Programming Assignments #4 and 5
CS 202 Programming Systems

For This Program
With both programs #4 and #5 you will be implementing your solutions using Java. Your goal must be to develop an object-oriented solution but this time implement it in Java. You may use an IDE and you should use the string class! Make sure that your OO Design is not centered around your data structures – your data structures support the design but shouldn't be the primary emphasis of your design.

Your Java programs must follow these rules:

- **No public or friendly fields (data members) *** NONE!!!*****
- No friendly methods (member functions); all members must use the public, private, or protected keywords
- Yes, you SHOULD use the string class!
- Limit your use of static methods – these should be restricted to just utility functions and main
- Use an inheritance hierarchy using "extends"; there must be a minimum of 5 classes with 3 of them in a hierarchy. *These should not be isolated to just your data structures.*
- Create at least one abstract base class
- Implement at least one constructor with arguments
- Implement at least two functions using function overloading between classes and experiment with the way function overloading works in Java. ***Write about this.
- Implement dynamic binding and experiment with how it works in Java. Prove to yourself that the functions are being overridden versus overloaded. ***Write about this
- Use the super keyword in invoking a base class' constructor. *This is what we use instead of an initialization list.*
- The data structures required in the assignment (below) are to be fully implemented by you

For each of the above that you experiment with, write up information about it in your efficiency write-up

What papers do you need to write?

1. There is ONLY ONE design writeup for the combined programs 4-5. This means, you are required to turn in ONE paper on how this solution will be object oriented (your design).
2. With EACH program 4 and program 5, you are required to write two papers:
    a. New Syntax – 400 words about the new syntax that you learned about (how you convinced yourself that the overriding, overloading, or hiding was taking place) instead of the efficiency writeup.
    b. IDE – 200 words about how you used the IDE to create your solution (instead of the debugger writeup)

Data Structures

In these last two programs, you must implement two data structures:

1. Program 4: A binary search tree or 2-3 tree
    a. In program 4, implement the other tree that you did not implement in program 3. If you have already implemented a 2-3 tree in program 3, then implement a BST in program 4, implementing insert, display, retrieve, retrieve all related items, remove an individual item, and remove all; the algorithms must be implemented recursively. **For this assignment, the BST will be a BST of linear linked lists where every node is a list of the matching items.** Therefore, data that is less goes to the left. Data that is greater goes to the right. Data that matches stays together.
    b. If you have not yet implemented a 2-3 tree yet, then this will need to be implemented with program 4. Implement the insert, display, retrieve, retrieve all related items and remove_all (no remove individual items).
2. Program 5: A linear linked list of arrays (e.g., a flexible array). Each node will have an array of data items.

The required data structures specified in the assignment must be your own implementation: as in BSTs (or balanced tree) and flexible array. Once you meet the basic requirements of the assignment, you are allowed to use libraries for any subsequent data structures.

Program Requirements

It is Spring term and time for the Rose Festival. If you are new to Portland, you don't want to miss all of the amazing events that take place this time of year. Each year the ships arrive (have you ever toured one?). There is the midway with rides, food, and music. There is the starlight parade which people line the streets for. And, you can't miss the grand floral parade. Really there are just many events!

Your job is to create a program of what will ultimately be an App to assist people in figuring out which events they would like to attend based on their desires. So, if someone really likes roses, then they should make sure not to miss the grand floral parade. On the other hand, if they like water sports maybe the dragon boat race would be something of interest. The first step will be to set up the data (program #4). Then, once the data exists, with Program #5 we can have users look up events to attend based on desires (program #5).

Because we want to use hierarchies, create at least three different categories of events. Select at least four keywords that users can select from when selecting an event (e.g., so the grand floral parade might have keywords of: Rose, Parade, Queen of Rosaria, Rose Princess). Remember to push common elements up and differences derived. Some events are self directed (e.g., midway, touring a ship) others are at a specific time and duration. Consider this when creating your categories!

Here are some suggestions on where to use the data structures assigned. These are JUST suggestions; you may adjust how the data structures are used:

1. Program #4 - A tree of events organized by keywords where each linear linked list is all of the events that share the same keyword. Luckily since we are working with references, the data itself will not be duplicated through the data structure!
2. Program #5 – A flexible array of all of the events that match all of the keywords that the user is interested in attending (i.e., the events that meet the user's criteria).

Your job is to come up with a design of an OO framework that will support this type of application. The key is to make sure to solve this problem using Object Oriented methodologies **with dynamic binding** and function overloading. *The use of external data file(s) are necessary!*