Bonus Assignment

Exercise 1 (7pt)

Implement the `Stack` of int class by extending the `ArrayList` class. It should contain the following methods:

- `size()` return the size of the list
- `peek()` returns the top integer
- `pop()` returns the top integer and removes it.
- `push(int)` adds an integer to the top of the stack
- `toString()`
- `equals()`

Note: some of the methods might be already implemented in the ArrayList class and you will not need to reimplement them.

Exercise 2 (5pt)

Write a `Book` class that contains the title and author of a book. Implement the `BookShelf` class that stores a `ArrayList` of books.

Add a method to sort the books (the sorting should first follow the title then the author), and a method to find a particular book.

Exercise 3 (7pt)

Write the `Complex` number class. The class must extend `java.lang.Number`.
The conversion to the basic types (e.g., float, double, …) should be done on the real part.

It should provide

- An empty constructor (initialise the number to 0)
- A constructor with one parameter (real number)
- A constructor with 2 parameters (real and imaginary part)

- `re()` that returns the real part
- `im()` that returns the imaginary part
- `conjugate()` that returns the complex conjugate

- addition, subtraction, and multiplication, with complex numbers or doubles
  (see https://en.wikipedia.org/wiki/Complex_number#Elementary_operations)

Exercise 3 (5pt)

Implement the `GeometricObject` class, it should provide

- The `x,y` position

- An empty constructor that initialises it at 0,0
- A constructor that takes the 2 fields

- A method `getArea()` that returns the area
- A method `getPerimeter()` that returns the perimeter

Implement also 3 subclasses (add all necessary fields and methods)

- Circle
- Rectangle
- Triangle

Implement setters for the radius width/height and base/height for the 3 geometric figures and throw the appropriate exception if the values are invalid (e.g., negative).

Exercise 4 (6pt)

Implement the `Triangle` class. The constructor should take 3 arguments, corresponding to the length of the sides. In a triangle, the sum of any two sides is grater the the other side.
Create the `IllegalTriangleException` class and make the constructor of the `Triangle` class throw such exception if the object violates the rule.

Example:

`new Triangle(10, 1, 1)`, violates the rule since 1 + 1 < 10

Exercise 5 (10pt)

Write a java program that counts that give you the weather forecast for an input zip code. You must use this RSS feed to get the information http://www.rssweather.com/zipcode/<zip>/rss.php where <zip> is the zip code. You can use Chrome or Firefox to open the url, right-click to view to page source to have an idea on how the feed looks like. Here is a screenshot to help.
Hint: you should iteratively locate the `<item>` string then search for title and description.

Example of call:

```
> java WeatherForecast 10001
```

Output

```
Today
Mostly sunny, with a high near 75. West wind around 11 mph.

Tonight
A 30 percent chance of showers, mainly between 9pm and 2am.  Mostly cloudy, with a low around 56.
Southwest wind 6 to 8 mph becoming northwest after midnight.

Monday
Mostly sunny, with a high near 63. Breezy, with a northwest wind 10 to 20 mph.

Monday Night
Mostly clear, with a low around 43. Northwest wind 8 to 16 mph.

Tuesday
Sunny, with a high near 61. Northwest wind 6 to 9 mph.
```

```
<rss version="2.0" xmlns:content="http://purl.org/rss/1.0/modules/content/">
    <channel>
        <title>New York, NY weather via rssWeather.com</title>
        <link>http://www.rssweather.com/zipcode/10001/wx.php</link>
        <description>
            <![CDATA[Current weather, forecasts and alerts delivered using RSS.
                <h2>Using the Feeds</h2>
                <ul>
                    <li>Request Frequency - The feeds are updated once per hour. More frequent requests may result in your access being limited.</li>
                    <li>Web Site Usage - If you are using the feed on your web site, you are required to maintain a link to rssWeather.com</li>
                </ul>]]>
        </description>
        <ttl>60</ttl>
        <generator>rssWeather.com (http://www.rssweather.com/)</generator>
        <language>en</language>

        <item>
            <title>New York, NY Weather :: 64F Fair</title>
            <link>http://www.rssweather.com/zipcode/10001/wx.php</link>
            <category>Current Conditions</category>
            <pubDate>Sun, 03 May 2020 10:51:00 -0400</pubDate>
            <description>64F Fair</description>
            <content:encoded>
                <![CDATA[<h4>
                    <a href="http://www.rssweather.com/zipcode/10001/wx.php" title="New York, NY Weather Forecast">
                    <img src="http://www.rssweather.net/images/fcicons/sunny.gif" alt="Fair" class="icon" width="55" height="58" id="echo $currentConditions->getIconName();" border="0"/>
                    </a>
                    <span class="sky">Fair</span>
                    <span class="temp">64&#176;F</span>
                </h4>
                <dl style="display: inline;">
                    <dt style="display: inline; font-weight: bold;">Humidity:</dt>
                    <dd id="humidity" style="display: inline;">65</dd>
                    <dt style="display: inline; font-weight: bold;">Wind Speed:</dt>
                    <dd id="windspeed" style="display: inline;">8 MPH</dd>
                    <dt style="display: inline; font-weight: bold;">Wind Direction:</dt>
                    <dd id="winddir" style="display: inline;">West ( (250&deg;)&#176;)</dd>
                    <dt style="display: inline; font-weight: bold;">Barometer:</dt>
                    <dd id="pressure" style="display: inline;">29.82 in.</dd>
                    <dt style="display: inline; font-weight: bold;">Dewpoint:</dt>
                    <dd id="dewpoint" style="display: inline;">52.0&#176;F</dd>
                    <dt style="display: inline; font-weight: bold;">Heat Index:</dt>
                    <dd id="heatindex" style="display: inline;">89&#176;F</dd>
                                <dt style="display: inline; font-weight: bold;">Visibility:</dt>
                    <dd id="visibility" style="display: inline;">10  mi</dd></dl>]]>
            </content:encoded>
            <guid isPermaLink="false">Current-Last Updated on May 3 2020, 10:51 am EDT</guid>
        </item>
            <item>
            <title>Today</title>
            <category>Weather Forecast</category>
            <link>http://www.rssweather.com/zipcode/10001/wx.php</link>
            <description>Mostly sunny, with a high near 75. West wind around 11 mph. </description>
            <pubDate>Sun, 03 May 2020 09:12:50 -0400</pubDate>
            <guid isPermaLink="false">Forecast-3 May 10:51 am EDT-Today</guid>
        </item>
            <item>
            <title>Tonight</title>
            <category>Weather Forecast</category>
            <link>http://www.rssweather.com/zipcode/10001/wx.php</link>
            <description>A 30 percent chance of showers, mainly between 9pm and 2am.  Mostly cloudy, with a low around 56. Southwest wind 6 to 8 mph becoming northwest after midnight. </description>
            <pubDate>Sun, 03 May 2020 09:12:50 -0400</pubDate>
            <guid isPermaLink="false">Forecast-3 May 10:51 am EDT-Tonight</guid>
        </item>
            <item>
            <title>Monday</title>
            <category>Weather Forecast</category>
            <link>http://www.rssweather.com/zipcode/10001/wx.php</link>
            <description>Mostly sunny, with a high near 63. Breezy, with a northwest wind 10 to 20 mph. </description>
            <pubDate>Sun, 03 May 2020 09:12:50 -0400</pubDate>
            <guid isPermaLink="false">Forecast-3 May 10:51 am EDT-Monday</guid>
        </item>
            <item>
            <title>Monday Night</title>
            <category>Weather Forecast</category>
            <link>http://www.rssweather.com/zipcode/10001/wx.php</link>
            <description>Mostly clear, with a low around 43. Northwest wind 8 to 16 mph. </description>
            <pubDate>Sun, 03 May 2020 09:12:50 -0400</pubDate>
            <guid isPermaLink="false">Forecast-3 May 10:51 am EDT-Monday Night</guid>
        </item>
```


Tuesday Night
Mostly cloudy, with a low around 46.

Wednesday
Mostly cloudy, with a high near 59.

Wednesday Night
Mostly cloudy, with a low around 46.

Thursday
A 30 percent chance of showers. Mostly sunny, with a high near 60.

Thursday Night
Partly cloudy, with a low around 45.

Friday
Mostly sunny, with a high near 60.

Friday Night
A 30 percent chance of showers. Mostly cloudy, with a low around 43.

Saturday
Partly sunny, with a high near 56.

Instructions

The solution of the exercises must be provides as a **java** (for the code, do not submit class files), **png** (for eventual screenshot), and **pdf** (for eventual text) files. The **files must be zipped** together before upload.

Assignments not respecting these instructions will be ignored.