

Assignment 5 (Tool): ESC/Java

17-654/17-754: Analysis of Software Artifacts
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Due: Tuesday, February 19, 2008 (5:00 pm)

100 points total

Turn in a file named `<username>-17654-A5.zip`, where username is your Andrew id. The file should contain `Stack.java`, `stack-output.txt`, `Square.java`, `square-output.txt`, and `answers.txt` (with your answer to question 3). In a comment at the top of `Stack.java`, state your name, Andrew id, and how long you spent on the assignment.

Assignment Objectives:

- Use ESC/Java to check functional correctness properties of programs

Instructions. Download ESC/Java 2. There are two options, the command-line tool, and an Eclipse plug-in.

Command Line Checker. You can download the command-line checking tool at:

`http://secure.ucd.ie/products/opensource/ESCJava2/download.html`

Follow the instructions in `README.release` to install the system. Install ESC/Java in a directory path without a space; in my experience having a space in the directory path can cause setup problems.

The installation instructions for Windows are not as clear as one might like. If you are working from Windows, you will need to modify `escj.bat` as follows:

- Change the line `"set ESCJAVA_ROOT=..."` so that the right of the equals sign refers to the directory where `escjava` is installed (the directory where `escj.bat` is).

Eclipse Plug-in. Instructions for downloading and installing the Eclipse plugin are at:

<http://kind.ucd.ie/products/opensource/ESCJava2/escjava-eclipse/updates/escjavaHelp.html#Installation>

If, after installing the tool, you get an error “Fatal error: Unable to invoke Simplify” you should go to Window — Preferences — Java — ESC/Java2 and click “Use Internal Version”.

To get helpful output from Eclipse in the console window, go to Window — Preferences — Java — ESC/Java2 and UNCHECK the box “Disable ESC/Java informational messages”.

Question 1 (60 points).

Now take the file Stack.java and StackCheck.java from the class website. Run ESC/Java 2 on both files together:

```
escj Stack.java StackCheck.java
```

Add pre- and post-conditions and invariants to Stack.java and fix any bugs you find in the code, until ESC/Java runs on both files without producing any warnings. You may not edit StackCheck.java. Nor may you remove the annotations that are already present in Stack.java.

Turn in: (a) your edited version of Stack.java, and (b) a printout of ESC/Java 2’s output when run on the two files in stack-output.txt.

If you are using ESC/Java from within Eclipse, you will need to capture ESC/Java’s output in the console window. To do this, first make sure ESC/Java is set up to give you detailed output. Go to Window — Preferences — Java — ESC/Java2 and UNCHECK the box “Disable ESC/Java informational messages”. You should get lots of information when you run ESC/Java. To make sure you get a clean capture, before you run ESC/Java right-click on the console and select the Clear option.

A final hint: sometimes ESC/Java works better if you express invariants directly in terms of fields like topOfStack rather than in terms of calling other functions like isFull(). My guess is that this is just a limitation of the tool.

Question 2 (30 points).

The sum of the odd numbers from 1 through $n*2-1$ is equal to n^2 . Write a program that computes n^2 using this series. Check the correctness of your program using ESC/Java, i.e. that it really computes n^2 . Your solution should use appropriate @requires, @ensures, and @loop_invariant clauses.

Turn in: (a) your java code Square.java, and (b) a printout of ESC/Java 2's output when run on the Square.java in square-output.txt.

Again, if you are using Eclipse, be sure you capture the complete output of the tool. It should list all the methods as it checks them and say "passed" along with timing and bytes information.

Question 3 (10 points).

In the file answers.txt, criticize the ESC/Java tool (1-2 paragraphs). What did you like about it, and conversely what stands in the way of making this a practical tool?