Programming and Data Structures
Assignment 3: Exception Handling and File IO

Objectives of the assignment

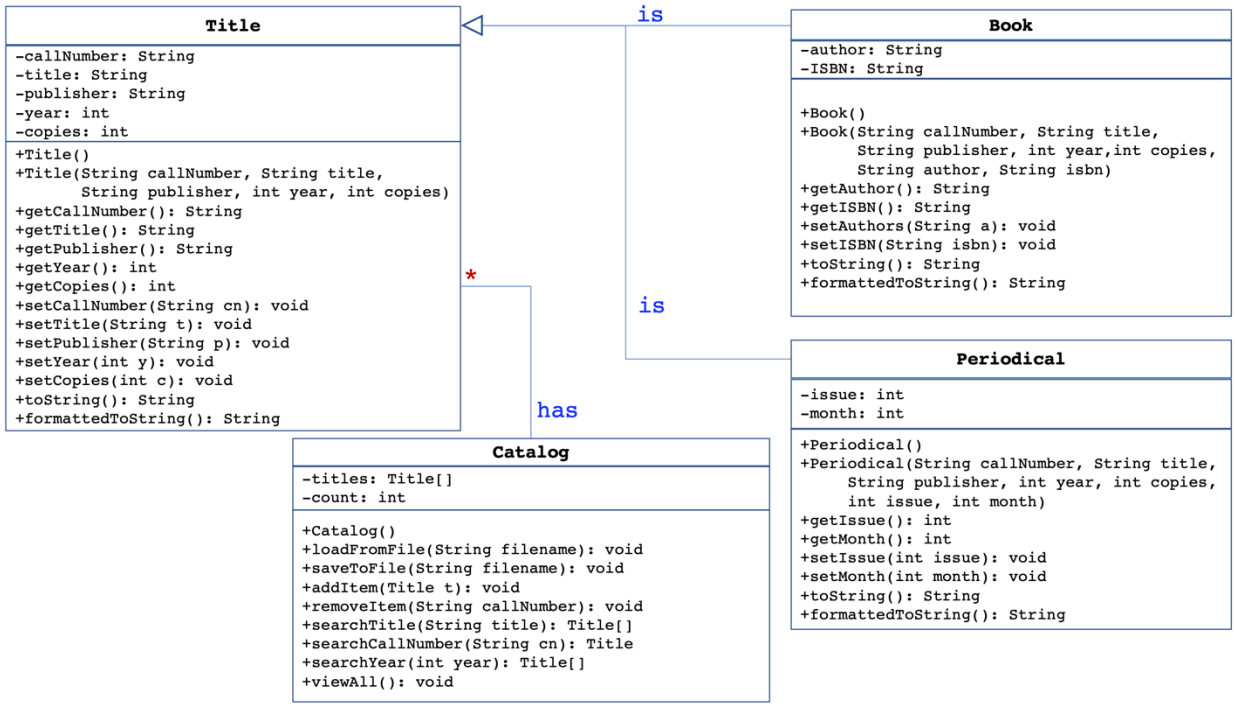
Students should demonstrate the following abilities:

1. Create classes and inheritance/association relationships from a given UML diagram
2. Create Exception classes that inherit Java class exceptions
3. Use Java Exception Handling mechanisms to throw and catch exceptions
4. Access text files for reading and writing to load and save data in their programs

---

The assignment consists in creating a program named "`LibraryManager`" to help the user manage the titles in a library catalog.

1. Implement the classes and the relationships shown in the UML diagram[1] below.



[1] Method **`toString()`** returns the data members separated with a **`"\n"`** and method **`formattedToString()`** returns the data members with a label before the value of each attribute. For example, the title is returned as **`"Title: " + title + "\n"`**.

2. Create two exception classes **`InvalidDate()`** and **`InvalidCallNumber`** that inherit the class **`InputMismatchException`** and have only two constructors (no-arg and one with a **`String`** parameter)
3. Create a class **`LibraryManager`** with a **`main`** method to do the following:
   a. Create an instance of the class **`Catalog`** named **`myLibrary`** using the default constructor that creates the array **`titles`** with capacity 1000 and initializes **`count`** to 0.
   b. Call the method **`loadFromFile`** on the instance **`myLibrary`** and pass the filename `"titles.txt"` as the argument. The method reads the information of the titles from the text file and creates an instance of **`Book`** or **`Periodical`** depending on the value of the field **`callNumber`** (starting with **`B`** for books and **`P`** for periodicals). The created instance is then added to array **`titles`** and **`count`** is incremented. Note that the file *`titles.txt`* contains six consecutive lines for each book or periodical with one attribute on each line.
   c. Prompt the user to select one of the following operations repeatedly until they choose to exit the program (operation 7).

      1. ***Find a title with a given call Number***: Prompt the user to enter the call number and check if it is valid using the method **`checkCallNumber`** which throws an exception of type **`InvalidCallNumber`** with the message *`"Invalid call number – Must be B-ddd-ddd-ddd or P-ddd-ddd-ddd"`*. Your method must use regular expressions to check the format of the call number. When the call number is validated, call the method **`searchCallNumber()`** on **`myLibrary`** and display the information of the title if found or an error message otherwise.
      2. ***Find titles with a given title***: Prompt the user to enter a string for the title and call the method **`searchTitle()`** on **`myLibrary`**. Display the list of titles returned by the method if the list is not empty or the message `"No titles found."` otherwise.
      3. ***Find titles with a given year***: Prompt the user to enter a year and check if the year is between 1900 and 2020. If it is not, throw an exception of type **`InvalidDate`**

with the message "`Invalid year – must be from 1900 to 2020`". If the year is valid, call the method **`searchYear()`** on **`myLibrary`**. Display the list of titles returned by the method if the list is not empty or the message "`No titles found.`" otherwise.

4. ***Add a new title***: Prompt the user to enter the title, the publisher, the year, and the number of copies. Check the year the same way you did in 3. Then, prompt the user to enter the type of title they want to add (book or periodical). If they choose book, prompt the user to enter the call number, the author, and the ISBN. Check the call number and throw an exception of type **`InvalidCallNumber`** if it not valid for a book. If they choose periodical, prompt the user to enter a call number, an issue number and a month. Check the call number and also the month. If the month is not between 1 and 12, throw an exception of type **`InvalidDate()`** with the message "`Invalid month – Must be from 1 to 12`". Create an instance of class **`Book`** or **`Periodical`** (depending on user's choice) and store it in a variable of type **`Title`**. Call the method **`addItem()`** on **`myLibrary`** to add the new title to the list of titles.
5. ***Remove a title with a given call number***: Prompt the user to enter a string for the call number and check its value using the method **`checkCallNumber`**. Call the method **`removeItem()`** on **`myLibrary`** to remove it from the list of titles.
6. ***View the list of titles in the library***: Call the method **`viewAll()`** on **`myLibrary`** to display the list of titles in the library (call number, title, publisher, and year only)
7. ***Exit the program***: Call the method **`saveToFile()`** on **`myLibrary`** with the argument "`titles.txt`" to save the content of the array **`titles`** in the text file `titles.txt`.

You program must handle the following exceptions: **`InvalidDate`**, **`InvalidCallNumber`**, and **`FileNotFoundException`**.

A sample run of the program is provided below for testing.

```
---------------------------------  RUN 1 ------------------------------------
Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
6
Call Number   Title                                      Publisher        Year
B-111-111-111 Introduction to Java Programming           Pearson          2018
P-222-222-222 IEEE Transactions on Computers             IEEE Press       1980
B-222-111-111 Programming and Data Structures in Java    McGraw Hill      2016
B-222-111-000 Engineering Your Future                    Oxford           2020
B-222-111-110 Society, Ethics, and Technology            Pearson          2016
B-222-111-101 Systems Engineering and Analysis           Prentice Hall    2010
P-000-111-111 IEEE Transactions on Affective Computing   IEEE             2020
P-111-000-110 IEEE Annals of History of Computing        IEEE             2020
P-111-222-333 IEEE Transactions on Communications        IEEE             1990
B-000-000-111 Introduction to C language                 Pearson          2018
P-111-111-111 IEEE Spectrum                              IEEE             1975

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
1
Enter a callNumber:
B-111-111-11
Invalid Call Number. Must be B-ddd-ddd-ddd or P-ddd-ddd-ddd

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
1
Enter a callNumber:
B-111-111-111
Title found:
Call Number: B-111-111-111
Title: Introduction to Java Programming
Publisher: Pearson
Year: 2018
Copies: 10
Author: M. Savitch
ISBN: 9876579310
```

```
Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
2
Enter a title:
Introduction to Java Programming
List of titles found: 1
Call Number    Title                                Publisher        Year
B-111-111-111  Introduction to Java Programming      Pearson          2018

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
3
Enter a year:
2030
Invalid Year. Must be between 1900 and 2020.

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
3
Enter a year:
2020
List of titles found: 3
Call Number     Title                                      Publisher   Year
B-222-111-000   Engineering Your Future                    Oxford      2020
P-000-111-111   IEEE Transactions on Affective Computing   IEEE        2020
P-111-000-110   IEEE Annals of History of Computing        IEEE        2020

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
4
```

```
Enter the title:
Data Science
Enter the publisher:
McGraw Hill
Enter year of publication:
2018
Enter number of copies:
5
Enter type of title (book/periodical):
book
Enter the call number (B-ddd-ddd-ddd):
B-333-333-333
Enter the author:
F. Franklin
Enter ISBN (10 digits):
1122334455

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
6
Call Number   Title                                        Publisher       Year
B-111-111-111 Introduction to Java Programming             Pearson         2018
P-222-222-222 IEEE Transactions on Computers               IEEE Press      1980
B-222-111-111 Programming and Data Structures in Java      McGraw Hill     2016
B-222-111-000 Engineering Your Future                      Oxford          2020
B-222-111-110 Society, Ethics, and Technology              Pearson         2016
B-222-111-101 Systems Engineering and Analysis             Prentice Hall   2010
P-000-111-111 IEEE Transactions on Affective Computing     IEEE            2020
P-111-000-110 IEEE Annals of History of Computing          IEEE            2020
P-111-222-333 IEEE Transactions on Communications          IEEE            1990
B-000-000-111 Introduction to C language                   Pearson         2018
P-111-111-111 IEEE Spectrum                                IEEE            1975
B-333-333-333 Data Science                                 McGraw Hill     2018

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
5
Enter the call number (B-ddd-ddd-ddd):
P-111-222-333

Select an operation:
1: Find Title
2: Search by Title
```

```
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
6
Call Number   Title                                    Publisher        Year
B-111-111-111 Introduction to Java Programming         Pearson          2018
P-222-222-222 IEEE Transactions on Computers           IEEE Press       1980
B-222-111-111 Programming and Data Structures in Java  McGraw Hill     2016
B-222-111-000 Engineering Your Future                  Oxford           2020
B-222-111-110 Society, Ethics, and Technology          Pearson          2016
B-222-111-101 Systems Engineering and Analysis         Prentice Hall    2010
P-000-111-111 IEEE Transactions on Affective Computing IEEE             2020
P-111-000-110 IEEE Annals of History of Computing      IEEE             2020
B-000-000-111 Introduction to C language               Pearson          2018
P-111-111-111 IEEE Spectrum                            IEEE             1975
B-333-333-333 Data Science                             McGraw Hill      2018

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
7
--------------------------- RUN 2 after RUN 1 ------------------------------
Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
6
Call Number   Title                                    Publisher        Year
B-111-111-111 Introduction to Java Programming         Pearson          2018
P-222-222-222 IEEE Transactions on Computers           IEEE Press       1980
B-222-111-111 Programming and Data Structures in Java  McGraw Hill     2016
B-222-111-000 Engineering Your Future                  Oxford           2020
B-222-111-110 Society, Ethics, and Technology          Pearson          2016
B-222-111-101 Systems Engineering and Analysis         Prentice Hall    2010
P-000-111-111 IEEE Transactions on Affective Computing IEEE             2020
P-111-000-110 IEEE Annals of History of Computing      IEEE             2020
B-000-000-111 Introduction to C language               Pearson          2018
P-111-111-111 IEEE Spectrum                            IEEE             1975
B-333-333-333 Data Science                             McGraw Hill      2018

Select an operation:
1: Find Title
2: Search by Title
3: Search by Year
```

```
4: Add Title
5: Remove Title
6: View All Titles
7: Exit
7
```

Submit the following java files: **`InvalidDate.java`**, **`InvalidCallNumber.java`**, **`Title.java`**, **`Book.java`**, **`Periodical.java`**, **`Catalog.java`**, and **`LibraryManager.java`**. Do not forget to include appropriate Javadoc documentation in all your classes.