CS2110 Spring 2015

Homework 2

Author: **Andrew Wilder**

Rules and Regulations

Academic Misconduct

Academic misconduct is taken very seriously in this class. Homework assignments are collaborative. However, each of these assignments should be coded by you and only you. This means you may not copy code from your peers, someone who has already taken this course, or from the Internet. You may work with others **who are enrolled in the course,** but each student should be turning in their own version of the assignment. Be very careful when supplying your work to a classmate that promises just to look at it. If he/she turns it in as his own you will both be charged.

We will be using automated code analysis and comparison tools to enforce these rules. **If you are caught you will receive a zero and will be reported to Dean of Students.**

Submission Guidelines

1. You are responsible for turning in assignments on time. This includes allowing for unforeseen circumstances. If you have an emergency let us know ***IN ADVANCE*** of the due time supplying documentation (i.e. note from the dean, doctor's note, etc). Extensions will only be granted to those who contact us in advance of the deadline and no extensions will be made after the due date.

2. You are also responsible for ensuring that what you turned in is what you meant to turn in. No excuses, what you turn in is what we grade. In addition, your assignment must be turned in via T-Square. When you submit the assignment you should get an email from T-Square telling you that you submitted the assignment. If you do not get this email that means that you did not complete the submission process correctly. Under no circumstances whatsoever we will accept any email submission of an assignment. Note: if you were granted an extension you will still turn in the assignment over T-Square.

3. There is a random grace period added to all assignments and the TA who posts the assignment determines it. The grace period will last **at least one hour** and may be up to 6 hours and can end on a 5 minute interval; therefore, you are guaranteed to be able to submit your assignment before 12:55AM and you may have up to 5:55AM. As stated it can end on a 5 minute interval so valid ending times are 1AM, 1:05AM, 1:10AM, etc. **Do not ask us what the grace period is we will not tell you**. *So what you should take from this is not to start assignments on the last day and depend on this grace period past 12:55AM.* There is no late penalty for submitting within the grace period. If you cannot submit your assignment on T-Square due to the grace period ending then you will receive a zero, no exceptions.

General Rules

1. In addition any code you write (if any) must be clearly commented and the comments must be meaningful. You should comment your code in terms of the algorithm you are implementing we all know what the line of code does.
2. Although you may ask TAs for clarification, you are ultimately responsible for what you submit.
3. Please read the assignment in its entirety before asking questions.
4. Please start assignments early, and ask for help early. Do not email us the night the assignment is due with questions.
5. If you find any problems with the assignment it would be greatly appreciated if you reported them to the author (which can be found at the top of the assignment). Announcements will be posted if the assignment changes.

Submission Conventions

1. **Failure to follow these may result in a max of 5 points taken off**
2. All files you submit for assignments in this course should have your name at the top of the file as a comment for any source code file, and somewhere in the file, near the top, for other files unless otherwise noted.
3. When preparing your submission you may either submit the files individually to T-Square or you may submit an archive (zip or tar.gz only please) of the files (preferred). You can create an archive by right clicking on files and selecting the appropriate compress option in on your system.
4. If you choose to submit an archive please don't zip up a folder with the files, only submit an archive of the files we want. (See Deliverables).
5. Do not submit compiled files that is .class files for Java code and .o files for C code. Only submit the files we ask for in the assignment.
6. Do not submit links to files. We will not grade assignments submitted this way as it is easy to change the files after the submission period ends.

Objectives

1. To understand the bitwise operators
2. To use bitwise operators to complete tasks
3. To understand ASCII

Overview

1. Three java files with method headers which you are to complete.

Resources

Begin by reading Chapter 2 of your text ("Introduction to Computing Systems"). Already read it? Read it again. No really, reading and understanding this chapter will prove to be a great advantage on this homework. It will help you understand several of the topics we will cover later in the course.

Coding

Time for some coding! Complete the methods given in the files HW2Bases.java, HW2BitVector.java, and HW2Operations.java. All of the methods have javadocs indicating what they should do, so make sure you read them carefully and follow the directions.

Each file has its own set of rules and limitations on what you may and may not use, so please look at the comments at the top of each file.

If you use anything that is banned, you will get no credit for that function. The point of this is to play with bit operations and learn how they work. You will not have all of these fancy Java API functions when we get to C programming. We have provided a verification program, HW2Verifier, which will notify you of code that breaks the guidelines. **We will run this on your submission and give no credit for functions that are found to use banned operations**.

Coding Guidelines for HW2

1. All bitmasks **MUST** be written in hexadecimal. This is the convention for masks and makes it very easy for the programmer to understand the purpose of the mask. If you write a mask in any other base you will lose points.
    - GOOD: (num & **0xFFE0**) >> 5 | (num & **0xF01F**) << 2 ^ **0x1**
    - BAD: (num & 65504) >> 5 | (num & 61471) << 2 ^ 1
    - Notice with the GOOD you can more easily tell what the line of code is doing.
    - Note the bolded parts are bitmasks!
2. Enter your name in the javadoc at the top of each file. Failure to do so will result in a point deduction!
3. Use HW2Tester to find out which functions worked part of the time, none of the time, or infinitely looped. The output only tells which functions need fixing, but a detailed log of what went wrong will be automatically generated as Results.log, which should be in the same directory as HW2Tester.
4. Use HW2Verifier to make sure none of your functions violate the banned operator guidelines.

Running HW2Verifier

HW2Verifier uses antlr4. The antlr4 runtime jar is sufficient, and can be downloaded here:

http://www.antlr.org/download/antlr-runtime-4.4.jar

HW2Verifier consists of 4 files:

```
HW2Verifier.java
JavaBaseListener.java
JavaLexer.java
JavaListener.java
JavaParser.java
```

Command Line

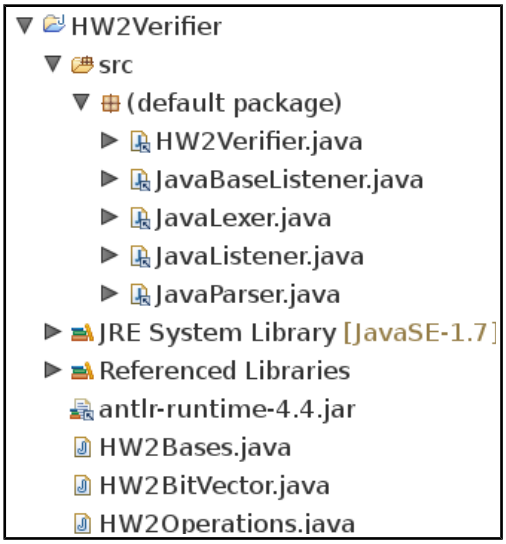
The HW2Verifier looks for your HW2 submission files (HW2Bases.java, HW2BitVector.java, HW2Operations.java) in the current working directory, and requires that the runtime jar be in your classpath to compile and run. Place antlr-runtime-4.4.jar in the same folder as the HW2Verifier files and HW2 submission files, and run:

```
javac -cp .:antlr-runtime-4.4.jar *.java
java -cp .:antlr-runtime-4.4.jar HW2Verifier
```

Note: This is UNIX syntax. The syntax may be different in a Windows terminal. Just replace "-cp .:antlr-runtime-4.4.jar" with whatever is necessary under Windows syntax to add that jar to the classpath when running java and javac.

Eclipse

To set up HW2Verifier to run in Eclipse, make a new, separate Java project just for the verifier. Add all five HW2Verifier files to the project's source folder (it will say there are errors at first, this is okay), and add your HW2 submission files to the project's root folder. The actual HW2 submission files must be in the root of the project folder; linking to them will not work. Right click the project, and go to Properties. Click Java Build Path, then the "Add JARs..." button, and add antlr-runtime-4.4.jar. You should now be able to run HW2Verifier. It should look like this:



Hints

Remember that all numbers are stored in your computer as binary. When you perform operations such as System.out.println(), the computer does the translation into another base for you. All you need to do is tell the computer how you are representing your numbers, and how to interpret them.

For example, you can specify 16 in decimal, octal, or hexadecimal like so:

```
System.out.println(16);      // decimal (base 10), the default
System.out.println(020);     // octal (base 8), precede the number with a zero
System.out.println(0x10);    // hexadecimal (base 16), precede the number with a "0x"
```

You can also tell Java to print out your number in different bases using a method called printf.

printf is the GRANDDADDY of all printing functions! When we get to C programming, you will be using it a lot. It is useful if you would like to write your own tester as well.

printf takes a variable number of arguments, the first of which is a format string.

After the format string come the parameters. The formatting for the numbers is controlled by the format string.

Example:

System.out.printf("In decimal: %d", 16);

System.out.printf("In octal: %o", 16);

System.out.printf("In hexadecimal: %x", 16);

The %d, %o, or %x get replaced by the parameter passed in.

printf does not support printing the number out in binary.

For more information about printf read http://en.wikipedia.org/wiki/Printf

(temporary link: http://www.cplusplus.com/reference/clibrary/cstdio/printf/)

Finally, you may find that there are times in which you need to use division or multiplication, but are not allowed to. Recall from lecture that you can use bitshifting to multiply or divide by powers of 2; this concept isn't found in the book, but is in the lecture slides.

Evaluation

1. Correctness of the output of your code
2. Implementation of code without banned operations
3. We will be running test cases of our own.

Deliverables

The file HW2Bases.java

The file HW2Operations.java

The file HW2BitVector.java