Lab: Iterators and Comparators

Problems for exercises and homework for the "CSharp Advanced" course @ Software University.

You can check your solutions here: https://judge.softuni.bg/Contests/1489/Iterators-and-Comparators-Lab

1. Library

NOTE: You need the namespace **`IteratorsAndComparators`**.

Create a class **Book**, which should have three public properties:

- **`string Title`**
- **`int Year`**
- **`List<string> Authors`**

Authors can be **anonymous, one or many**. A Book should have only **one constructor**.

Create a class **`Library`**, which should store a collection of books and implement the **`IEnumerable<Book>`** interface.

- **`List<Book> books`**

A Library could be intilized without books or with any number of books and should have only **one constructor**.

Examples

StartUp.cs

```
public static void Main()
{
    Book bookOne = new Book("Animal Farm", 2003, "George Orwell");
    Book bookTwo = new Book("The Documents in the Case", 2002, "Dorothy Sayers", "Robert Eustace");
    Book bookThree = new Book("The Documents in the Case", 1930);

    Library libraryOne = new Library();
    Library libraryTwo = new Library(bookOne, bookTwo, bookThree);
}
```

Solution

```
public class Book
{
    public Book(string title, int year, params string[] authors)
    {
        this.Title = title;
        this.Year = year;
        this.Authors = authors;
    }

    public string Title { get; set; }

    public int Year { get; set; }

    public IReadOnlyList<string> Authors { get; set; }
}
```

```
public class Library
{
    private List<Book> books;

    public Library(params Book[] books)
    {
        this.books = new List<Book>(books);
    }
}
```

2. Library Iterator

NOTE: You need the namespace **`IteratorsAndComparators`**.

Extend your solution from the prevoius task. Inside the Library class create a **nested class LibraryIterator,** which should implement the **IEnumerator<Book>** interface. Try to implement the bodies of the inherited methods by yourself. You will need two more members:

- **`List<Book> books`**
- **`int currentIndex`**

Now you should be able to iterate through a Library in the Main method.

Examples

Startup.cs

```
public static void Main()
{
    Book bookOne = new Book("Animal Farm", 2003, "George Orwell");
    Book bookTwo = new Book("The Documents in the Case", 2002, "Dorothy Sayers", "Robert Eustace");
    Book bookThree = new Book("The Documents in the Case", 1930);

    Library libraryOne = new Library();
    Library libraryTwo = new Library(bookOne, bookTwo, bookThree);

    foreach (var book in libraryTwo)
    {
        Console.WriteLine(book.Title);
    }
}
```

Output

```
Animal Farm
The Documents in the Case
The Documents in the Case
```

Solution

```
    public IEnumerator<Book> GetEnumerator()
    {
        return new LibraryIterator(this.books);
    }
    IEnumerator IEnumerable.GetEnumerator() => this.GetEnumerator();

    private class LibraryIterator : IEnumerator<Book>
    {
        private readonly List<Book> books;
        private int currentIndex;

        public LibraryIterator(IEnumerable<Book> books)
        {
            this.Reset();
            this.books = new List<Book>(books);
        }

        public void Dispose(){}
        public bool MoveNext() => ++this.currentIndex < this.books.Count;
        public void Reset() => this.currentIndex = -1;
        public Book Current => this.books[this.currentIndex];
        object IEnumerator.Current => this.Current;
    }
}
```

3. Comparable Book

NOTE: You need the namespace **`IteratorsAndComparators`**.

Extend your solution from the prevoius task. Implement the **`IComparable<Book>`** interface in the existing class **Book**. The comparison between two books should happen in the following order:

- First sort them in **ascending chronological** order (by year)
- If two books are published in the **same year**, sort them **alphabetically**

Override the **`ToString()`** method in your Book class, so it returns a string in the format:

- **`"{title} - {year}"`**

Change your **`Library`** class, so that it stores the books in the correct order.

Examples

Startup.cs

```
public static void Main()
{
    Book bookOne = new Book("Animal Farm", 2003, "George Orwell");
    Book bookTwo = new Book("The Documents in the Case", 2002, "Dorothy Sayers", "Robert Eustace");
    Book bookThree = new Book("The Documents in the Case", 1930);

    Library libraryOne = new Library();
    Library libraryTwo = new Library(bookOne, bookTwo, bookThree);

    foreach (var book in libraryTwo)
    {
```

```
        Console.WriteLine(book);
    }
}
```

Examples

Output
The Documents in the Case - 1930 The Documents in the Case - 2002 Animal Farm - 2003

Solution

```
public class Book : IComparable<Book>
{
    public Book(string title, int year, params string[] authors)...

    public string Title { get; private set; }
    public int Year { get; private set; }
    public IReadOnlyList<string> Authors { get; private set; }

    public int CompareTo(Book other)
    {
        int result = this.Year.CompareTo(other.Year);
        if (result == 0)
        {
            result = this.Title.CompareTo(other.Title);
        }
        return result;
    }

    public override string ToString()
    {
        return $"{this.Title} - {this.Year}";
    }
}
```

4. Book Comparator

NOTE: You need the namespace **`IteratorsAndComparators`**.

Extend your solution from the prevoius task. Create a class **`BookComparator`**, which should implement the **`IComparer<Book>`** interface and thus include the following method:

- **`int Compare(Book, Book)`**

BookComparator must **compare** two books by:

1. Book title - **alphabetical order**
2. Year of publishing a book - **from the newest to the oldest**

Modify your **`Library`** class once again to implement the **new sorting**.

Examples

Startup.cs

```
public static void Main()
{
    Book bookOne = new Book("Animal Farm", 2003, "George Orwell");
    Book bookTwo = new Book("The Documents in the Case", 2002, "Dorothy Sayers", "Robert Eustace");
    Book bookThree = new Book("The Documents in the Case", 1930);

    Library library = new Library(bookOne, bookTwo, bookThree);
}
```

Output

```
Animal Farm - 2003
The Documents in the Case - 2002
The Documents in the Case - 1930
```

Solution

```
public class BookComparator : IComparer<Book>
{
    public int Compare(Book x, Book y)
    {
        int result = x.Title.CompareTo(y.Title);
        if (result == 0)
        {
            result = y.Year.CompareTo(x.Year);
        }

        return result;
    }
}
```