CS101 Assignment Two

1 Quadratic Equation Solver

Write a program that asks the user for the three coefficients of the equation:

\[ ax^2 + bx + c = 0 \]

and finds the roots. As you know, the solutions are given by:

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

The quantity under the square root is called the discriminant. Your program should identify all the following testing cases and report a different message for each along with the root values:

1. There are no roots (a == 0 and b == 0 and c != 0).
2. There is one root (a == 0 and b != 0).
3. There are two real roots (discriminant > 0).
4. There is one double root (discriminant == 0).
5. The roots are complex (discriminant < 0).

For the case of complex roots, you do not have to calculate the values.

-------- Select one of the following questions --------

2 Calculate \( \pi \) with Iterations

Write a program that calculates \( \pi \) iteratively, using a for loop, from the following equation:

\[ \frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots \]

This series converges very slowly. Use console output (System.out.println) to report the value of \( \pi \) after 10, 100, 1000, 10,000, 100,000, and 1,000,000 iterations. Also report the system value for \( \pi \) given by Math.PI.
3 Greatest Common Divisor

Write a program that finds the greatest common divisor of 2 positive integers x and y (assume that x is greater than y). We use Euclid’s algorithm:

- loop if x is not divisible by y
  - (x, y) = (y, x % y)
- output the greatest common divisor y

In the above pseudo-code, (x, y) = (y, x % y) means assigning the values of y and x % y to x and y respectively. Write a Java program based on the above pseudo-code.

4 What to Submit

You should submit the Java programs. You need to solve question 1 and choose one from questions 2 and 3. Pay attention to good Java programming style. Add appropriate comments in your program. Upload your program files to WebCT before the submission deadline. There will be a 3-day grace period. But late submission would involve 10% point deduction for each day. Submissions later than 3 days are not accepted.