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## **COP 3003 Assignment #2 – Fall 2013**

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Write a multithreaded Java program using pipes to solve a sequence of N quadratic equations of the form:

$$a * x^2 + b * x + c = 0$$

with double coefficients a, b, and c entered from the keyboard by the operator. Threads should communicate via pipes. The value of N>0 should be present in the command line (as an argument) when program is invoked, and the program shall be structured as follows:

- 1) Reading the coefficients from keyboard should be done by a separate thread, using a method named `readCoeffs()`, that takes no parameters and delivers coefficients of a single equation as an array of 3 elements, which are then sent via a pipe to the second thread.
- 2) Calculation of the roots should be done by the second thread as soon as the full set of 3 coefficients for a single equation has been entered and produced by the method `readCoeffes()`. The actual root calculation has to be done by a method named `calcRoots()`, which should take the 3 coefficients in a single array and deliver the 2 roots as a 2-element double array. Then the roots have to be delivered to the third thread. Provision has to be made in all cases when there are no roots, so that the third thread would know about it.
- 3) Outputting results to a file named `results.dat` should be done by a third thread in the following format:

```
For coefficients:
a = <value>; b = <value>; c = <value>;
the roots are:
root1 = <value>; root2 = <value>;
<empty line>
```

each time the results are available for a single equation, but only if the roots exist. If the roots do not exist, the thread should display on the screen (but not write to a file) the following information

```
For coefficients:
a = <value>; b = <value>; c = <value>;
real roots do not exist.
```

- 4) In addition, the second thread doing calculation of roots should produce the graph of all roots, after all roots have been calculated, drawing one line as values of first roots of all equations versus the equation number, and the second line as values of second roots of all equations versus the equation number. This should be done by a single method named `drawGraph()`. If roots do not exist for a certain equation, then this equation number should appear on the graph (on the x axis) but no data should be drawn for it. Producing the graph should be done from the thread doing calculation of roots, after all roots have been calculated. A sample program to do the graphs using `jvagently` package is linked to the Assignments page.

*Note 1. No global variables are allowed.*

*Note 2. All this means that the threads should act on a single set of 3 coefficients (a, b, c) and produce the results for it, then wait for another set of coefficients and produce the results, and so on, until all sets of coefficients have been entered from the keyboard. Only then the program should produce the graph.*

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| • Form of submission: | source code (unzipped) emailed to Instructor at <code>zalewski@fgcu.edu</code> |
| • Deadline            | September 19 (Thursday), Midnight  |
| • Grade: Max 10 pts;  | Tardiness: 2 pts per day.  |
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