CS256 Lab 10 - Alexandria was not built in a day, so you will have six

Value: 30 points, plus 10 points extra credit
Due: Sunday 17 November @ 16:00 (design document due for class on Wednesday 6 Nov and Friday 8 Nov)
Submission Format: Design document (image) and a Python script, lab_10.py, optionally lab_10_ec.py and my-lib-transactions.dat.

This lab is mostly about software design, the problem description is generic enough that you will use your own approach to design, build, and test the solution. This will give us more practice designing objects, writing code, and exploring the process of teasing-out the mechanics of a software design from the description of a problem.

Setup

The New York Public Library needs a new software system for managing book acquisitions, removals, check-outs, and check-ins; they have come to your tech-startup for a solution. They explain that the system has these components:

- books with an ISBN number and title
- patrons with an ID number

The system supports these transactions:

- add a copy of a book, remove a copy of a book
- add a patron, remove a patron
- check-out a book (if it's available, and they are a patron)
- check-in a book

To facilitate your work they have provided a fragment of the transaction log from last year which has examples of each of the transactions:

```
addPatron, 4455
addPatron, 2266
addBook, 076790818X, “A Short History of Nearly Everything”
checkout, 4455, 076790818X
checkin, 4455, 076790818X
removeBook, 1982102314
removePatron, 2266
```

Tasks

Your software will read and process a transaction log in the same format. They explain that unfortunately, people sometimes try to check-out books with nonexistent patron IDs, or check-out books when there are no available copies, or check-in books that were not checked-out from this library or not checked-out by them. Your system will need to watch for all of these bad transactions and reject them.

To demonstrate your software to the NYCPL's staff you will process a transaction log and then display the following statistics: total books held, number of check-outs, number of check-ins, the ISBN, title, and check-out count of the book that was checked-out most often, and the ID and check-out count of the patron that checked-out the most books, as so (this is **not** a canon):

```
10100200
15000
15002
076790818X, "A Short History of Nearly Everything", 104
2244, 31
```

Implementation Notes

- Design your solution on paper first, again there is more of your design in this lab than in previous ones. Make sure your design covers all of the assignment, you will be turning-in an image of it on Wednesday and Friday.
- Your script must have one command line argument, -i for the input transaction file.
- Your script must use the main() technique, it helps organize the code and it makes reuse much easier.

Extra Credit

- (10 points) There are a number of invalid transactions that the library staff neglected to mention and that the sample log file does not illustrate. Figure-out what these are and improve your solution to account for them. At the top of your extra credit source file briefly describe each of the additional invalid transactions that you now catch. You will need to manufacture a small data file with the appropriate characteristics to illustrate that your solution works correctly. Turn-in both the script and your data file.