

# Development of a Software Application for a Community Library to Manage Its Movie DVDs

## Important Notes:

Staff Username: Admin

Staff Password: Admin

## Data Structures used:

- Array
- Binary Tree

Binary Tree was selected to store the movie DVDs in the management system that would be available for renting. Binary tree decreases the time complexity while searching, inserting, deleting which were the main functions that were required in the system. **Worst-case big-O =  $O(\log n)$ .**

On the other hand, I used Array to store the customers/borrowers in the management system and each customer has its own array of DVDs that a customer borrowed. I first tried using queue which is similar in concept with stack (FIFO vs FILO) but it wouldn't have been a good data structure as finding a customer in a queue would be very inefficient as it is easier to fetch the first and the last objects but not some object that is in the middle. Although it has the worst case time complexity of  $O(1)$ , it would be ineffective in our case. Hence I continued using Array. For array I wanted to use QuickSort to sort the customer array or the borrowed movie array (by single customer) so that it would be easier to do binary search and decrease the time to search in array to Big-o of  $O(\log n)$ . But as I was facing bugs and errors, I decided instead of using binary search, I'll use linear search as I wanted the system to work properly before submission. I still have QuickSort class that I didn't use and BinarySearch for customers which I commented, for future improvements.

## Classes:

The DVD class stores the information about the DVDs.

The Borrower class stores the information about the borrower.

The DVDCollection Class stores the instances of the Borrower and DVD which are used every time the management system is used.

### **Algorithm used for making “adding a movie DVD to the movie DVD management system” function.**

I used BinaryTree search and Insert algorithm to make this function. This is because it would make the Average Time Complexity to insert of  $O(\log n)$ . Even though in extreme case where staff is adding movies in an order the Worst Time Complexity to insert would be  $O(n)$ , but I assumed that it is a rare case. Same goes for searching algorithm for the B-tree. I used separate classes called BSTree and BTreeNode to help make the code neater. The Movies are displayed in a with the titles being in alphabetical order and stored the same way. BTreeNode stores a DVD in its root and 2 child BTreeNodes. BSTree has also got methods which with helps display all the available movies in an InOrderTraverse (in alphabetical order) or display movies of certain genre in an InOrderTravers.

## Testing:

### 1) Staff login:

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
Welcome to the Movie DVD library
-----Login-----

    1 - Staff
    n - Close the app
-----

Select an option (1 or n) and press Enter key: 1
Please enter the username and password below or type b and press enter to go back.
-----
Username:WrongUsername
-----Incorrect Username!-----
Please enter the username and password below or type b and press enter to go back.
-----
Username:admin
Password:Wrongpassword
-----Password Incorrect-----
Please enter the username and password below or type b and press enter to go back.
-----
Username:admin
Password:admin
```

### 2) Displaying all movie titles and their quantities.

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
-----Staff Menu-----
Choose a function from the following options:
    1 - Display all Movie DVDs
    2 - Display all Movie DVDs of a specefic genre
    3 - Add a new Movie DVD
    4 - Rent out or return a Movie DVD
    5 - Logout and return to main menu
    n - Close the app

Select an option and press Enter key: 1
Avengers | Quantity: 1
George of the jungle | Quantity: 2
Interstellar | Quantity: 1
Tenet | Quantity: 1

-----Staff Menu-----
Choose a function from the following options:
    1 - Display all Movie DVDs
    2 - Display all Movie DVDs of a specefic genre
    3 - Add a new Movie DVD
    4 - Rent out or return a Movie DVD
    5 - Logout and return to main menu
    n - Close the app

Select an option and press Enter key:
```

3) Displaying movies of a specific genre:

```
-----Staff Menu-----
Choose a function from the following options:
    1 - Display all Movie DVDs
    2 - Display all Movie DVDs of a specefic genre
    3 - Add a new Movie DVD
    4 - Rent out or return a Movie DVD
    5 - Logout and return to main menu
    n - Close the app

Select an option and press Enter key: 2

Console to the Movie DVD management system
-----

Choose from the following genres:
-----
    1 - Drama
    2 - Adventure
    3 - Family
    4 - Action
    5 - Comedy
    6 - Animated
    7 - Thriller
    8 - Other
-----
    b - Go back
    n - Close the app
```

Continue 3) After pressing 7

(please don't mind the placeholder text and dates, if you see in the code, Avengers and Tenet were made Thriller just in a hurry!)

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe

Genre selected: Thriller
-----
Title:           Avengers
Starring:        Robert Downy Jr.
Director:        James bond
Duration:        180min
Classification:  General
Release Date:    22/2/2012
Quantity:        1
-----
Title:           Tenet
Starring:        james bond
Director:        chris nolen
Duration:        140min
Classification:  General
Release Date:    29/1/2010
Quantity:        1
-----

Console to the Movie DVD management system
-----

Choose from the following genres:
-----
1 - Drama
2 - Adventure
3 - Family
```

#### 4) Adding a new DVD

It is assumed that the staff member will put the data in the same method.

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
8 - Other
-----
b - Go back
n - Close the app
b
-----Staff Menu-----
Choose a function from the following options:
1 - Display all Movie DVDs
2 - Display all Movie DVDs of a specefic genre
3 - Add a new Movie DVD
4 - Rent out or return a Movie DVD
5 - Logout and return to main menu
n - Close the app

Select an option and press Enter key: 3
-----Add a Movie DVD-----
Title: Iron Man
Starring: Tony Stark
Director: Jon Favreau
Duration: 190
Genre: Action
Classification: General
Release Date (DD): 01
Release Month (MM): 05
Release Year (YYYY): 2008

-----Staff Menu-----
Choose a function from the following options:
```

Continue 4) Checking for the new added movie:

```
Genre selected: Action

-----
Title:          Iron Man
Starring:       Tony Stark
Director:       Jon Favreau
Duration:       190min
Classification: General
Release Date:   1/5/2008
Quantity:       1

Console to the Movie DVD management system
-----

Choose from the following genres:
-----
1 - Drama
2 - Adventure
```

5) Adding another Iron man DVD, which should increase the quantity by 1.

```
Genre selected: Action
-----
Title:           Iron Man
Starring:        Tony Stark
Director:        Jon Favreau
Duration:        180min
Classification:  General
Release Date:    1/5/2008
Quantity:        2

Console to the Movie DVD management system
-----

Choose from the following genres:
-----
    1 - Drama
    2 - Adventure
```

6) Displaying lend or return movie part.

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assign
-----Lend or Return a Movie-----
    1 - Lend a movie DVD
    2 - Return a movie DVD
    3 - Show existing Borrowers
    b - Go back
    n - Close the app

Select an option and press Enter key:
```

7) Lending a movies.

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
-----Lend a Movie-----
Title of the movie that customer wants to borrow:
Tenet
Customer First Name:
Jay
Customer Last Name:
Sehmbey
Customer Contact Number:
432790019
Tenet

Customer has been added. Press enter to continue.
```

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
-----Lend a Movie-----
Title of the movie that customer wants to borrow:
Avengers
Customer First Name:
Bob
Customer Last Name:
Dey
Customer Contact Number:
43747790
Avengers

Customer has been added. Press enter to continue.
```

Looking at existing borrowers.

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
-----Lend or Return a Movie-----
1 - Lend a movie DVD
2 - Return a movie DVD
3 - Show existing Borrowers
b - Go back
n - Close the app

Select an option and press Enter key: 3
Existing customers with the movies that they have borrowed
-----
Name: Jay Sehmbey
Contact Number: 432790019

Movies currently borrowed:
Tenet
-----
Name: Bob Dey
Contact Number: 43747790

Movies currently borrowed:
Avengers
Press any key to continue
```



Going back to see the available movies in the system we can see Tenet and Avengers are missing.

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
    b - Go back
    n - Close the app

Select an option and press Enter key: b

-----Staff Menu-----
Choose a function from the following options:
    1 - Display all Movie DVDs
    2 - Display all Movie DVDs of a specefic genre
    3 - Add a new Movie DVD
    4 - Rent out or return a Movie DVD
    5 - Logout and return to main menu
    n - Close the app

Select an option and press Enter key: 1
George of the jungle | Quantity: 2
Interstellar | Quantity: 1
Iron Man | Quantity: 2

-----Staff Menu-----
Choose a function from the following options:
    1 - Display all Movie DVDs
    2 - Display all Movie DVDs of a specefic genre
    3 - Add a new Movie DVD
```

Lending Iron Man to an existing customer and seeing the decrease in quantity: Please note the changes can also be viewed in “Display all Movie DVDs of a specific genre”. As the phone number is assumed to be unique, it doesn’t matter what name the staff put it, if the number exists in the data structure, it will update the dvds in that but not change the name or contact number:

```
C:\Users\jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
-----Lend or Return a Movie-----
1 - Lend a movie DVD
2 - Return a movie DVD
3 - Show existing Borrowers
b - Go back
n - Close the app

Select an option and press Enter key: 3
Existing customers with the movies that they have borrowed
-----
Name: Jay Sehmbey
Contact Number: 432790019
Movies currently borrowed:
Tenet
Iron Man
-----
Name: Bob Dey
Contact Number: 43747790
```

```
C:\Users\jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin\Debug\netcoreapp3.1\IFN564_Assignment.exe
Genre selected: Action
-----
Title:      Iron Man
Starring:   Tony Stark
Director:   Jon Favreau
Duration:   180min
Classification: General
Release Date: 1/5/2008
Quantity:   1

Console to the Movie DVD management system
-----
Choose from the following genres:
-----
1 - Drama
2 - Adventure
3 - Family
4 - Action
5 - Comedy
6 - Animated
7 - Thriller
```

as we can see the quantity decreased.

- 8) Returning a movie (please note this doesn't work completely and gives a Null object error). It removes the movie from the customer's array of movies but is unable to insert the DVD back into the system as it tries to insert Null object which is an error starting in class Borrower and the method removeDVD. Due to lack of time, I was unable to completely solve this issue.

```
C:\Users\Jaskaran\source\repos\IFN564_Assignment\IFN564_Assignment\bin
-----Return a Movie-----
Phone Number of the Customer:
432790019
Title of the movie that is being returned:
Iron Man
```