Databases
Homework 1
To receive full credit for this assignment, all your writing should be legible and all pages you submit should be stapled together. You may, of course, type your responses if you'd like.

Assume you have been hired by the Memphis Public Library to analyze their database system which manages records of books, and patrons who have checked out books. They have the following relations:

Book(title, authorName, publisher, year, genre, copies)
Patron(patronName, libCard, favGenre, birthday)
Author(authorName, hometown, birthday)
Checkout(libCard, title, dayOut, dayDue, dayReturned)

In the relations above, it should be clear what most of the attributes mean, but here are some clarifications:
- title: title of a book
  - You may assume that every book in the library has a unique title.
- libCard: library card number of a patron
  - You may assume every library patron has a unique library card number.
- You may assume the names of authors are unique as well.
- favGenre: the favorite genre of a patron (they can have only one favorite genre)
- dayOut, dayDue, dayReturned: the date that a book was checked out, the date it was due, and the date it was actually returned (the returned date might be before or after the actual due date).
  - Note that date attributes can be compared with <, <=, etc, just like other attributes.

Write relational algebra expressions for the following queries. You may find it helpful to use the "linear notation for algebraic expressions" described in section 2.4.13 (starting on page 51). This notation lets you give temporary names to parts of a relational algebra expression, thus letting you build a big expression out of smaller pieces, which is usually easier to manage than writing one huge expression.

1. Retrieve the names of all authors who were born in Memphis.

2. Retrieve the names of patrons and their birthdays who were born in the 1990s.

3. Retrieve the titles and authors of all mystery or sci-fi books published in 2015 or later.

4. Retrieve the titles and genres of all books published by authors born before 1970.

5. Retrieve the names of all patrons who ever checked out a romance novel and returned it late.

6. Retrieve a list of all patron names matched up with the titles and authors of books that match each patron's favorite genre.

7. Retrieve a list of all book titles were ever checked out (at least once) in 2016 and (at least once) in 2017.

8. Retrieve a list of all authors who have never had any of their books checked out.

9. Retrieve a list of all the publishers who have published books in multiple (at least two) different genres.

10. Retrieve a list of all patrons who have ever checked out multiple (at least two) books by the same author on the same day.