

Project #1 **Clarified**
Computer Science 2334
Spring 2010

User Request:

“Create an Awards Information System.”

Milestones:

1. Use program arguments to specify a file name. *10 points*
 2. Use simple File I/O to read a file. *15 points*
 3. Create an abstract data type (ADT) to store a person's award information. *15 points*
 4. Create an ADT that abstracts the use of an array of award information. *15 points*
 5. Implement a program that allows the user to search the award list as described below. *20 points*
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- ▶ Develop and use a proper design. *15 points*
 - ▶ Use proper documentation and formatting. *15 points*

Description:

For this project, you will put together several techniques and concepts learned in CS 1323 and some new techniques to make an application that searches a large collection of award information which we will call an “award information system” or “AIS.” This project creates a simple program that allows users to enter people’s names and see which awards they have won.

One of the best things about this project is that it will allow for the uses of lots of data. Your program must be capable of handling over 10,000 names and awards. To the surprise of no one, the best approach to this somewhat large problem is to decompose the problem into separate classes that can be gradually built up.

Note that much of the code you write for this program could be reused in more complex applications, such as full-fledged personal record systems that also include information on nationality, team participation, and so forth.

Operational Issues:

Your program will read the award information file (a text file) as specified by a file name. The file name will be given as a program argument. (See below for information on how to read program arguments). Each line of the file contains a last name, followed by a comma, followed by a space, followed by a first name, followed by a comma, followed by a space, followed by an award name, followed by a comma, followed by a year. For example:

```
van 't Hoff, Jacobus, Nobel Prize in Chemistry, 1901
```

You will need to store each name and its associated award as a single object and the list of all awards will be stored as an array of these objects.

Once the award list has been read into your program and stored in an array, your program will use a **JOptionPane** to display to the user a dialog box requesting an input name.

When the user enters a name into the dialog, your program will search for it in the award list. If the name is in the list, your program will use another dialog to inform the user of that fact along with that person's associated award. If the name is *not* in the list, your program will use a dialog to inform the user of *that* fact.

After checking whether the name is in the award list and informing the user one way or the other, your program will again use a dialog to request a name. It will continue in this loop until the user clicks on cancel, at which time the program should gracefully exit.

Implementation Issues:

There are two Java elements in this project that may be new to some students: reading from a file, and program arguments. These Java features are summarized below.

Reading from a file:

We will discuss File I/O in depth later in the class, this project is just designed to give you a brief introduction to the technique. Reading files is accomplished in Java using a collection of classes in the **java.io** package. To use the classes you must import the following package:

```
import java.io.IOException;
```

The first action is to open the file. This associates a variable in the program with the name of the file sitting on the disk.

```
String fileName = "AwardList.txt";  
FileReader fr = new FileReader(fileName);
```

Next the **FileReader** is wrapped with a **BufferedReader**. A **BufferedReader** is more efficient than a **FileReader** since a **BufferedReader** saves groups of characters during a single operation instead of working with characters individually. Another advantage of using a **BufferedReader** is that there is a command to read an entire line of the file, instead of a single character at a time. This feature comes in particularly handy for this project.

```
BufferedReader br = new BufferedReader(fr);
```

The **BufferedReader** can now read in Strings.

```
String nextline;  
nextline = br.readLine();
```

Look at the Java API listing for **BufferedReader** and find out what `readLine()` returns when it encounters the end of the file (stream). When you are finished with the **BufferedReader**, the file should be closed. This informs the operating system that you're finished using the file.

```
br.close();
```

Closing the **BufferedReader** also closes the **FileReader**.

Any method which performs I/O will have to throw or catch an **IOException**. If it is not caught, then it must be passed to the the calling method. The syntax is given below:

```
public void myMethod(int argument) throws IOException {  
    //method body here  
}
```

Program Arguments:

Sometimes it is handy to be able to give a program some input when it first starts executing. Program arguments can fulfill this need. Program arguments in Eclipse are equivalent to MS-DOS or Unix command line arguments. Program arguments are handled in Java using a String array that is traditionally called args (the name is actually irrelevant). See the slides from Lab #2 for how to supply program arguments in Eclipse.

The program below will print out the program arguments.

```
public static void main(String[] args) {
    System.out.println(args.length + " program arguments:");
    for (int i=0; i< args.length; i++)
        System.out.println("args[" + i + "] = " + args[i]);
}
```

Milestones:

A milestone is a “significant point in development.” In other words, milestones serve to guide you in the development of your project. Listed below are a set of milestones for this project along with a brief description of each.

Milestone 1. Use program arguments to specify a file name.

The name of the file that stores the list of contact information will be passed to the program using program arguments as discussed above. Type in the sample program given in the section on program arguments and make sure that you understand how the program arguments you provide affect the `String[] args` parameter that is passed into the main method of the program. Then, write a main method for your program that reads in the name of the data file from the program arguments.

Milestone 2. Use simple File I/O to read a file.

Before you can allow the user to search the award list, you must first be able to read a text file. Examine the section above on reading from a file. A good start to the program is to be able to read in the name of a file from the program arguments, read each line from the file, one at a time, and print each line to the console using `System.out.println()`. Later, you will want to remove the code that prints out each line read in from the file, since the project requirements do not specify that the file is to be written out to the console as it is read.

Milestone 3. Create an abstract data type (ADT) to store a person’s award information.

You must create a class that holds the award information for a single person in the award list before you can store the information that is read in from the input file. Think about what information is associated with each person and how to most efficiently store the information. Also, think about any methods that may help you to manage and search the data by abstracting operations to be performed on a single entry in the list that will be used by another class.

Milestone 4. Create an ADT that abstracts the use of an array of award information.

You are to store the object representing each entry in the collection into an array of objects. However, it is not necessary for the portions of the program that will carry out user actions to directly operate on this array. You should create a class that encapsulates this array and allows the addition of new names and their awards and also supports the required search operations on the array.

This class will represent the collection of information associated with the program. Think about the operations that this class needs to support and how it will use the ADT created for Milestone 3. At this point, you should be able to read in the input file and create an object for each person from the file, and store the object into the array. Note that the data file used for grading may be larger (or smaller) than the data file provided for testing.

Milestone 5. Implement a program that allows the user to search the award list as described below.

This is where the entire program starts to take on its final form and come together. Here you will create the input and output dialogs and the menu system. Start by creating the input dialog and the output dialog. Tie together the input dialog, the ADT from Milestone 4, and the output dialog to make this search functional and test its functionality.

Finally, you are ready to create the menu using an input dialog and write the main loop of the program that will take a menu option as input and invoke the correct methods that were created to test the two search options.

Remember that when the user clicks on “cancel” in the program menu, the program must gracefully exit. This can be accomplished by using `System.exit(0)`.

How to Complete this Project:

1. Revise your UML class diagram from the lab session. Be sure to clearly write “Project 1” on the top of the UML diagram. Make sure to keep a copy of this when you turn it in. It would be a good idea to create an electronic copy, preferably in PDF, to be submitted in the drop box with the rest of the assignment.
2. Create the classes and methods specified in your design, but do not put code in the methods. Add the required documentation to your classes and methods as specified in the documentation requirements posted on the class website. This is called “stubbing” your classes and methods.
3. Run your stubbed Java files through Javadoc as described in the Lab #2 slides. This will create a set of HTML files in a directory named “docs” under your project directory.
4. Implement the design you have developed by coding each method you have defined as well as any others you have left out of your design. As you do this, make sure to modify and annotate the changes to your design on your UML and properly document all new code. A good approach to the implementation of your project is to follow the project's milestones in the order they have been supplied.
5. Test your program and fix any bugs.
6. Once you have completed the project and are ready to submit it for grading, create a new set of Javadoc files using Eclipse and inspect them to make sure your detailed design is properly documented in your source code.

Extra Credit Features:

You may extend this project with more search features for an extra 5 points of credit. Think of ways to enable a wider range of searches to be used, such as searching based on awards or years or regular expressions or wild cards. Alternatively, think of ways to decompose the class for a person's information into logical subclasses. You could also revise the user interface elements. If you revise the user interface, you **must** still read the file name from the program arguments and the award list from the text file.

To receive the full five points of extra credit, your extended feature must be novel (unique) and it must involve effort in the design of the integration of the feature into the project and the actual coding of the feature. Also, you must indicate on your final UML design, the portions of the design that support the extra feature(s); and you must include a write-up of the feature(s) in your milestones file. The write-up must indicate what the feature is, how it works, how it is unique, and the write-up must cite any outside resources used.

Due Dates and Notes:

Your revised design and detailed Javadoc documentation are due on **Wednesday, February 10th**. Submit the project archive following the steps given in the submission instructions **by 9:00pm**. Submit your revised UML design on *engineering paper* or a hardcopy using UML layout software and a hardcopy of the stubbed source code at the **beginning of lab on Thursday, February 11th**.

The final version of the project is due on **Wednesday, February 17th**. Submit the project archive following the steps given in the submission instructions **by 9:00pm**. Submit your final UML design on *engineering paper* or a hardcopy using UML layout software and a hardcopy of the source code at the **beginning of lab on Thursday, February 18th**.

You are not allowed to use the **StringTokenizer** class. Instead you must use `String.split()` and a regular expression that specifies the delimiters you wish to use to “tokenize” or split each line of the file.

You may write your program from scratch or may start from programs for which the source code is freely available on the web or through other sources (such as friends or student organizations). If you do not start from scratch, you must give a complete and accurate accounting of where all of your code came from and indicate which parts are original or changed, and which you got from which other source. Failure to give credit where credit is due is academic fraud and will be dealt with accordingly.

Do not be confused by the term “abstract data type” (ADT). An ADT is **not** the same as an abstract class, even though they both contain the word “abstract” in them.

A data type is simply a description of how bits in a computer are grouped and interpreted. Maybe one set of 32 bits is interpreted as a character, whereas another set of 32 bits is interpreted as an integer, and a set of 64 other bits is interpreted as an integer that can hold larger magnitudes, etc. With *concrete* data types, implementation details matter, such as the number of bits, whether the bits are ordered from least to most significant, etc. If you try to mix implementations, you’ll screw things up.

With an abstract data type, you hide the implementation details of the data type from the user, so that what matters is how one *interacts* with instances of the type, not how they are *implemented* internally. So, if you add two integers whose internal representations differ, you should still get a sensible result.

This means that if you create a class using Object-Oriented techniques (such as making variables private and only accessible through methods, etc.), then even a *concrete* class is an *abstract* data type.

The reason this description doesn't just tell you to create a class to store a person's award information is because you don't have to use just one class. You could use two classes, or three, or more. You could arrange them in an inheritance hierarchy (where one is a subclass of another). You could use composition or aggregation (the types of has-a links we have discussed). All of these classes could be concrete or some of them could be concrete and some could be abstract. You could also include interfaces, if you saw a good reason to do so. All of these alternatives would count as creating an ADT.

If the term 'ADT' is still confusing you, think of the assignment as saying “Create something appropriate that the computer can use to store a person’s award information.” This is what it means.