

Final Project  
LibraryThreadManager.java

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## 1. Program Summary

### 1.1. Book.java

This class has attributes of Book. I added an Integer field of maximum number. Also it includes two methods.

### 1.2. LibraryClient1.java

### 1.3. LibraryClient2.java

These two classes implement threads by Runnable interface including run methods. They have borrow and return methods which are thread safe by using synchronized blocks. If their request is blocked, they will be cancelled by using interrupt methods. Also, each class has a method for showing books the client holds.

### 1.4. LibraryServer.java

This class creates a lock object and condition objects for controlling client classes in which are implemented threads.

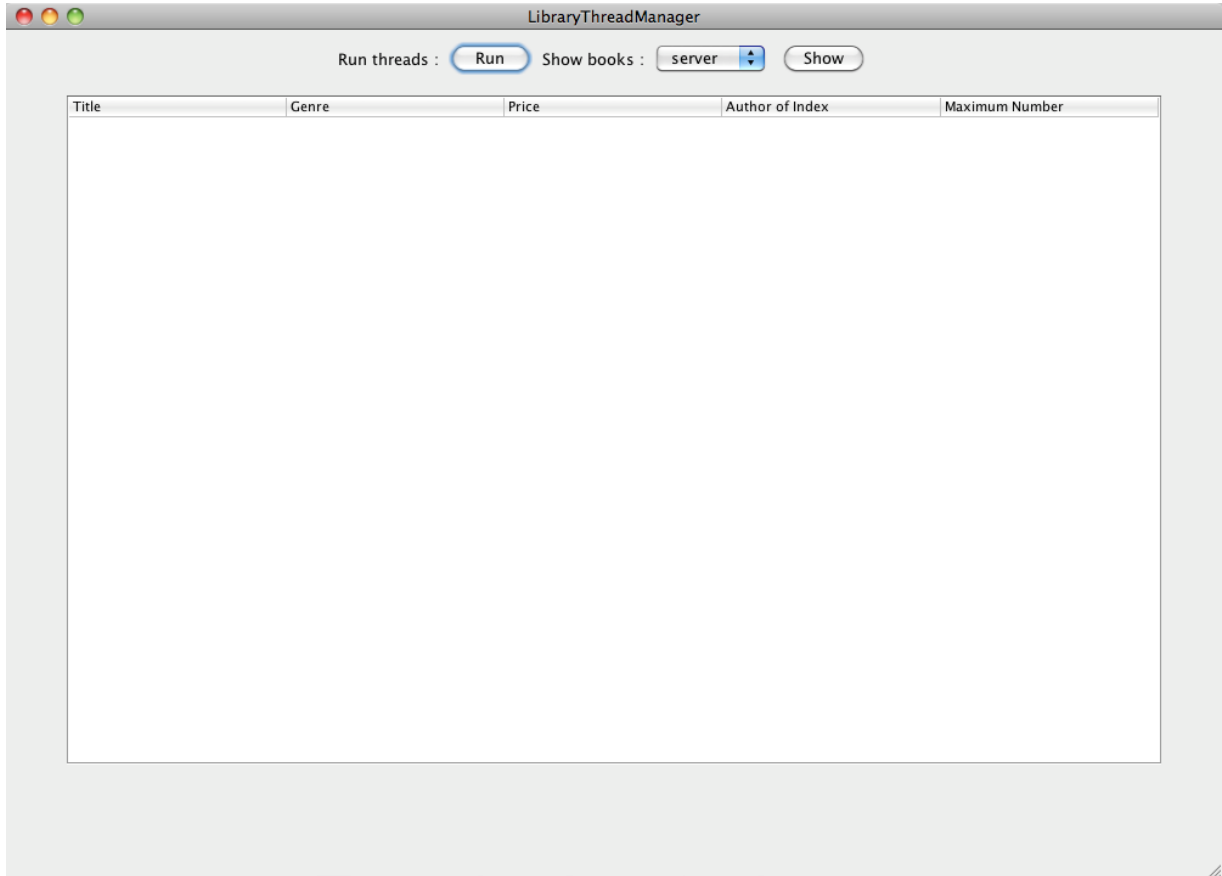
In addition to the function of controlling threads, it creates a master book index list and a master book list. It also has a method for showing books the book list holds.

### 1.5. LibraryThreadManager.java

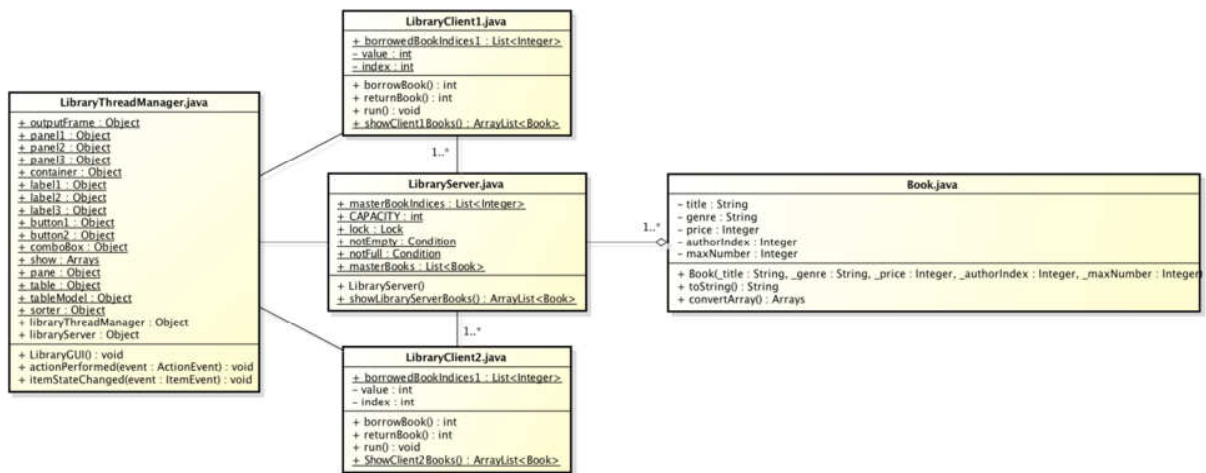
This is a manager class that includes the main method. It starts and terminates threads by using ExecutorService. It also creates a Swing GUI.

## 2. Execution Result

LibraryThreadManager



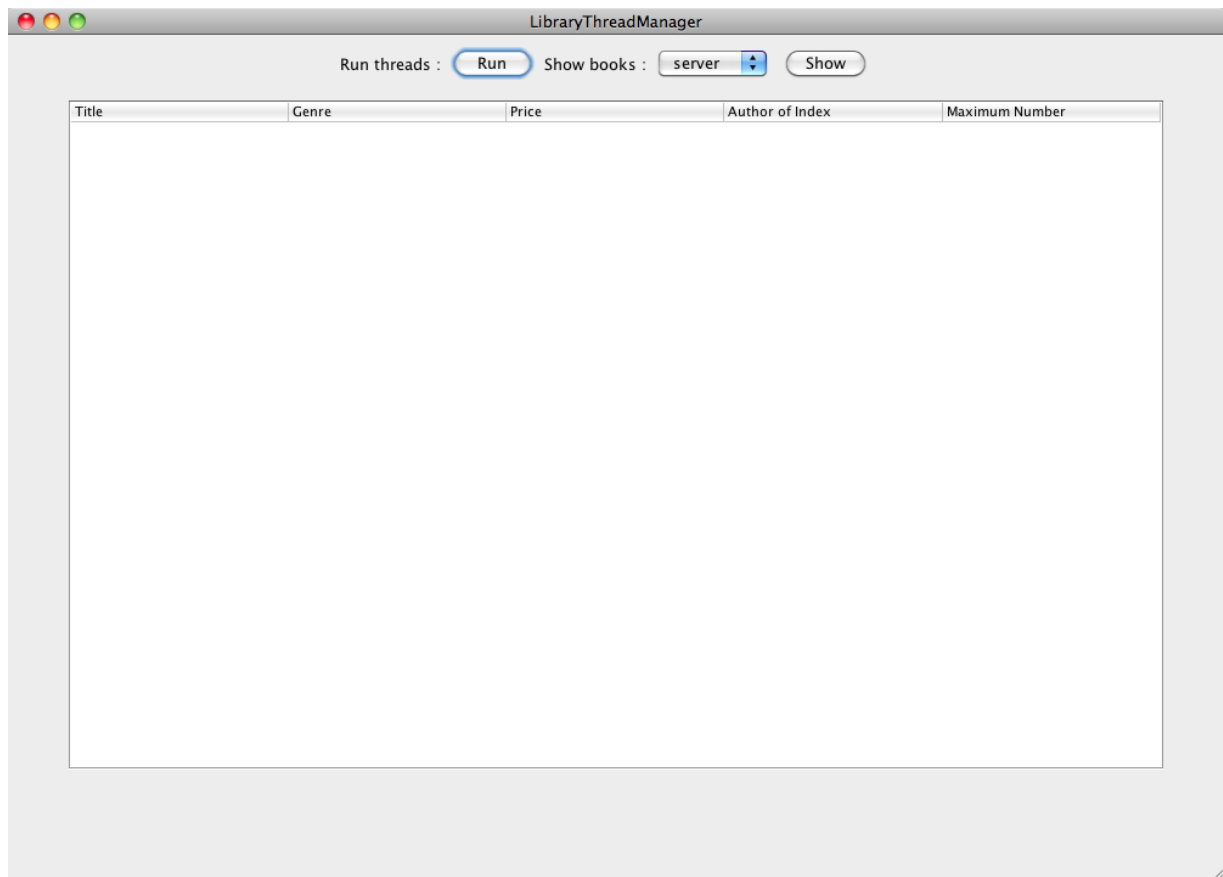
### 3. Class Diagram



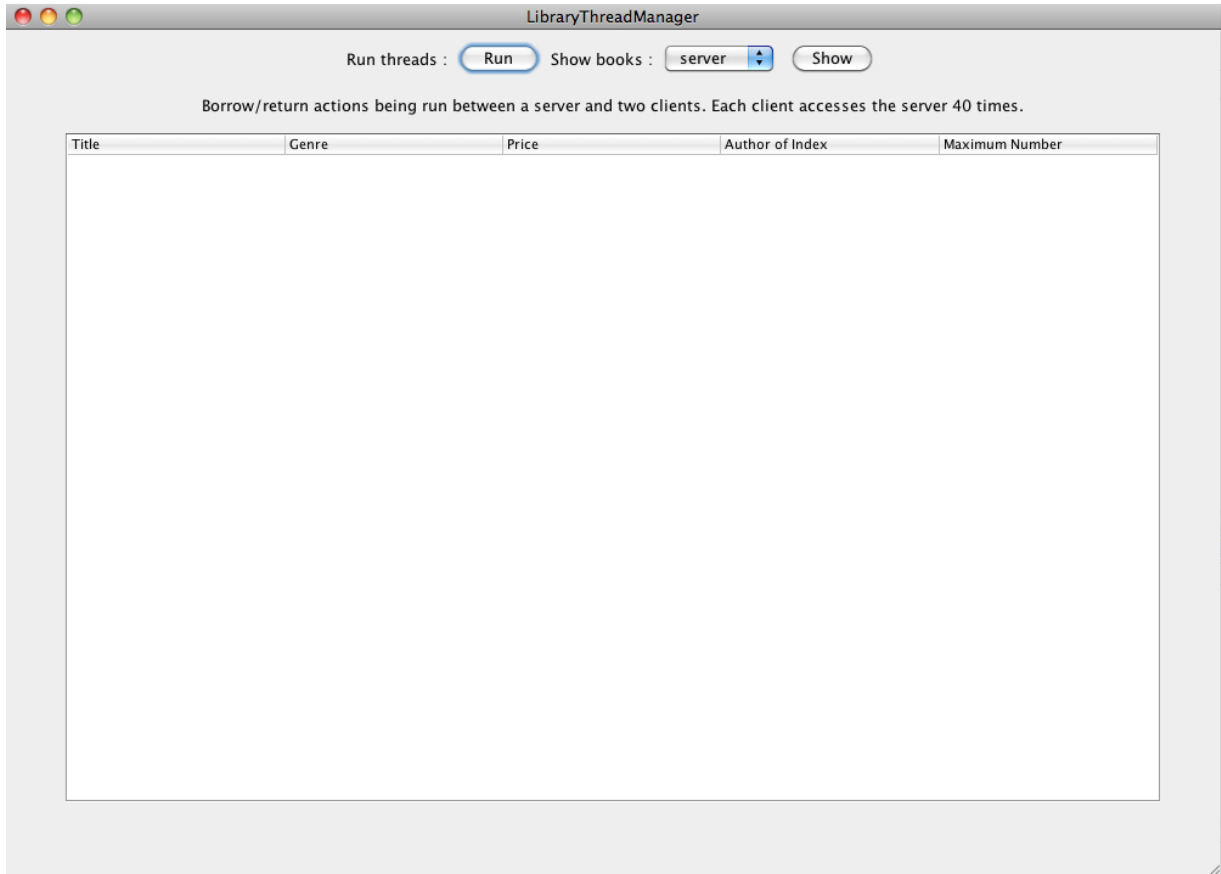
### 4. Operating Instructions & Test Cases

#### 4.1. Run threads

- 1) Click on "Run" button. Then, thread actions will start automatically in the background.



- 2) After clicking on "Run" button, you get a message "Borrow/return actions being run between a server and two clients. Each client accesses the server 40 times." below the button.



- 3) All the client access transactions are shown in the console. The left column is actions of Client1, and the right column is actions of Client2.

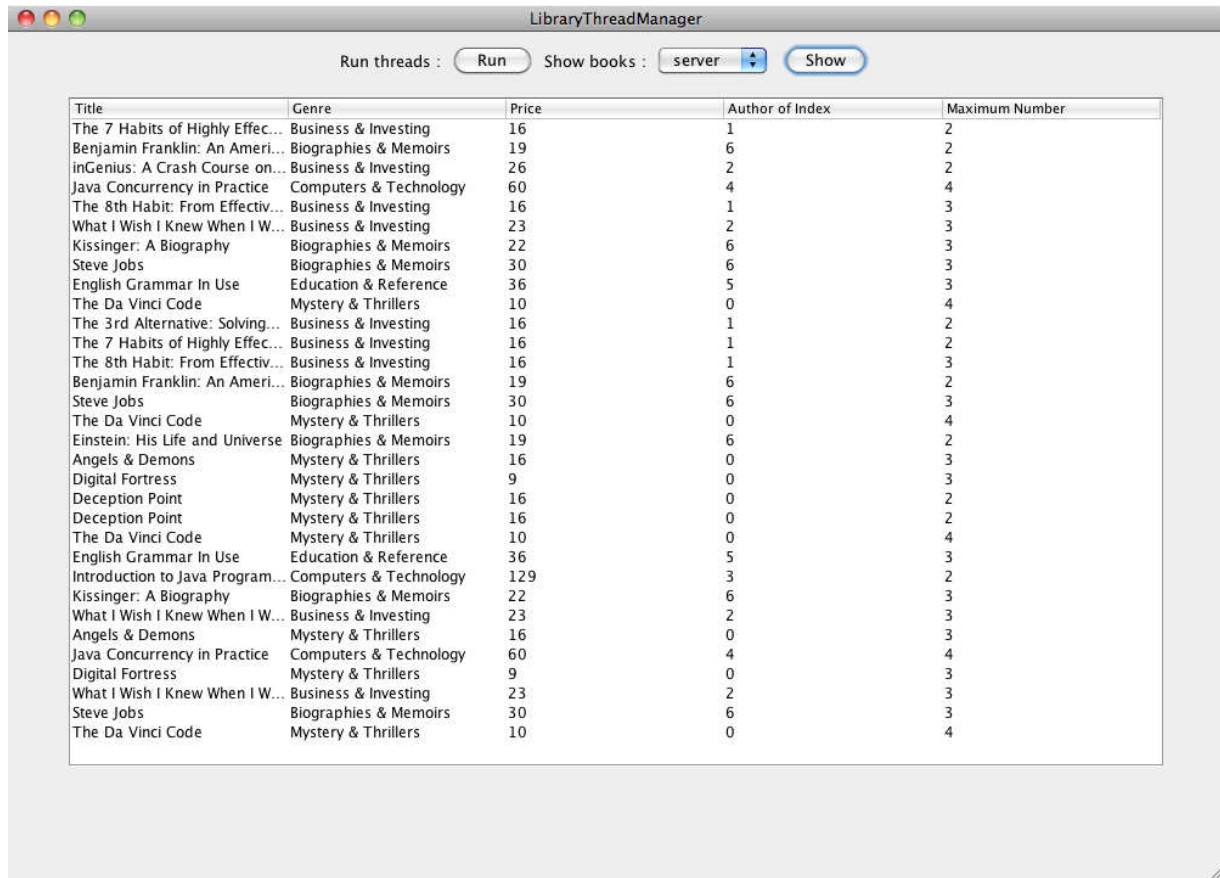
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<terminated> LibraryThreadManager [Java Application] /System/Library/Java/JavaVirtualMachines/1.6.0.jdk/Contents/Home/bin/java (May 13, 2012 8:
Client1 borrows book index 4
Client2 borrows book index 2
Client1 borrows book index 4
Client2 returns book index 11
Client1 borrows book index 1
Client2 returns book index 9
Client1 borrows book index 12
Client2 returns book index 5
Client1 returns book index 4
Client2 returns book index 10
Client1 returns book index 6
Client2 borrows book index 7
Client1 borrows book index 12
Client2 borrows book index 2
Client1 returns book index 12
Client2 returns book index 2
Client1 borrows book index 9
Client2 borrows book index 4
Client1 borrows book index 11
Client2 returns book index 4
Client1 borrows book index 2
Client2 returns book index 2
Client1 returns book index 1
Client2 borrows book index 13
Client1 borrows book index 10
Client2 returns book index 13
Client1 returns book index 9
Client2 borrows book index 3
Client1 returns book index 2
Client2 borrows book index 12
Client1 borrows book index 8
Client2 returns book index 3
Client1 borrows book index 4
Client2 borrows book index 7
Client1 borrows book index 1
Client2 borrows book index 11
Client1 returns book index 11
Client2 borrows book index 0
Client1 returns book index 8

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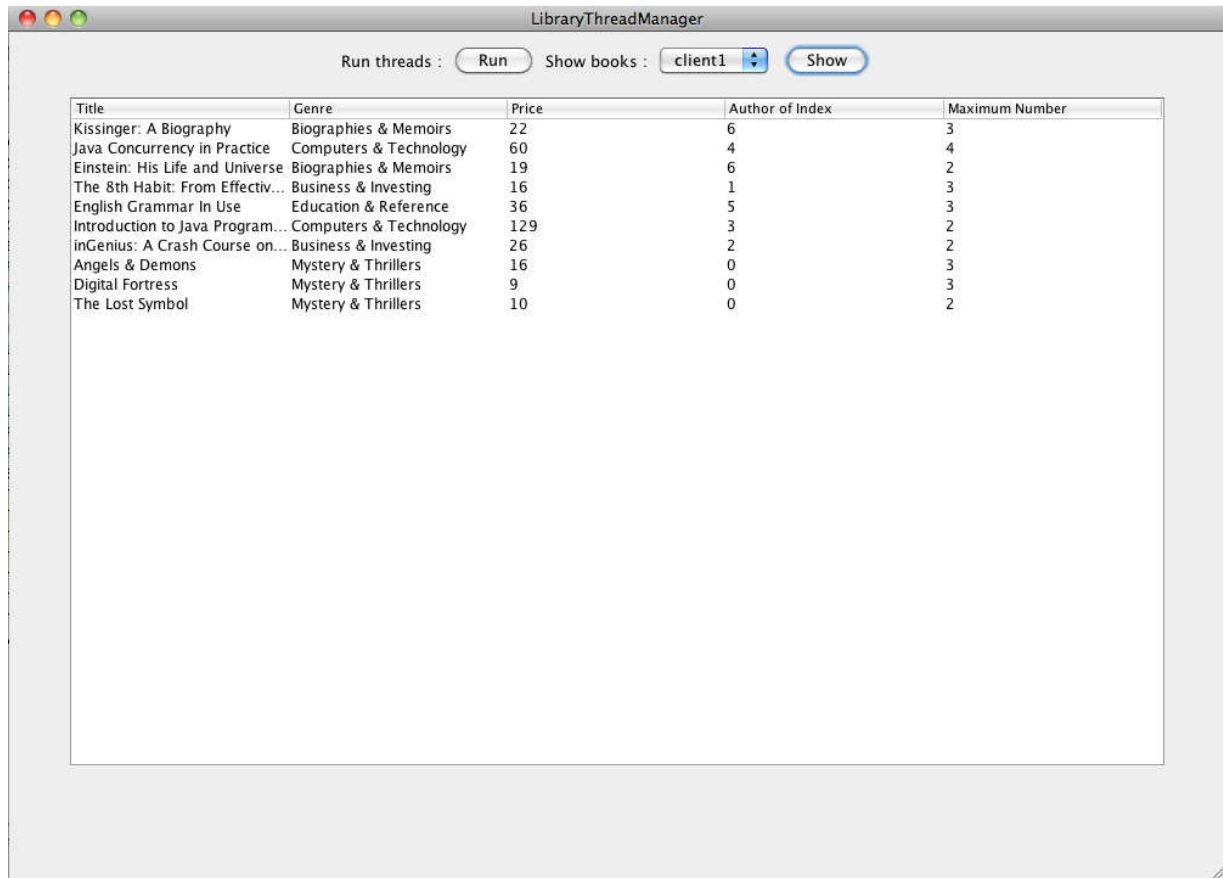
#### 4.2. Show books

- 1) After threads terminate, you can confirm which objects hold what books. Select "server" from the combo box, and click on "show" button. Then, you get the books Server holds in the table.

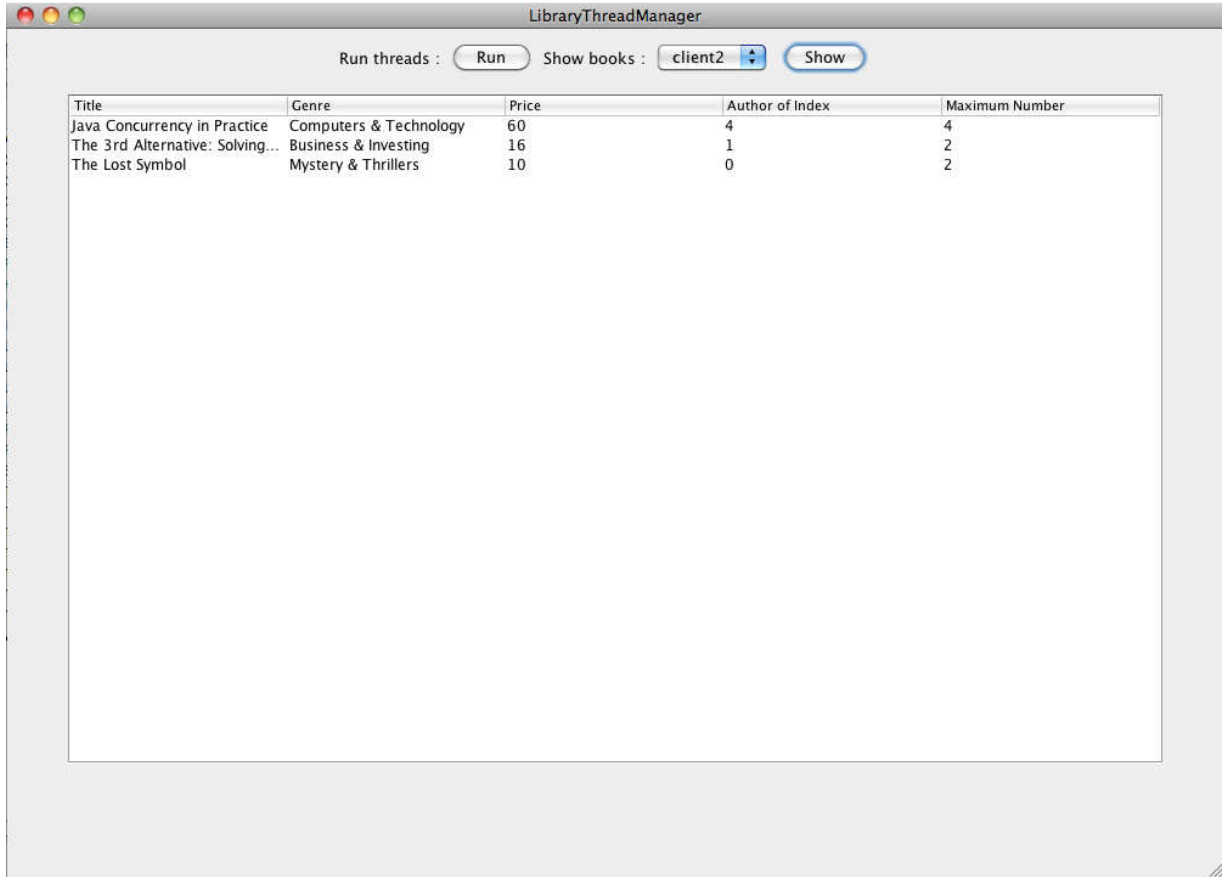


- 2) Select "client1" from the combo box, and click on "show" button. Then, you get the books Client1 holds in the table.





- 3) Select "client2" from the combo box, and click on "show" button. Then, you get the books Client2 holds in the table.



## 5. Test Data

### 5.1. Book Table

index	Title	Genre	price	auth of index	maximum number
0	The Lost Symbol	Mystery & Thrillers	\$10	0	2
1	Angels & Demons	Mystery & Thrillers	\$16	0	3
2	The Da Vinci Code	Mystery & Thrillers	\$10	0	4
3	Deception Point	Mystery & Thrillers	\$16	0	2
4	Digital Fortress	Mystery & Thrillers	\$9	0	3
5	The 7 Habits of Highly Effective People	Business & Investing	\$16	1	2
6	The 8th Habit: From Effectiveness to Greatness	Business & Investing	\$16	1	3
7	The 3rd Alternative: Solving Life's Most Difficult Problems	Business & Investing	\$16	1	2
8	What I Wish I Knew When I Was 20	Business & Investing	\$23	2	3
9	inGenius: A Crash Course on Creativity	Business & Investing	\$26	2	2
10	Introduction to Java Programming, Comprehensive	Computers & Technology	\$129	3	2
11	Java Concurrency in Practice	Computers & Technology	\$60	4	4
12	English Grammar In Use	Education & Reference	\$36	5	3
13	Steve Jobs	Biographies & Memoirs	\$30	6	3
14	Einstein: His Life and Universe	Biographies & Memoirs	\$19	6	2
15	Benjamin Franklin: An American Life	Biographies & Memoirs	\$19	6	2
16	Kissinger: A Biography	Biographies & Memoirs	\$22	6	3