name.
findBooksByLastName	Inherited Method	String lastName	List<Rental> rentals	Return a rental list that filtered by given customer's last name.
rentBook	Inherited Method	int bNo, int cNo	int result	Process a book rent event and return the state of result.
retrieveBook	Inherited Method	String rNo	None	Processes a book retrieve event.

(*1) IOException
(*2) NullPointerException, FileNotFoundException, IOException

i) [GUI Group] Class 'BookStoreGUI'
* Only contains abstract methods. (Skip descriptions)
* Exception means the denoted exceptions are thrown by the corresponding method.

Name	Type	Parameter	Return	Description
store	BookStore	* These are attributes (or Properties)		BookStore instance
frame	JFrame			Main frame component
panelM	JPanel			Body panel component * Mutable as data dependent
btnB	JButton			Button for Book view
btnC	JButton			Button for Customer view
btnR	JButton			Button for Rental view
btnS	JButton			Button for Search list view
btnL	JButton			Button for All list view
sBar	JTextField			Search bar component * Mutable as data dependent
table	JTable			Table object * Mutable as data dependent
menuD	JMenuItem			Menu item for Detail event
menuL	JMenuItem			Menu item for Rent event
menuR	JMenuItem			Menu item for Retrieve event
popupD	DetailViewGUI			Dialog component for detail view

popupR	RentalViewGUI			Dialog component for rent event view.
prop	Property			Property instance.
BookStoreGUI	Constructor Method	None	None	Initiate and set up attributes.
run (*1)	Implemented Method	None	None	Configure and add on UI properties to its frame and activate the GUI program
createMessagePanel	Implemented Method	String filePath, boolean hasHeader	None	Create header and footer panel and add on its components
createBodyPanel	Implemented Method	None	Set<String> allAdvisors	Create body panel and add on its components.
createBtnGroupPanel	Implemented Method	None	JPanel bPanel	Create group button components.
createTablePanel	Implemented Method	String [] columns, List<T> list	JPanel tPanel	Create table component by given data list.
createPopupMenu	Implemented Method	None	JPopupMenu popupMenu	Create menu items that will be implemented to the table.
createSearchBarPanel	Implemented Method	None	JPanel sPanel	Create search bar components.
createBtn	Implemented Method	String btnType	JButton btn	Create and configure generally used button component.
updateTable	Implemented Method	String [] columns, List<T> list	None	Redraw table to apply the changes in data in the view.
actionPerformed	Inherited Method	ActionEvent e	None	Function that handles each UI events.

(*1) IOException

j) [GUI Group] Class ‘DetailViewGUI’
* This is Sub-GUI class and inherits JDialog Class.
* Unlike general constructor, this class activate itself by constructor since it is JDialog component Class.
* Used generic type for optimize the reusability of the program.

Name	Type	Parameter	Return	Description
isDialogOpen	boolean	* This is class attribute (or Property)		Indicate whether current dialog has been open already.
DetailViewGUI	Constructor Method	JFrame frame, DataType dataType, T info	None	Instantiate and set up dialog properties then activate to be shown.
createDescriptionField	Implemented Method	DataType dataType, T info	JTextArea description	Creates text area component with given data combined.
isDialogOpen	Implemented Method	None	boolean isDialogOpen	Assessor of isDialogOpen
setDialogOpen	Implemented	boolean isDialogOpen	None	Mutator of isDialogOpen

	Method			

k) [GUI Group] Class ‘RentalViewGUI’
* This is Sub-GUI class and inherits JDialog Class.
* Unlike general constructor, this class activate itself by constructor since it is JDialog component Class.
* Except the attribute ‘isDialogOpen’, other attributes set as class attributes for convenience in aspect of variable access.

Name	Type	Parameter	Return	Description
prop	Property	* These are attributes (or Properties)		Property instance
store	BookStore			BookStore instance
selection	JComboBox<String>			Combo box component
rSels	Map<Integer, int []>			Number Identifier list for customers
isDialogOpen	boolean			Indicate whether current dialog has been open already.
RentalViewGUI	Constructor Method	JFrame frame, String bTitle, int bNo	None	Instantiate and set up dialog properties then activate to be shown.
isDialogOpen	Implemented Method	None	boolean isDialogOpen	Assessor of isDialogOpen
setDialogOpen	Implemented Method	boolean isDialogOpen	None	Mutator of isDialogOpen

(*) Exceptions have been thrown from this method only. The exceptions are like as below:
FileNotFoundException, ArrayIndexOutOfBoundsException, NullPointerException, NumberFormatException, IOException

5) Benefits of the implementation (OOP and other properties)

* By using interface: This not only can clarify the actual methods which are related to the main purpose but also can hide unused, unrelated, and avoid being revealed from main class level code that might can make confusion. Also, using interface is beneficial as it prevents programming flaws to be occurred from compiling level.

* By utilizing polymorphism/ Using generic type of functions: By referencing interface rather than directly initiate as its class instance variables, unused methods such as getters or setters will be hidden and not permit to be added on main class until interface create the link for those methods. This is beneficial for developers who want to avoid uncontrolled access of private variables even if its accessors are declared as public. Also, generic functions help not only to improve reusability of code but also to make the code more readable since it minimizes duplicated function so that average length of the class file can be shorten.

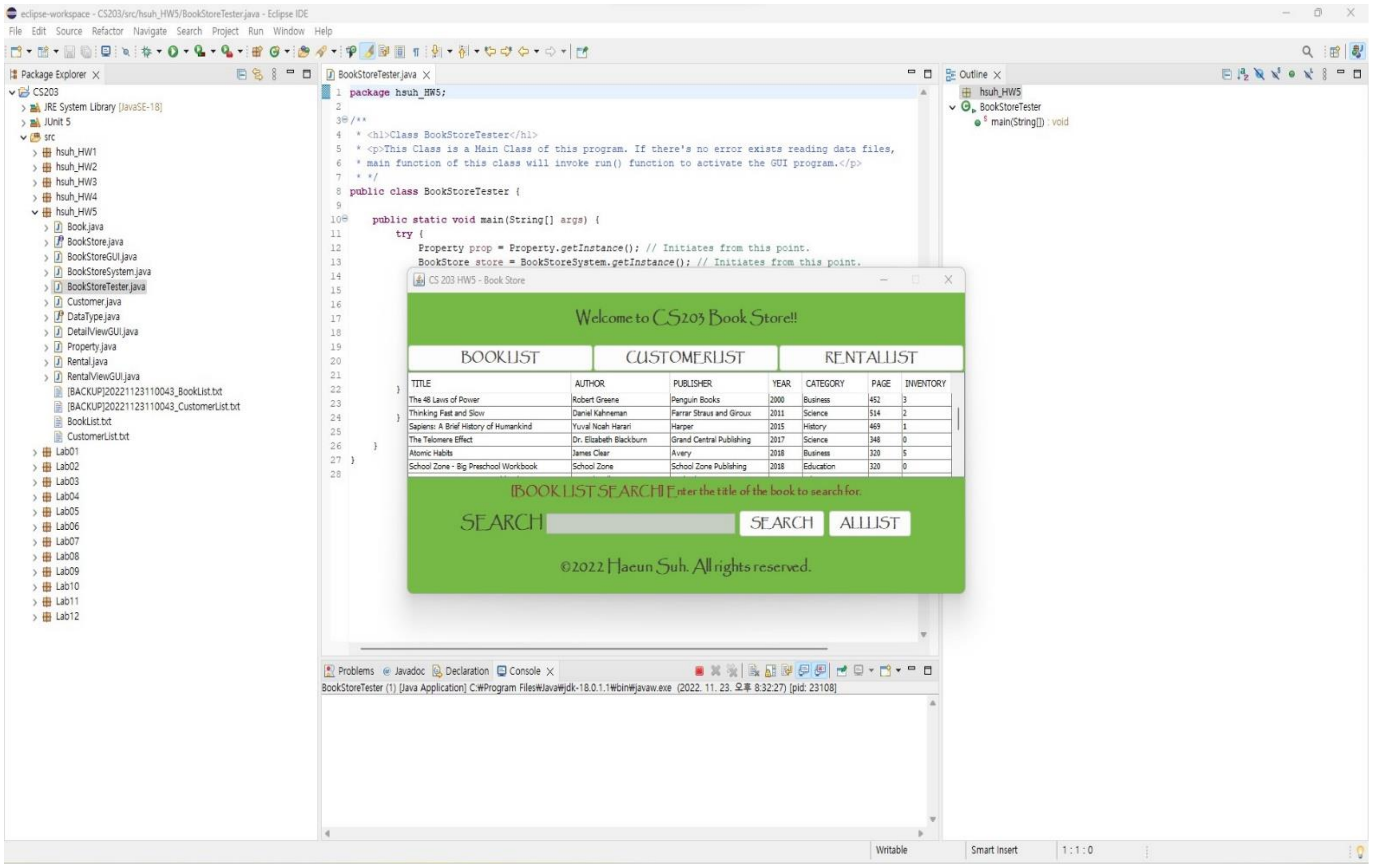
* Utilizing Enum property: Rather than identify by other attribute, Using Enum property is much more clear way to identify since its values are exactually have Integer values internally. This class is especially good to combine with map property since it can be used as key value. Also, combine this property with switch statement can make code much more intuitively compared to a general, conditional statements.

* By using override methods: This can minimize duplicity and improve reusability.

* By using throws statements: This makes errors can be managed centrally.

Result

1) Program Start Display and change the view mode.
   From Beginning, the program starts from the view of book list table.



```
package hsuh_HW5;

/**
 * <h1>Class BookStoreTester</h1>
 * <p>This Class is a Main Class of this program. If there's no error exists reading data files,
 * main function of this class will invoke run() function to activate the GUI program.</p>
 * */
public class BookStoreTester {

    public static void main(String[] args) {
        try {
            Property prop = Property.getInstance(); // Initiates from this point.
            BookStore store = BookStoreSystem.getInstance(); // Initiates from this point.
```

TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
Thinking Fast and Slow	Daniel Kahneman	Farrar Straus and Giroux	2011	Science	514	2
Sapiens: A Brief History of Humankind	Yuval Noah Harari	Harper	2015	History	469	1
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Atomic Habits	James Clear	Avery	2018	Business	320	5
School Zone - Big Preschool Workbook	School Zone	School Zone Publishing	2018	Education	320	0

```
BookStoreTester (1) [Java Application] C:₩Program Files₩Java₩jdk-18.0.1.1₩bin₩javaw.exe (2022. 11. 23. 오후 8:32:27) [pid: 23108]
```

CS 203 HW5 - Book Store
Welcome to CS203 Book Store!!
BOOKLIST
CUSTOMERLIST
RENTALLIST
[BOOK LIST SEARCH] Enter the title of the book to search for.
SEARCH
SEARCH
ALLLIST
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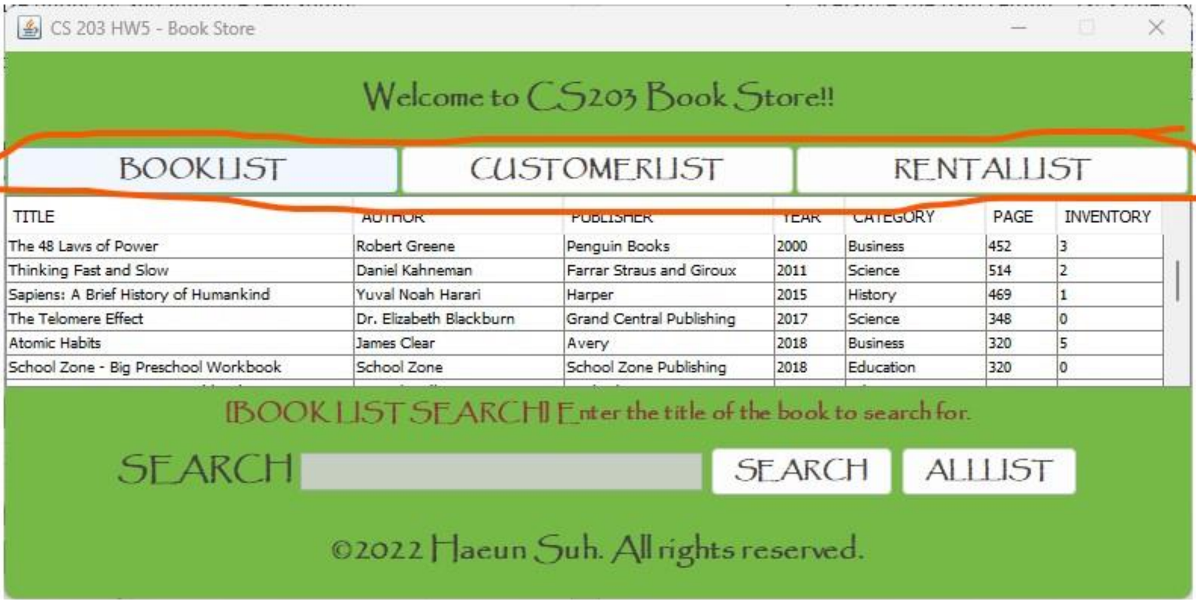
[Screenshot] Main view (Book View)

By the group button that are marked as red, user can change the view as desire data type. Three types of view are available: Book View, Customer View, Rental View.



CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
Thinking Fast and Slow	Daniel Kahneman	Farrar Straus and Giroux	2011	Science	514	2
Sapiens: A Brief History of Humankind	Yuval Noah Harari	Harper	2015	History	469	1
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Atomic Habits	James Clear	Avery	2018	Business	320	5
School Zone - Big Preschool Workbook	School Zone	School Zone Publishing	2018	Education	320	0

[BOOKLIST SEARCH] Enter the title of the book to search for.

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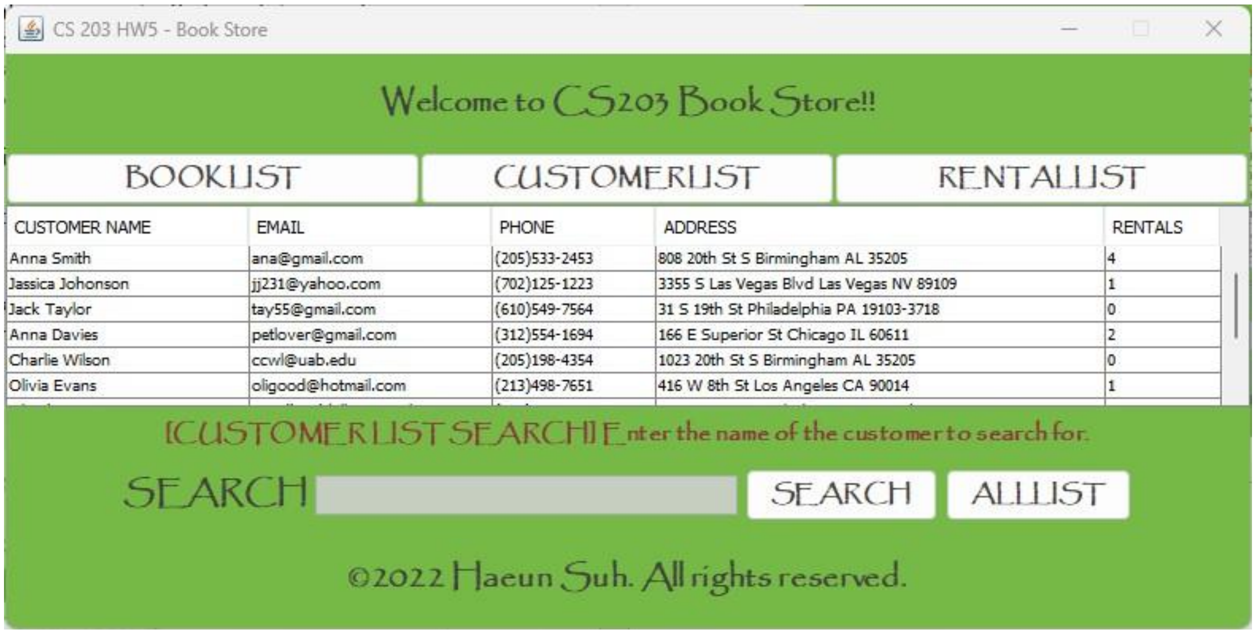
[Screenshot] Group Button

For instance, if user pressed 'CUSTOMERLIST' or 'RENTALLIST' button, then the view will be changed like as below:



CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

CUSTOMER NAME	EMAIL	PHONE	ADDRESS	RENTALS
Anna Smith	ana@gmail.com	(205)533-2453	808 20th St S Birmingham AL 35205	4
Jassica Johonson	jj231@yahoo.com	(702)125-1223	3355 S Las Vegas Blvd Las Vegas NV 89109	1
Jack Taylor	tay55@gmail.com	(610)549-7564	31 S 19th St Philadelphia PA 19103-3718	0
Anna Davies	petlover@gmail.com	(312)554-1694	166 E Superior St Chicago IL 60611	2
Charlie Wilson	ccwl@uab.edu	(205)198-4354	1023 20th St S Birmingham AL 35205	0
Olivia Evans	oligood@hotmail.com	(213)498-7651	416 W 8th St Los Angeles CA 90014	1

[CUSTOMERLIST SEARCH] Enter the name of the customer to search for.

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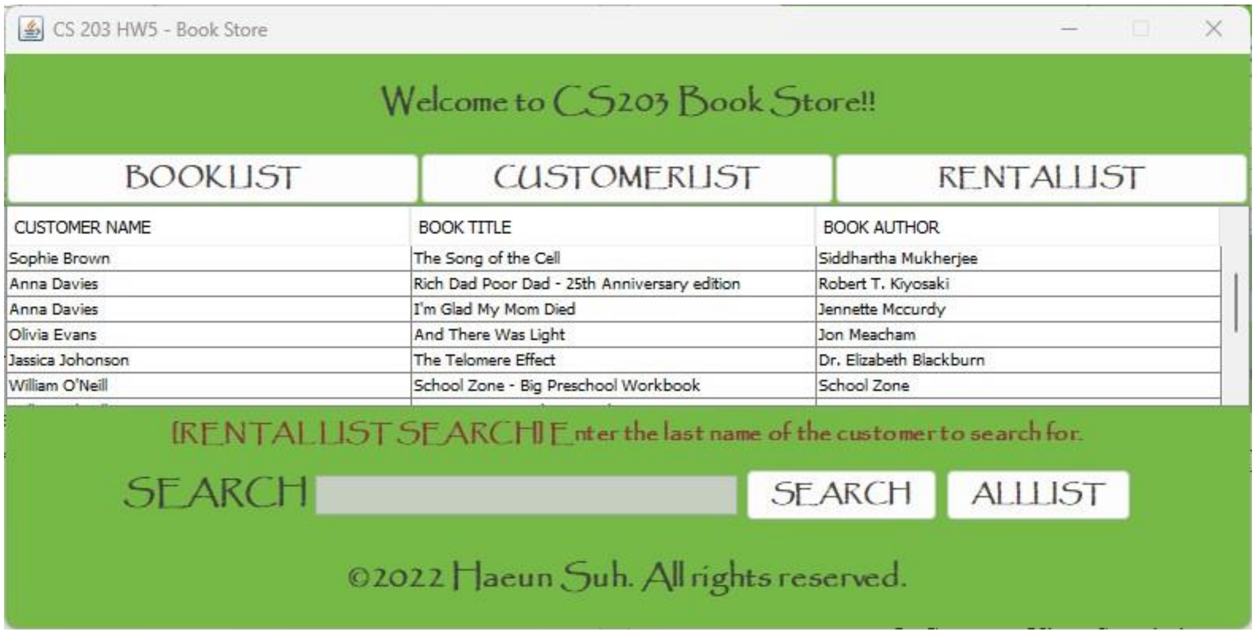
[Screenshot] Customer View


CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

BOOKLIST | CUSTOMERLIST | RENTALLIST

CUSTOMER NAME	BOOK TITLE	BOOK AUTHOR
Sophie Brown	The Song of the Cell	Siddhartha Mukherjee
Anna Davies	Rich Dad Poor Dad - 25th Anniversary edition	Robert T. Kiyosaki
Anna Davies	I'm Glad My Mom Died	Jennette Mccurdy
Olivia Evans	And There Was Light	Jon Meacham
Jassica Johonson	The Telomere Effect	Dr. Elizabeth Blackburn
William O'Neill	School Zone - Big Preschool Workbook	School Zone

[RENTALLIST SEARCH] Enter the last name of the customer to search for.

SEARCH | SEARCH | ALLLIST

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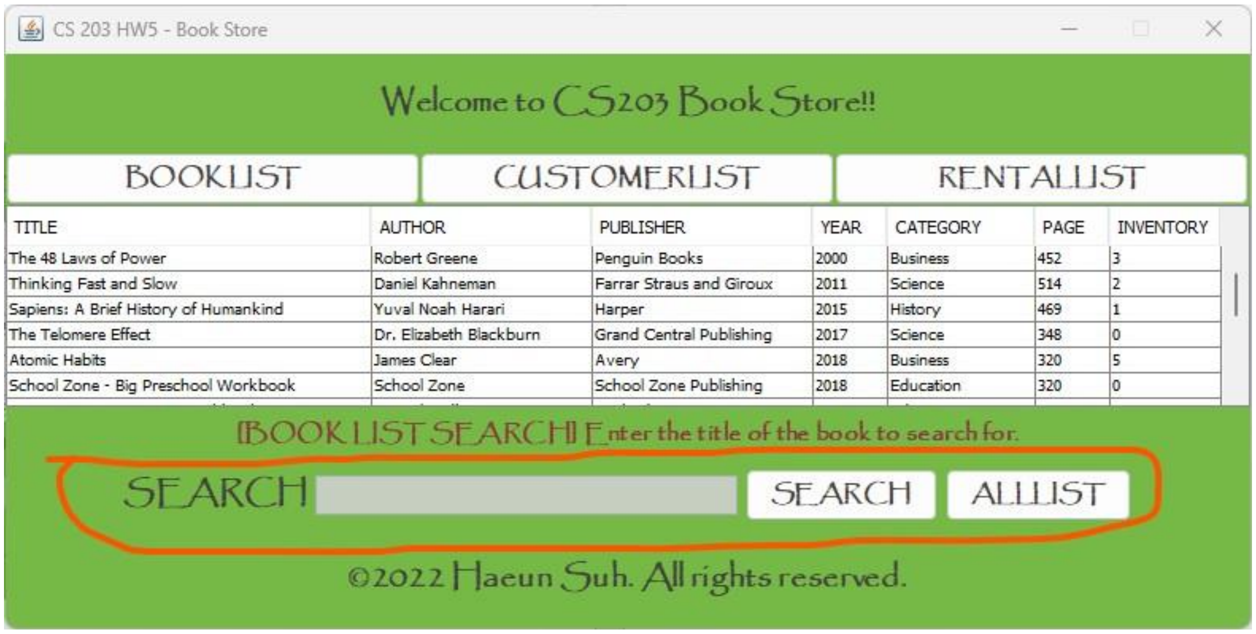
[Screenshot] Rental View

2) Search and filter the list of each view.
 By the search bar and related buttons that are marked as red, user can search and retrieve desired list by the certain keywords.


CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

BOOKLIST | CUSTOMERLIST | RENTALLIST

TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
Thinking Fast and Slow	Daniel Kahneman	Farrar Straus and Giroux	2011	Science	514	2
Sapiens: A Brief History of Humankind	Yuval Noah Harari	Harper	2015	History	469	1
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Atomic Habits	James Clear	Avery	2018	Business	320	5
School Zone - Big Preschool Workbook	School Zone	School Zone Publishing	2018	Education	320	0

[BOOK LIST SEARCH] Enter the title of the book to search for.

SEARCH | SEARCH | ALLLIST

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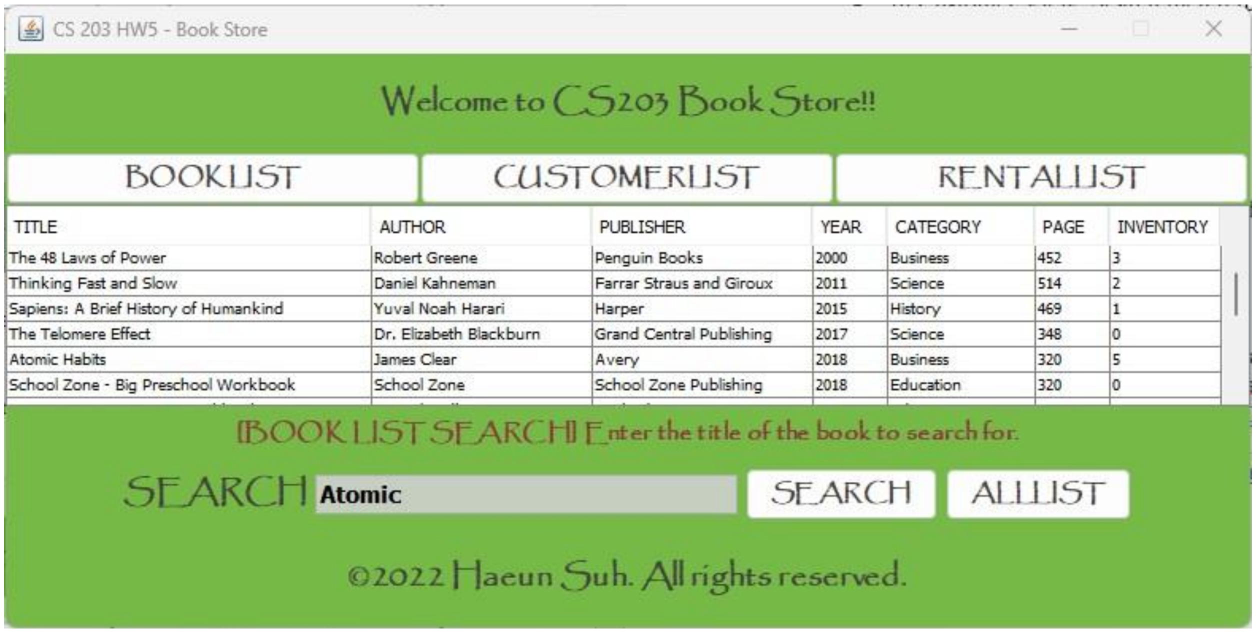
[Screenshot] Search bar components

As view changes, the type of search will be changed as well. For examples, from the Book View, the user can search a specific book list that contains a target keyword within the book titles.


CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
Thinking Fast and Slow	Daniel Kahneman	Farrar Straus and Giroux	2011	Science	514	2
Sapiens: A Brief History of Humankind	Yuval Noah Harari	Harper	2015	History	469	1
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Atomic Habits	James Clear	Avery	2018	Business	320	5
School Zone - Big Preschool Workbook	School Zone	School Zone Publishing	2018	Education	320	0

[BOOK LIST SEARCH] Enter the title of the book to search for.

SEARCH Atomic

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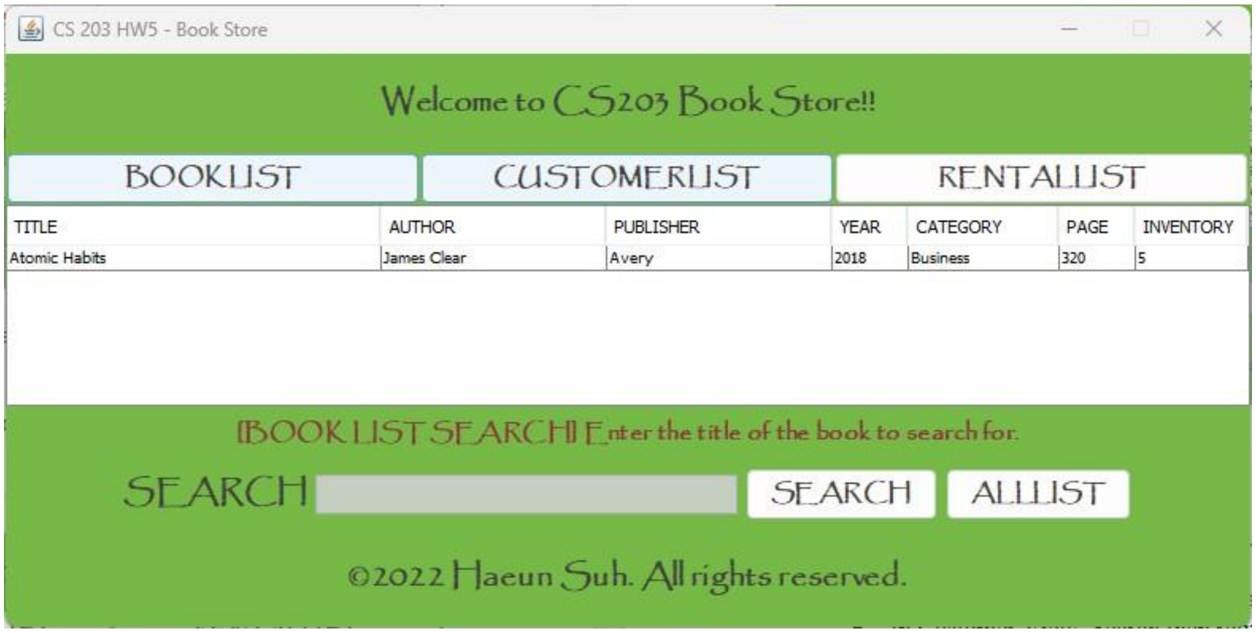
[Screenshot] Search ‘Atomic’


CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
Atomic Habits	James Clear	Avery	2018	Business	320	5

[BOOK LIST SEARCH] Enter the title of the book to search for.

SEARCH

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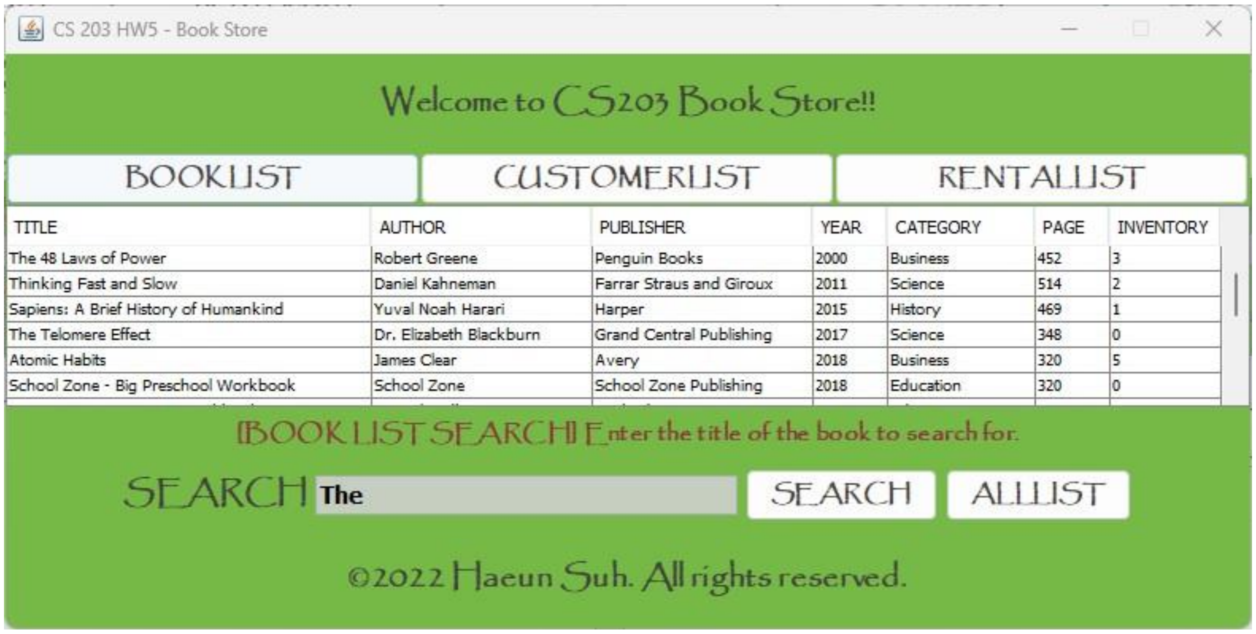
[Screenshot] Search ‘Atomic’ - result

Since users would not always aware of the complete book title, result will return all books that contain the keyword within its their titles. (But it will be case sensitive in order to avoid too excessive number of results.)


CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
Thinking Fast and Slow	Daniel Kahneman	Farrar Straus and Giroux	2011	Science	514	2
Sapiens: A Brief History of Humankind	Yuval Noah Harari	Harper	2015	History	469	1
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Atomic Habits	James Clear	Avery	2018	Business	320	5
School Zone - Big Preschool Workbook	School Zone	School Zone Publishing	2018	Education	320	0

[BOOK LIST SEARCH] Enter the title of the book to search for.

SEARCH The

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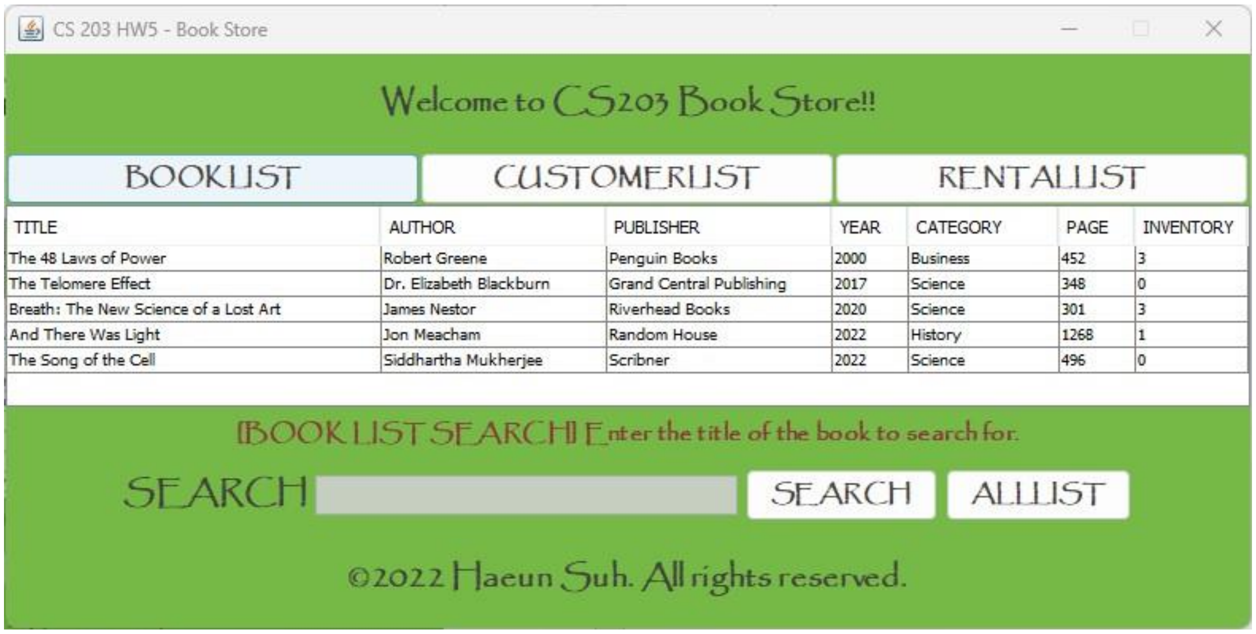
[Screenshot] Search 'The'


CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Breath: The New Science of a Lost Art	James Nestor	Riverhead Books	2020	Science	301	3
And There Was Light	Jon Meacham	Random House	2022	History	1268	1
The Song of the Cell	Siddhartha Mukherjee	Scribner	2022	Science	496	0

[BOOK LIST SEARCH] Enter the title of the book to search for.

SEARCH

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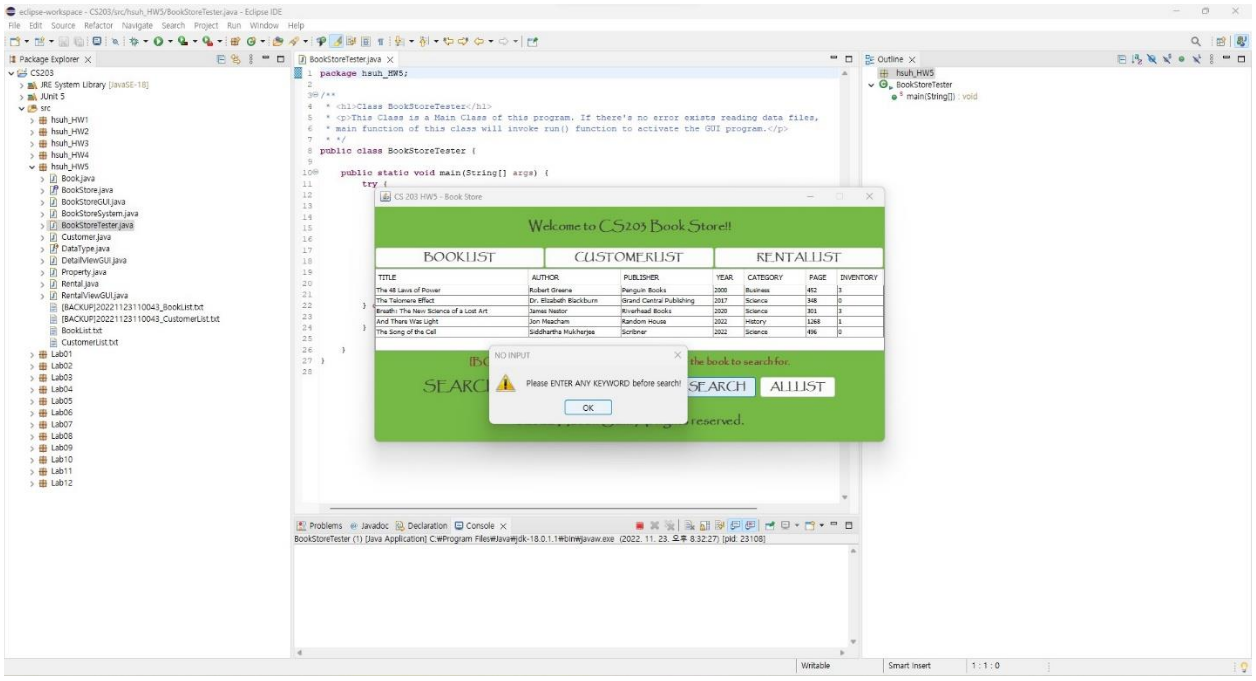
[Screenshot] Search 'The'– result

Search event can be activated by press enter after input the desire keyword into search bar or click the 'SEARC'' button. However, if nothing has been inputted then the program will send a warning message.



```
package hsuh_HW5;

/**
 * <h1>Class BookStoreTester</h1>
 * <p>This Class is a Main Class of this program. If there's no error exists reading data files,
 * main function of this class will invoke run() function to activate the GUI program.</p>
 * */
public class BookStoreTester {

    public static void main(String[] args) {
        try {
```

TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Breath: The New Science of a Lost Art	James Nestor	Riverhead Books	2020	Science	301	3
And There Was Light	Jon Meacham	Random House	2022	History	1268	1
The Song of the Cell	Siddhartha Mukherjee	Scribner	2022	Science	496	0

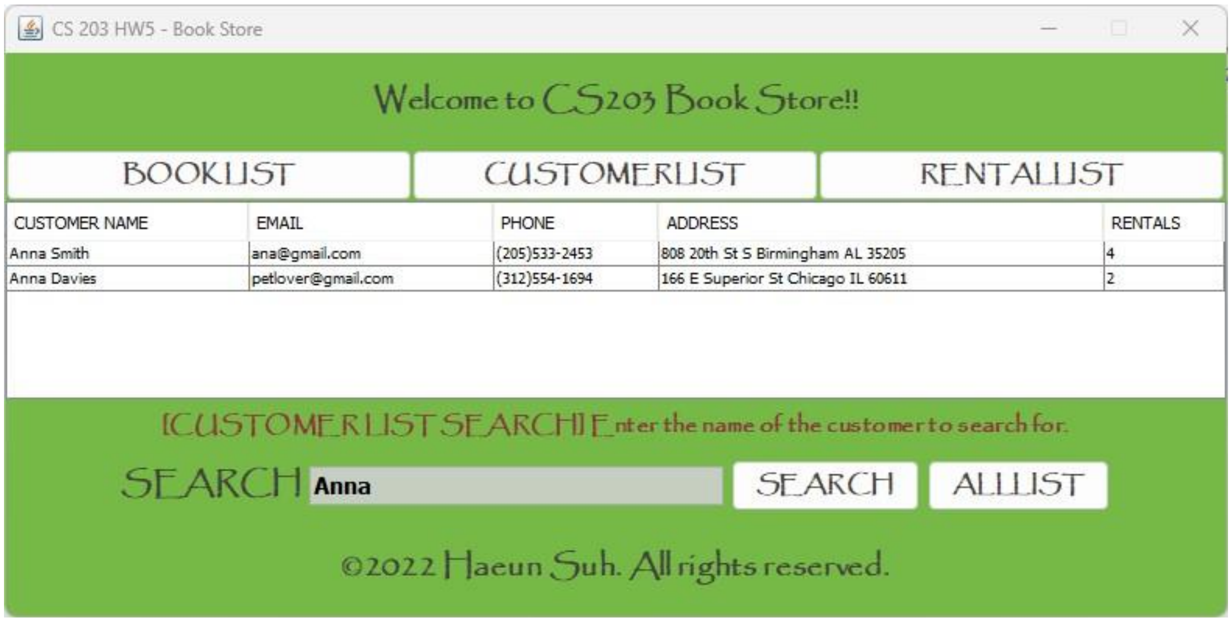
Please ENTER ANY KEYWORD before search!

```
BookStoreTester (1) [Java Application] C:₩Program Files₩Java₩jdk-18.0.1.1₩bin₩javaw.exe (2022. 11. 23. 오후 8:32:27) [pid: 23108]
```

[Screenshot] Search No input – result

Overall search events are similar regardless of the view types, but attributes that the system will consider will differ like as below:

- In Book View: Search then return a particular list by the target book title.
- In Customer View: Search then return a particular list by the target customer's name.
- In Rental View: Search then return a particular list by the target customer's last name.


CS 203 HW5 - Book Store
Welcome to CS203 Book Store!!
BOOKLIST
CUSTOMERLIST
RENTALLIST

CUSTOMER NAME	EMAIL	PHONE	ADDRESS	RENTALS
Anna Smith	ana@gmail.com	(205)533-2453	808 20th St S Birmingham AL 35205	4
Anna Davies	petlover@gmail.com	(312)554-1694	166 E Superior St Chicago IL 60611	2

[CUSTOMERLIST SEARCH] Enter the name of the customer to search for.

SEARCH Anna

SEARCH
ALLLIST
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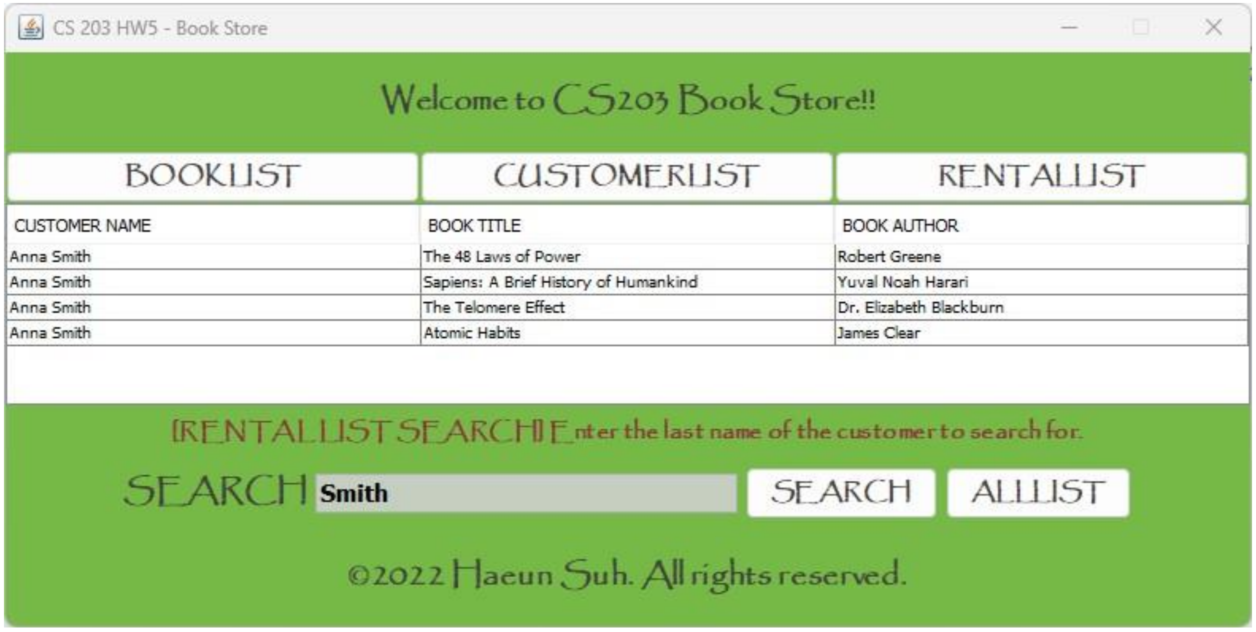
[Screenshot] Customer Search by name 'Anna' – Customer View


CS 203 HW5 - Book Store
Welcome to CS203 Book Store!!
BOOKLIST
CUSTOMERLIST
RENTALLIST

CUSTOMER NAME	BOOK TITLE	BOOK AUTHOR
Anna Smith	The 48 Laws of Power	Robert Greene
Anna Smith	Sapiens: A Brief History of Humankind	Yuval Noah Harari
Anna Smith	The Telomere Effect	Dr. Elizabeth Blackburn
Anna Smith	Atomic Habits	James Clear

[RENTALLIST SEARCH] Enter the last name of the customer to search for.

SEARCH Smith

SEARCH
ALLLIST
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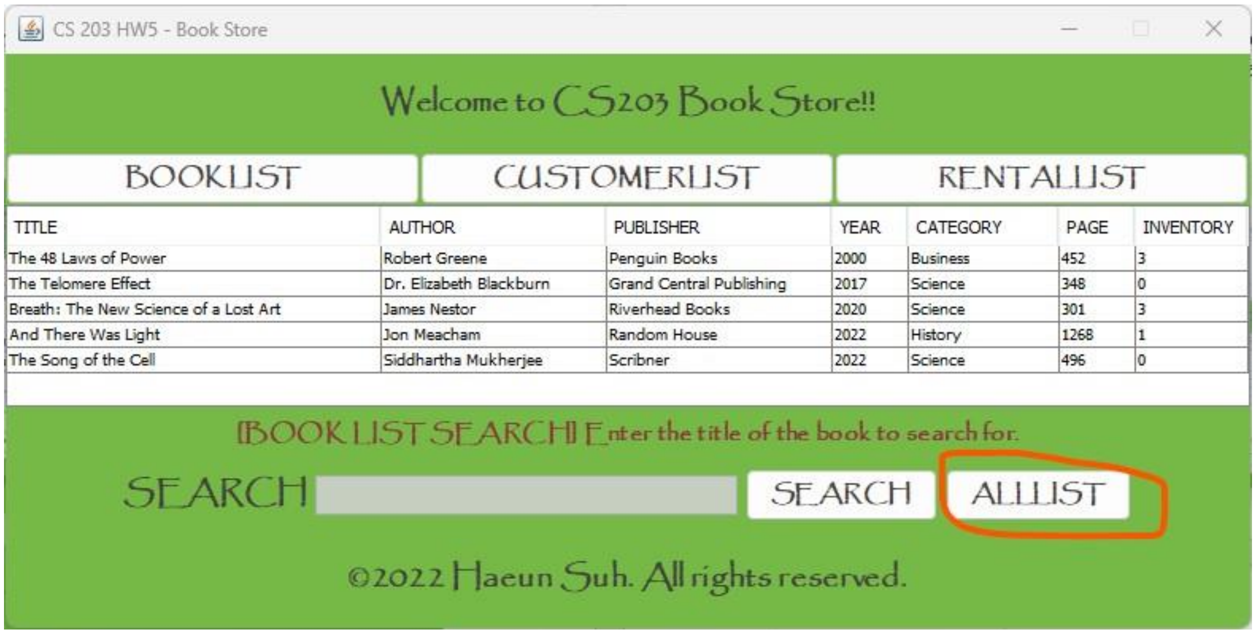
[Screenshot] Rental Search By last name'Smith' – Rental View

If user wish to return the table view as a whole list table view, user can click the 'ALLLIST' button to return as the whole list table view.



CS 203 HW5 - Book Store
Welcome to CS203 Book Store!!
BOOKLIST
CUSTOMERLIST
RENTALLIST
[BOOK LIST SEARCH] Enter the title of the book to search for.
SEARCH
SEARCH
ALLLIST
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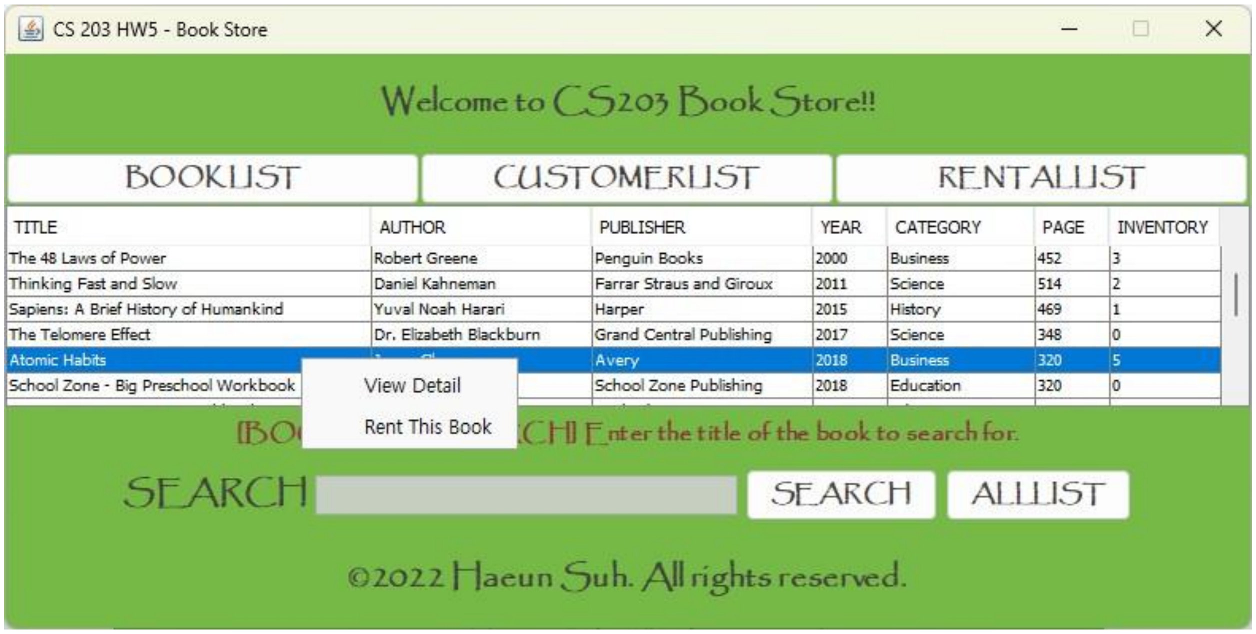
TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Breath: The New Science of a Lost Art	James Nestor	Riverhead Books	2020	Science	301	3
And There Was Light	Jon Meacham	Random House	2022	History	1268	1
The Song of the Cell	Siddhartha Mukherjee	Scribner	2022	Science	496	0

[Screenshot] All list button

3) Display individual description for book, customer, or rental respectively, by selecting from a menu item of the selected row item.
 User can select a desire data row, then retrieve a menu list in order to display the detail of the target data. The menu list can be shown by right click on the selected row.



CS 203 HW5 - Book Store
Welcome to CS203 Book Store!!
BOOKLIST
CUSTOMERLIST
RENTALLIST
View Detail
Rent This Book
[BO CH] Enter the title of the book to search for.
SEARCH
SEARCH
ALLLIST
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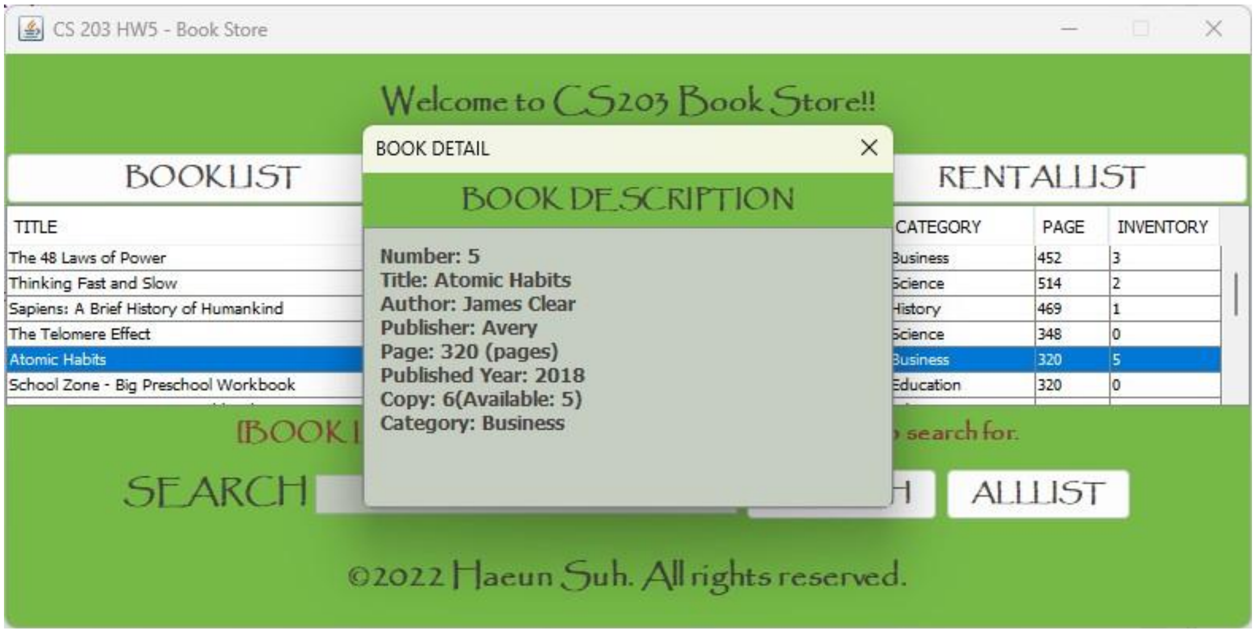
TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
Thinking Fast and Slow	Daniel Kahneman	Farrar Straus and Giroux	2011	Science	514	2
Sapiens: A Brief History of Humankind	Yuval Noah Harari	Harper	2015	History	469	1
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Atomic Habits	[illegible]	Avery	2018	Business	320	5
School Zone - Big Preschool Workbook	[illegible]	School Zone Publishing	2018	Education	320	0

[Screenshot] Pop up menu list – Book View

If user clicks the menu item ‘View Detail’, then a description of the target data will be shown from a new window component.

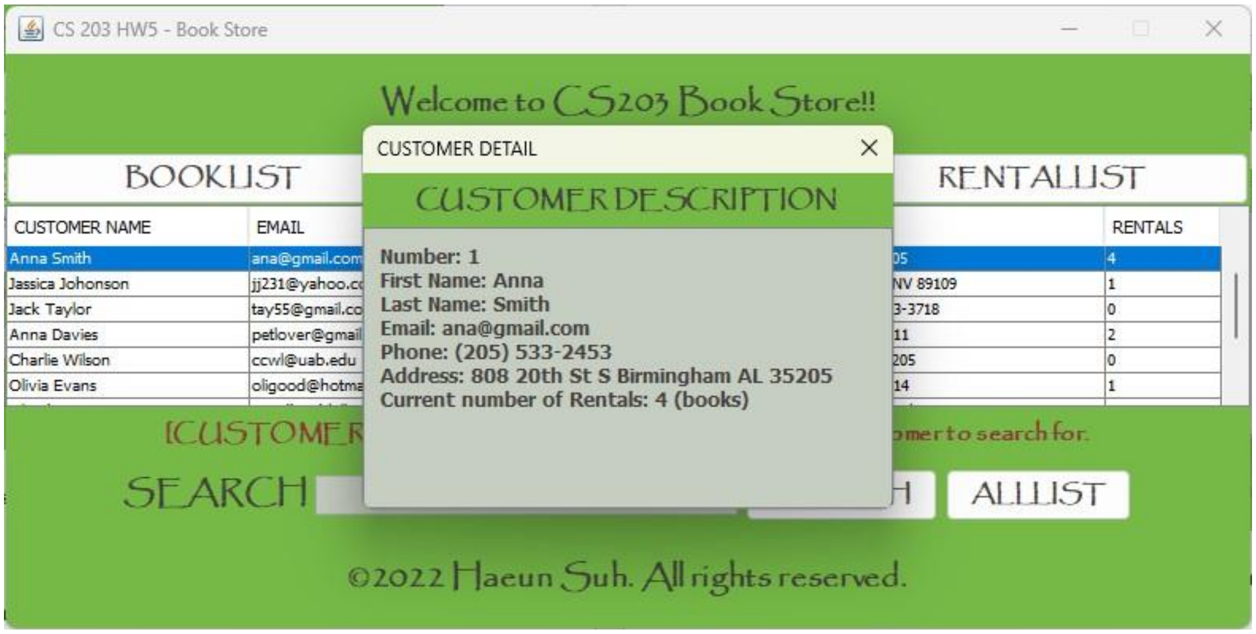


BOOK DETAIL

BOOK DESCRIPTION

Number: 5
Title: Atomic Habits
Author: James Clear
Publisher: Avery
Page: 320 (pages)
Published Year: 2018
Copy: 6(Available: 5)
Category: Business

[Screenshot] Detail View – Book View


CS 203 HW5 - Book Store
Welcome to CS203 Book Store!!
BOOKLIST
RENTALLIST
CUSTOMER NAME EMAIL
Anna Smith ana@gmail.com
Jassica Johonson jj231@yahoo.c
Jack Taylor tay55@gmail.co
Anna Davies petlover@gmail
Charlie Wilson ccwl@uab.edu
Olivia Evans oligood@hotma
RENTALS
05 4
NV 89109 1
3-3718 0
11 2
205 0
14 1
[CUSTOMER
mer to search for.
SEARCH
ALLLIST
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CUSTOMER DETAIL

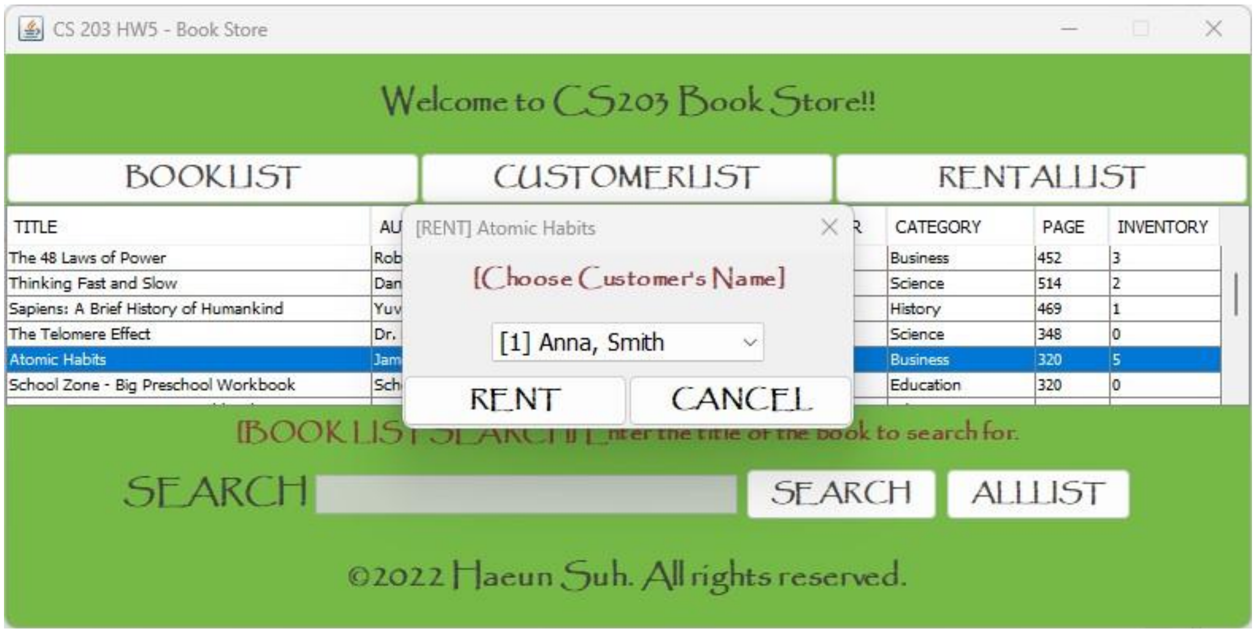
CUSTOMER DESCRIPTION

Number: 1
First Name: Anna
Last Name: Smith
Email: ana@gmail.com
Phone: (205) 533-2453
Address: 808 20th St S Birmingham AL 35205
Current number of Rentals: 4 (books)

[Screenshot] Detail View –Customer View

4) Rent a book

Rent book menu item will be only available from the Book View. After clicking the menu item ‘Rent this Book’, a rental selection window will be shown like as below:


CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	AU	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Rob	Business	452	3
Thinking Fast and Slow	Dan	Science	514	2
Sapiens: A Brief History of Humankind	Yuv	History	469	1
The Telomere Effect	Dr.	Science	348	0
Atomic Habits	Jam	Business	320	5
School Zone - Big Preschool Workbook	Sch	Education	320	0

[RENT] Atomic Habits

[Choose Customer's Name]

[1] Anna, Smith

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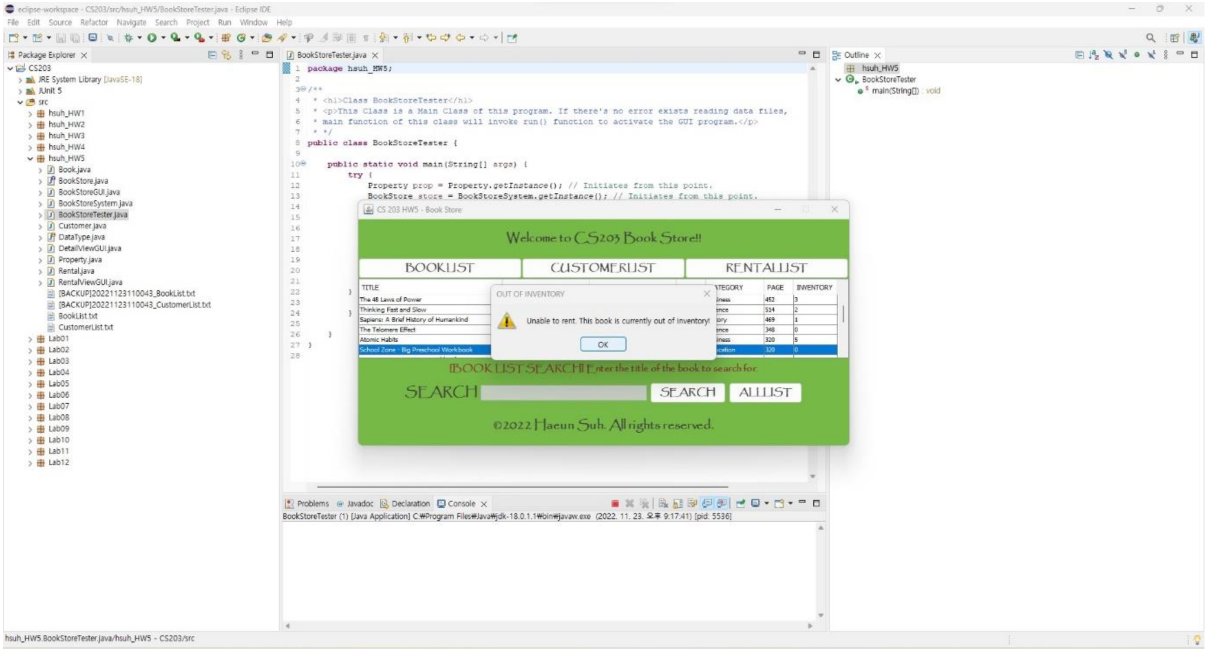
BOOKLIST
CUSTOMERLIST
RENTALLIST
RENT
CANCEL
[BOOK LIST SEARCH] Enter the title of the book to search for.
SEARCH
SEARCH
ALLLIST

[Screenshot] Rental View –Book View

However, the rental will be approved only if the target book is in current inventory and the book has not rented by the same customer.


```
package hsuh_HW5;

/**
 * <h1>Class BookStoreTester</h1>
 * <p>This Class is a Main Class of this program. If there's no error exists reading data files,
 * main function of this class will invoke run() function to activate the GUI program.</p>
 * */
public class BookStoreTester {

    public static void main(String[] args) {
        try {
            Property prop = Property.getInstance(); // Initiates from this point.
            BookStore store = BookStoreSystem.getInstance(); // Initiates from this point.
```

CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	ATEGORY	PAGE	INVENTORY
The 48 Laws of Power	iness	452	3
Thinking Fast and Slow	ence	514	2
Sapiens: A Brief History of Humankind	ory	469	1
The Telomere Effect	ence	348	0
Atomic Habits	iness	320	5
School Zone - Big Preschool Workbook	cation	320	0

OUT OF INVENTORY

Unable to rent. This book is currently out of inventory!

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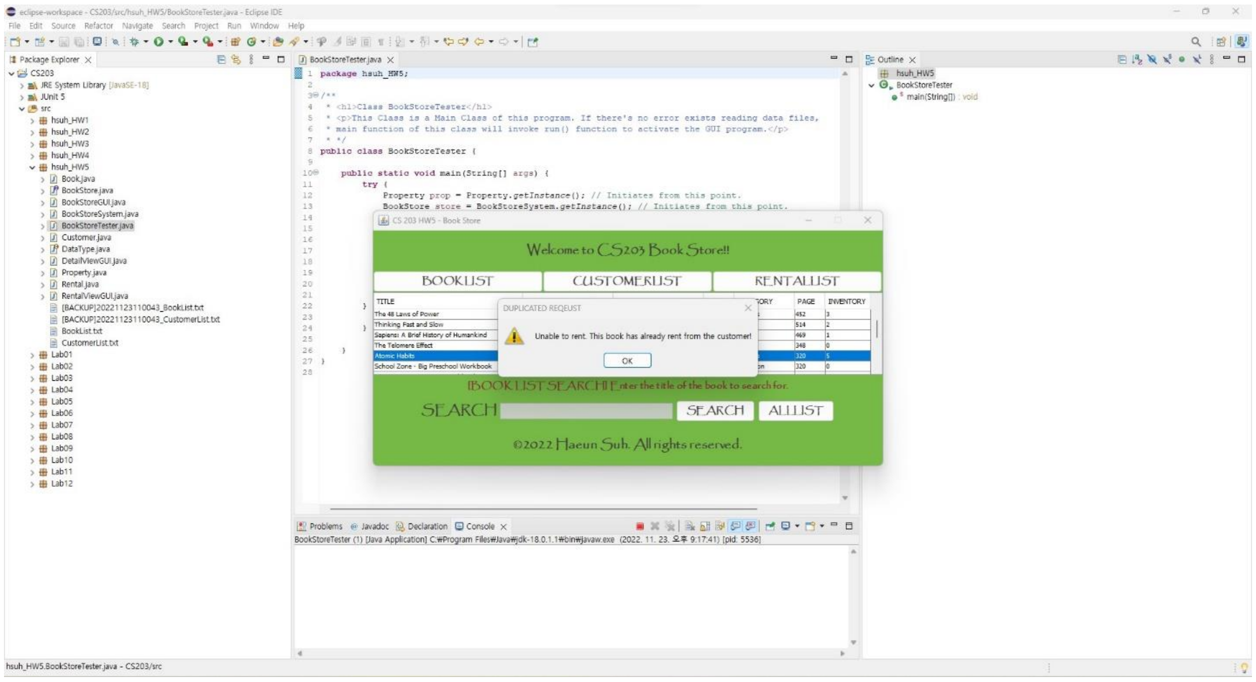
[Screenshot] Out of stock



```java
package hsuh_HW5;

/**
 * <h1>Class BookStoreTester</h1>
 * <p>This Class is a Main Class of this program. If there's no error exists reading data files,
 * main function of this class will invoke run() function to activate the GUI program.</p>
 * */
public class BookStoreTester {

    public static void main(String[] args) {
        try {
            Property prop = Property.getInstance(); // Initiates from this point.
            BookStore store = BookStoreSystem.getInstance(); // Initiates from this point.
```

CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	PAGE	INVENTORY
The 48 Laws of Power	452	3
Thinking Fast and Slow	514	2
Sapiens: A Brief History of Humankind	469	1
The Telomere Effect	348	0
Atomic Habits	320	5
School Zone - Big Preschool Workbook	320	0

DUPLICATED REQEUST

Unable to rent. This book has already rent from the customer!

[BOOK LIST SEARCH] Enter the title of the book to search for.

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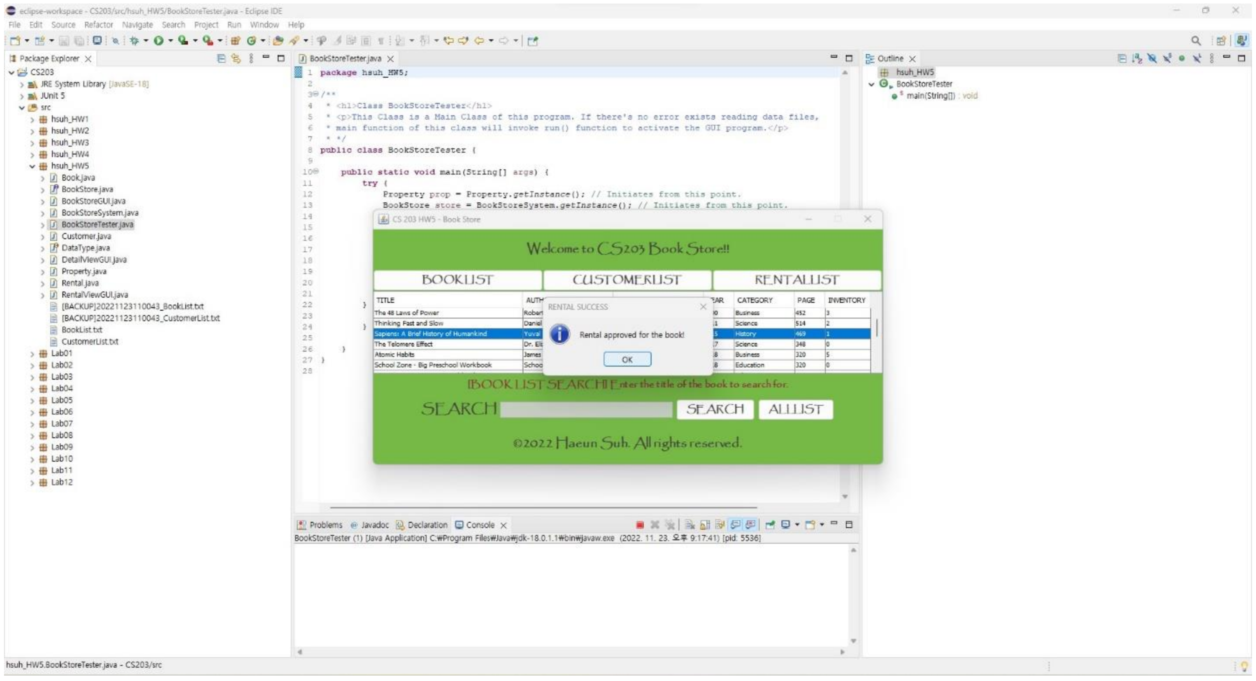
```
BookStoreTester (1) [Java Application] C:₩Program Files₩Java₩jdk-18.0.1.1₩bin₩javaw.exe  (2022. 11. 23. 오후 9:17:41) [pid: 5536]
```

[Screenshot] No duplication allowed

If rent has approved, the system will process the rental event and return a message like as below:



```java
package hsuh_HW5;

/**
 * <h1>Class BookStoreTester</h1>
 * <p>This Class is a Main Class of this program. If there's no error exists reading data files,
 * main function of this class will invoke run() function to activate the GUI program.</p>
 * */
public class BookStoreTester {

    public static void main(String[] args) {
        try {
            Property prop = Property.getInstance(); // Initiates from this point.
            BookStore store = BookStoreSystem.getInstance(); // Initiates from this point.
```

CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

TITLE	AUTH	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert	Business	452	3
Thinking Fast and Slow	Daniel	Science	514	2
Sapiens: A Brief History of Humankind	Yuval	History	469	1
The Telomere Effect	Dr. Eli	Science	348	0
Atomic Habits	James	Business	320	5
School Zone - Big Preschool Workbook	Schoo	Education	320	0

RENTAL SUCCESS

Rental approved for the book!

[BOOK LIST SEARCH] Enter the title of the book to search for.

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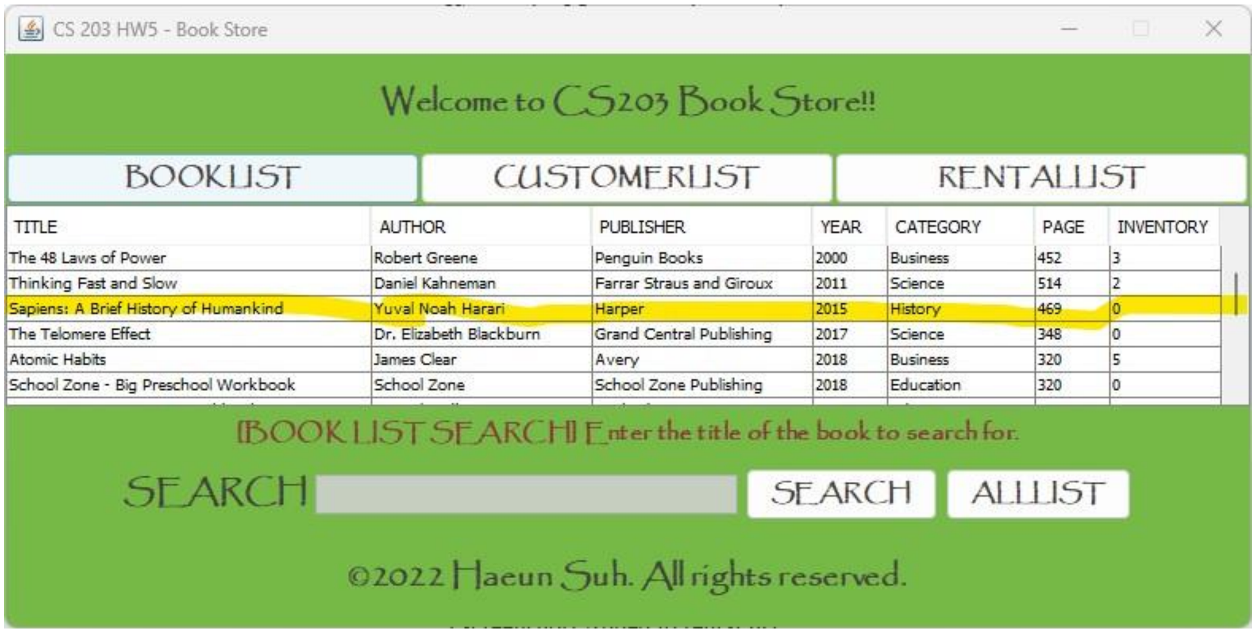
```
BookStoreTester (1) [Java Application] C:₩Program Files₩Java₩jdk-18.0.1.1₩bin₩javaw.exe  (2022. 11. 23. 오후 9:17:41) [pid: 5536]
```

[Screenshot] Rent Approved

After rental event, the system will refresh and redraw the data table to update the changes.



TITLE	AUTHOR	PUBLISHER	YEAR	CATEGORY	PAGE	INVENTORY
The 48 Laws of Power	Robert Greene	Penguin Books	2000	Business	452	3
Thinking Fast and Slow	Daniel Kahneman	Farrar Straus and Giroux	2011	Science	514	2
Sapiens: A Brief History of Humankind	Yuval Noah Harari	Harper	2015	History	469	0
The Telomere Effect	Dr. Elizabeth Blackburn	Grand Central Publishing	2017	Science	348	0
Atomic Habits	James Clear	Avery	2018	Business	320	5
School Zone - Big Preschool Workbook	School Zone	School Zone Publishing	2018	Education	320	0

[BOOK LIST SEARCH] Enter the title of the book to search for.
SEARCH
SEARCH
ALLLIST
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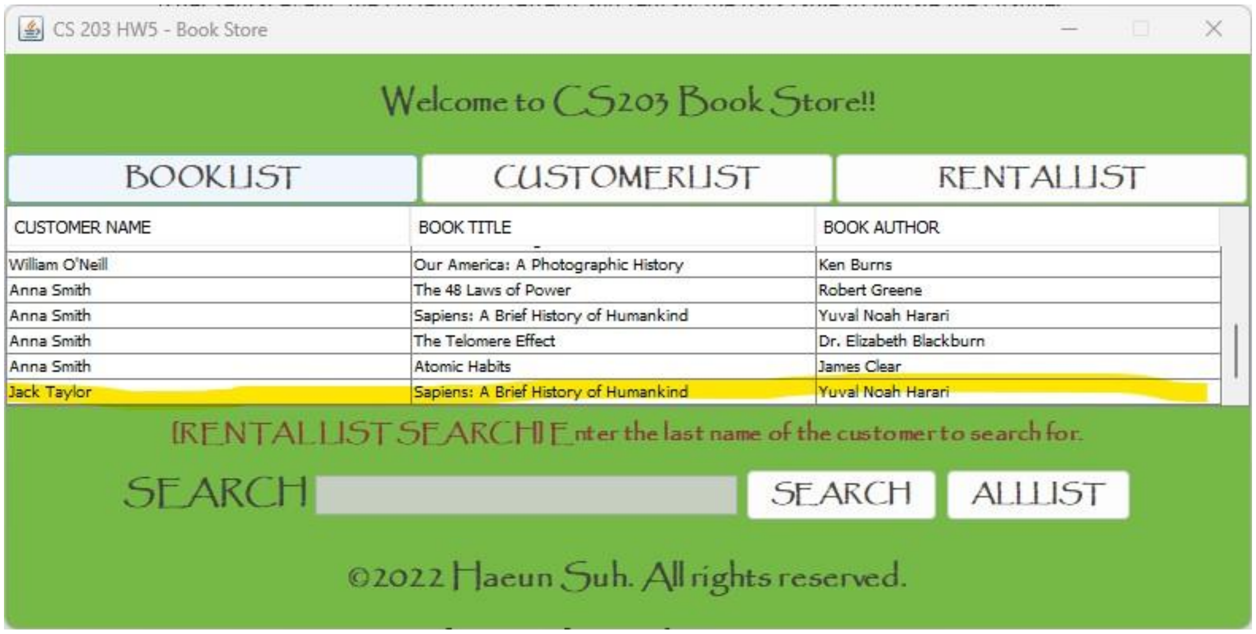
[Screenshot] Inventory decreased



CUSTOMER NAME	BOOK TITLE	BOOK AUTHOR
William O'Neill	Our America: A Photographic History	Ken Burns
Anna Smith	The 48 Laws of Power	Robert Greene
Anna Smith	Sapiens: A Brief History of Humankind	Yuval Noah Harari
Anna Smith	The Telomere Effect	Dr. Elizabeth Blackburn
Anna Smith	Atomic Habits	James Clear
Jack Taylor	Sapiens: A Brief History of Humankind	Yuval Noah Harari

[RENTAL LIST SEARCH] Enter the last name of the customer to search for.
SEARCH
SEARCH
ALLLIST
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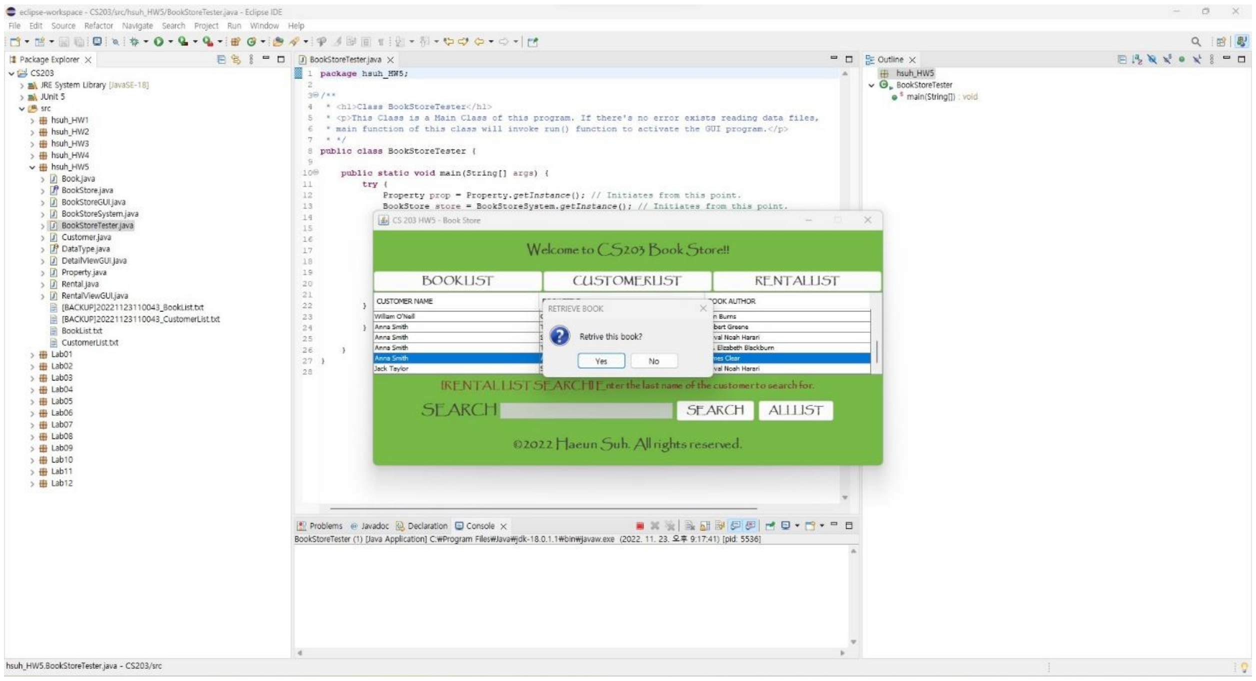
[Screenshot] Added to rental list

5) Retrieve a book from a customer.
 Retrieve book menu item will be only available from the Rental View. After clicking the menu item 'Return this Book', a return confirmation window will be shown like as below:



```java
package hsuh_HW5;

/**
 * <h1>Class BookStoreTester</h1>
 * <p>This Class is a Main Class of this program. If there's no error exists reading data files,
 * main function of this class will invoke run() function to activate the GUI program.</p>
 * */
public class BookStoreTester {

    public static void main(String[] args) {
        try {
            Property prop = Property.getInstance(); // Initiates from this point.
            BookStore store = BookStoreSystem.getInstance(); // Initiates from this point.
```

RETRIEVE BOOK

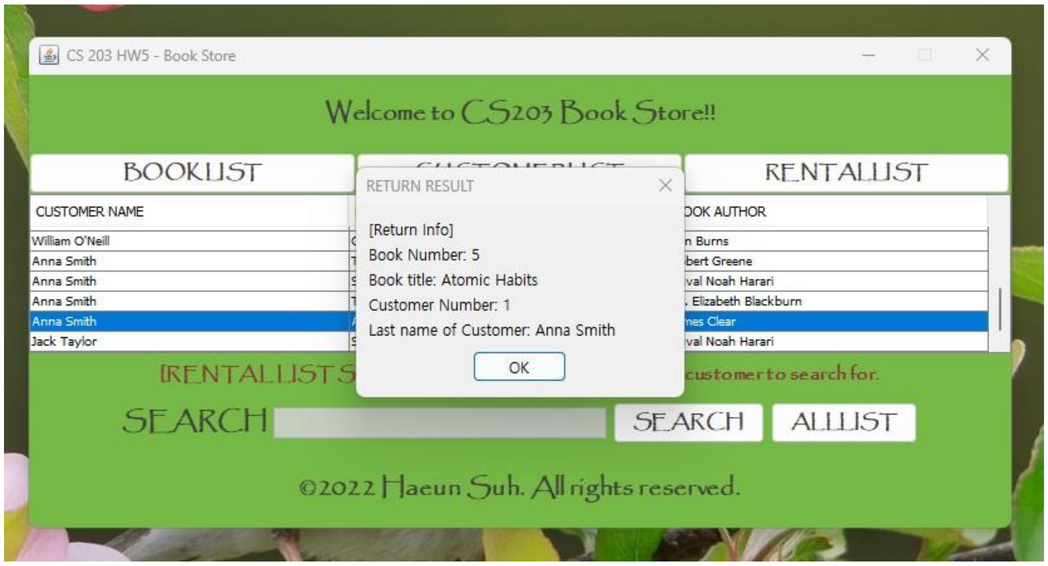
Retrive this book?

```
BookStoreTester (1) [Java Application] C:₩Program Files₩Java₩jdk-18.0.1.1₩bin₩javaw.exe (2022. 11. 23. 오후 9:17:41) [pid: 5536]
```

Welcome to CS203 Book Store!!
BOOKLIST
CUSTOMERLIST
RENTALLIST
CUSTOMER NAME
William O'Neill
Anna Smith
Anna Smith
Anna Smith
Anna Smith
Jack Taylor
Yes
No
[RENTALLIST SEARCH] Enter the last name of the customer to search for.
SEARCH
SEARCH
ALLLIST
©2022 Haeun Suh. All rights reserved.

[Screenshot] Return confirmation View – Rental View

 If user agrees, then the retrieve event will be occurred and will return the inform message window after completion of the process.

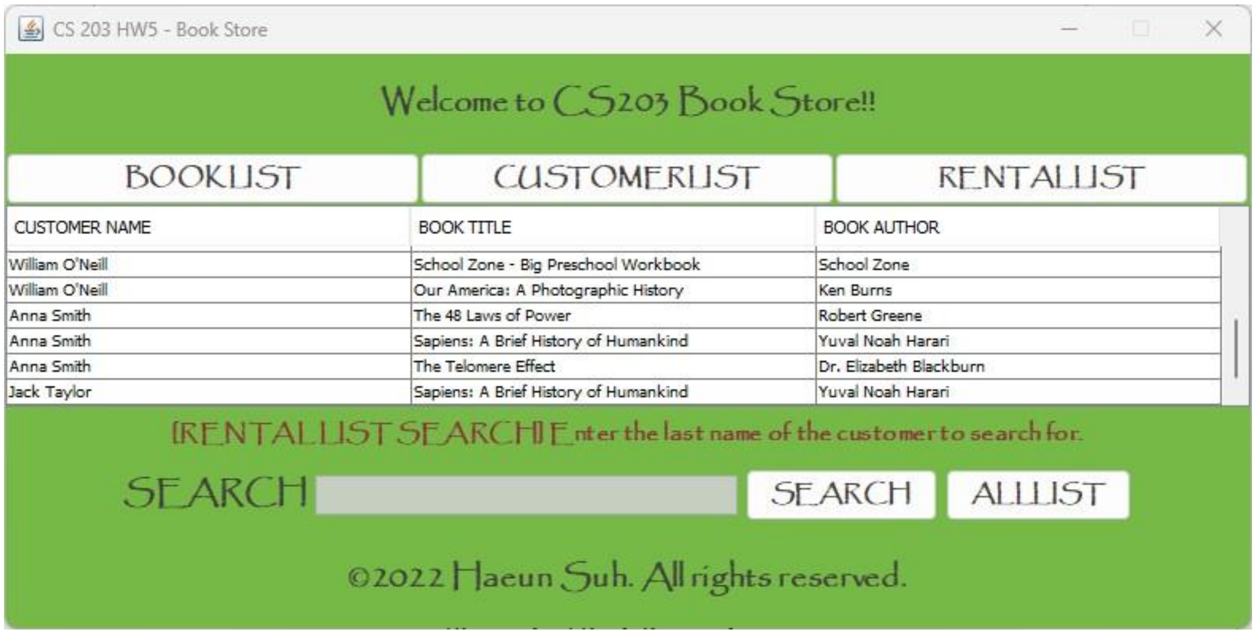


RETURN RESULT

[Return Info]
Book Number: 5
Book title: Atomic Habits
Customer Number: 1
Last name of Customer: Anna Smith

[Screenshot] Book Returned

Same as the rental event, the system will refresh the data table so to update the data changes.


CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

CUSTOMER NAME	BOOK TITLE	BOOK AUTHOR
William O'Neill	School Zone - Big Preschool Workbook	School Zone
William O'Neill	Our America: A Photographic History	Ken Burns
Anna Smith	The 48 Laws of Power	Robert Greene
Anna Smith	Sapiens: A Brief History of Humankind	Yuval Noah Harari
Anna Smith	The Telomere Effect	Dr. Elizabeth Blackburn
Jack Taylor	Sapiens: A Brief History of Humankind	Yuval Noah Harari

[RENTALLIST SEARCH] Enter the last name of the customer to search for.

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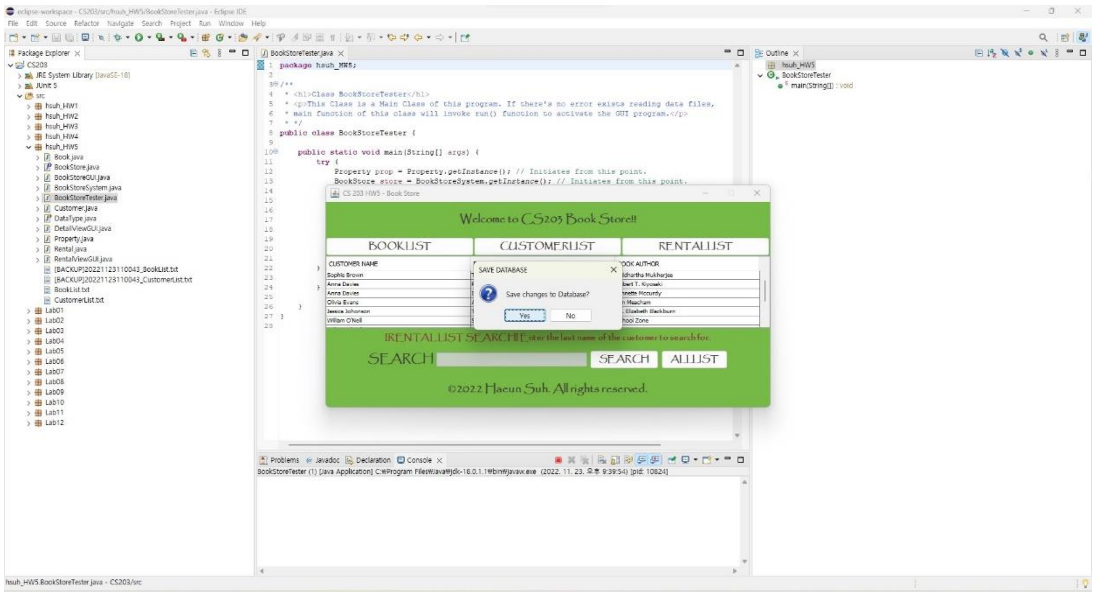
[Screenshot] Rental list has removed (Anna Smith & Atomic Habits)

6) Database update before termination

   When closing the program, a confirmation window will appear to ask the user to save the changes to the current database.


eclipse-workspace - CS203/src/hsuh_HW5/BookStoreTester.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer
Outline
Problems Javadoc Declaration Console

```
CS203
  JRE System Library [JavaSE-18]
  JUnit 5
  src
    hsuh_HW1
    hsuh_HW2
    hsuh_HW3
    hsuh_HW4
    hsuh_HW5
      Book.java
      BookStore.java
      BookStoreGUI.java
      BookStoreSystem.java
      BookStoreTester.java
      Customer.java
      DataType.java
      DetailViewGUI.java
      Property.java
      Rental.java
      RentalViewGUI.java
      [BACKUP]20221123110043_BookList.txt
      [BACKUP]20221123110043_CustomerList.txt
      BookList.txt
      CustomerList.txt
    Lab01
    Lab02
    Lab03
    Lab04
    Lab05
    Lab06
    Lab07
    Lab08
    Lab09
    Lab10
    Lab11
    Lab12
```

BookStoreTester.java

```
package hsuh_HW5;

/**
 * <h1>Class BookStoreTester</h1>
 * <p>This Class is a Main Class of this program. If there's no error exists reading data files,
 * main function of this class will invoke run() function to activate the GUI program.</p>
 * */
public class BookStoreTester {

    public static void main(String[] args) {
        try {
            Property prop = Property.getInstance(); // Initiates from this point.
            BookStore store = BookStoreSystem.getInstance(); // Initiates from this point.
        }
        }
    }
}
```

```
BookStoreTester (1) [Java Application] C:₩Program Files₩Java₩jdk-18.0.1.1₩bin₩javaw.exe (2022. 11. 23. 오후 9:39:54) [pid: 10824]
```

hsuh_HW5.BookStoreTester.java - CS203/src

CS 203 HW5 - Book Store

Welcome to CS203 Book Store!!

CUSTOMER NAME	BOOK AUTHOR
Sophie Brown	Siddhartha Mukherjee
Anna Davies	Robert T. Kiyosaki
Anna Davies	Jeanette Mccurdy
Olivia Evans	Jon Meacham
Jessica Johonson	Dr. Elizabeth Blackburn
Willam O'Neill	School Zone

SAVE DATABASE

Save changes to Database?

[RENTALLIST SEARCH] Enter the last name of the customer to search for.

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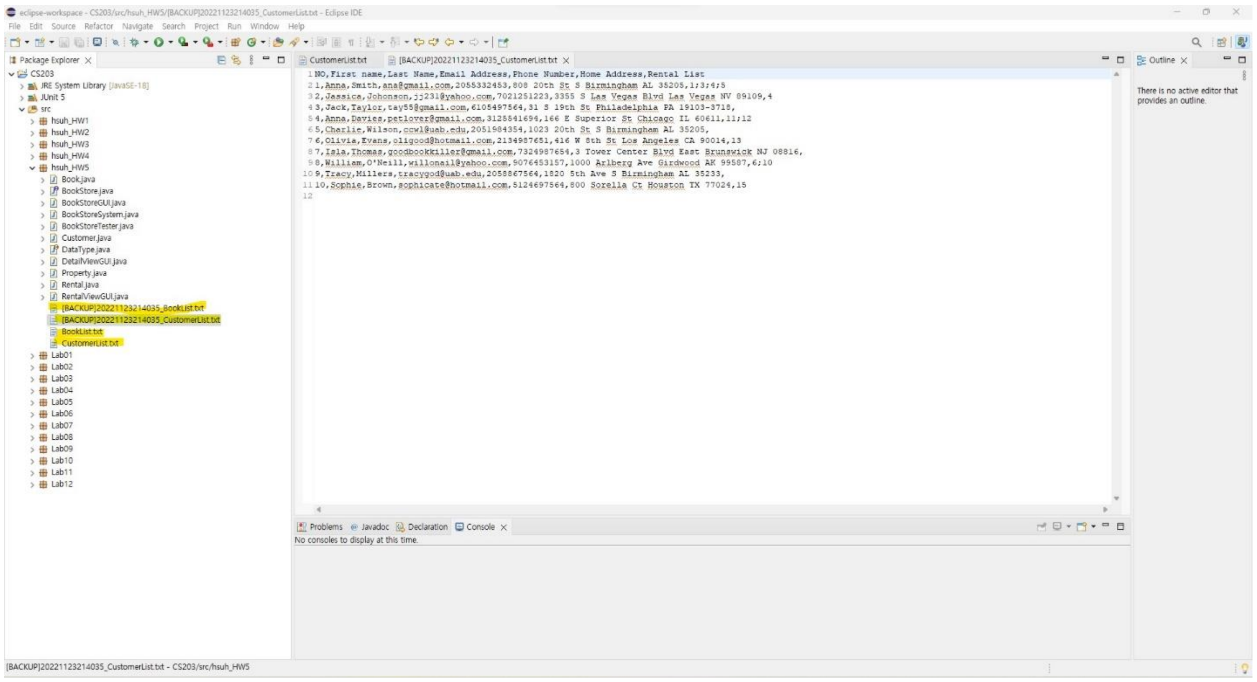
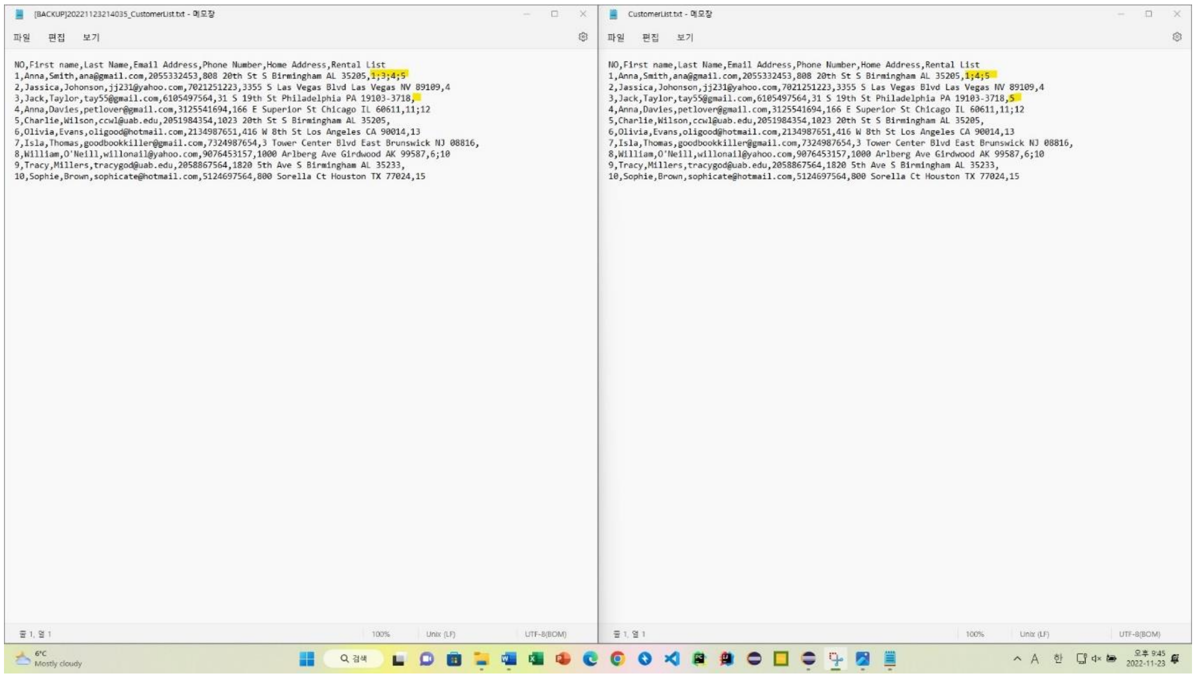
[Screenshot] Database update confirmation

If choose to save the changes in data system, then system will back the original files then update the change like as below:



```
NO,First name,Last Name,Email Address,Phone Number,Home Address,Rental List
1,Anna,Smith,ana@gmail.com,2055332453,808 20th St S Birmingham AL 35205,1;3;4;5
2,Jassica,Johonson,jj231@yahoo.com,7021251223,3355 S Las Vegas Blvd Las Vegas NV 89109,4
3,Jack,Taylor,tay55@gmail.com,6105497564,31 S 19th St Philadelphia PA 19103-3718,
4,Anna,Davies,petlover@gmail.com,3125541694,166 E Superior St Chicago IL 60611,11;12
5,Charlie,Wilson,ccwl@uab.edu,2051984354,1023 20th St S Birmingham AL 35205,
6,Olivia,Evans,oligood@hotmail.com,2134987651,416 W 8th St Los Angeles CA 90014,13
7,Isla,Thomas,goodbookkiller@gmail.com,7324987654,3 Tower Center Blvd East Brunswick NJ 08816,
8,William,O'Neill,willonail@yahoo.com,9076453157,1000 Arlberg Ave Girdwood AK 99587,6;10
9,Tracy,Millers,tracygod@uab.edu,2058867564,1820 5th Ave S Birmingham AL 35233,
10,Sophie,Brown,sophicate@hotmail.com,5124697564,800 Sorella Ct Houston TX 77024,15
```

[Screenshot] File creation result



[BACKUP]20221123214035_CustomerList.txt - 메모장

```
NO,First name,Last Name,Email Address,Phone Number,Home Address,Rental List
1,Anna,Smith,ana@gmail.com,2055332453,808 20th St S Birmingham AL 35205,1;3;4;5
2,Jassica,Johonson,jj231@yahoo.com,7021251223,3355 S Las Vegas Blvd Las Vegas NV 89109,4
3,Jack,Taylor,tay55@gmail.com,6105497564,31 S 19th St Philadelphia PA 19103-3718,
4,Anna,Davies,petlover@gmail.com,3125541694,166 E Superior St Chicago IL 60611,11;12
5,Charlie,Wilson,ccwl@uab.edu,2051984354,1023 20th St S Birmingham AL 35205,
6,Olivia,Evans,oligood@hotmail.com,2134987651,416 W 8th St Los Angeles CA 90014,13
7,Isla,Thomas,goodbookkiller@gmail.com,7324987654,3 Tower Center Blvd East Brunswick NJ 08816,
8,William,O'Neill,willonail@yahoo.com,9076453157,1000 Arlberg Ave Girdwood AK 99587,6;10
9,Tracy,Millers,tracygod@uab.edu,2058867564,1820 5th Ave S Birmingham AL 35233,
10,Sophie,Brown,sophicate@hotmail.com,5124697564,800 Sorella Ct Houston TX 77024,15
```

CustomerList.txt - 메모장

```
NO,First name,Last Name,Email Address,Phone Number,Home Address,Rental List
1,Anna,Smith,ana@gmail.com,2055332453,808 20th St S Birmingham AL 35205,1;4;5
2,Jassica,Johonson,jj231@yahoo.com,7021251223,3355 S Las Vegas Blvd Las Vegas NV 89109,4
3,Jack,Taylor,tay55@gmail.com,6105497564,31 S 19th St Philadelphia PA 19103-3718,5
4,Anna,Davies,petlover@gmail.com,3125541694,166 E Superior St Chicago IL 60611,11;12
5,Charlie,Wilson,ccwl@uab.edu,2051984354,1023 20th St S Birmingham AL 35205,
6,Olivia,Evans,oligood@hotmail.com,2134987651,416 W 8th St Los Angeles CA 90014,13
7,Isla,Thomas,goodbookkiller@gmail.com,7324987654,3 Tower Center Blvd East Brunswick NJ 08816,
8,William,O'Neill,willonail@yahoo.com,9076453157,1000 Arlberg Ave Girdwood AK 99587,6;10
9,Tracy,Millers,tracygod@uab.edu,2058867564,1820 5th Ave S Birmingham AL 35233,
10,Sophie,Brown,sophicate@hotmail.com,5124697564,800 Sorella Ct Houston TX 77024,15
```

[Screenshot] Comparison of the original and the updated database file

References

1. Class materials including lab slides.
2. Previous code materials, such as HW3 and HW4.
3. Relative file path setting - Java Files.walk examples
   [Link] https://mkyong.com/java/java-files-walk-examples/
4. Singleton Pattern - Java Singleton Design Pattern Best Practices with Examples
   [Link] https://www.digitalocean.com/community/tutorials/java-singleton-design-pattern-best-practices-examples