ESC101 : Fundamental of Computing

Lab 3 for 13th August 2008

1. **Intersection of lines :**
   You are given two lines $a1 * x + b1 * y + c1 = 0$, and $a2 * x + b2 * y + c2 = 0$. Write a JAVA program that prints whether these two lines intersect or not.

   Declare and initialize six variables, `a1, b1, c1, a2, b2, c2` of type `double`. Now write the JAVA code to find whether these two lines intersect or not. Your program should handle all cases, including the case when a line is vertical.

2. **Finding remainders of $n \cdot a$ mod p :**
   Let `p` be a prime number and `a` be any number such that `a` is not a multiple of `p`. Write a program to find the remainders of numbers $a, 2a, 3a, \ldots (p-1)a$ when divided by p.

   Programming Hint: Use `while` loop and '%' operator.

3. **Continued Fractions :**
   A continued fraction of a number n is an expression denoted as:

$$n = a_0 + \cfrac{1}{a_1 + \cfrac{1}{a_2 + \cfrac{1}{a_3 + \cfrac{1}{\ddots}}}}$$

   where n is any number where a_0 is an integer and $a_1, a_2, a_3, \ldots$ are positive integers. Continued fractions have some nice properties and we wish to evaluate them. (For more information, see here: `http://en.wikipedia.org/wiki/Continued_fraction`)

   Suppose we have a rational no. $\frac{a}{b}$ with numerator a and denominator b. Find the continued fraction for this rational no.as shown above and print $a_0 a_1 a_2 \ldots$

   For example, let $\frac{a}{b} = \frac{58}{13}$. We first round off $\frac{58}{13}$ to nearest integer i.e 4. And the remainder is 6.

   So $\frac{58}{16} = 4 + \frac{6}{13}$. Now invert $\frac{6}{13}$, we have $\frac{13}{6}$. Similarly $\frac{13}{6} = 2 + \frac{1}{6}$. So $\frac{58}{13} = 4 + \frac{1}{2+\frac{1}{6}}$ Finally print

   Continued fraction of $\frac{58}{13} = 4\ 2\ 6$

   Declare two variables `numerator` and `denominator` each of type `int`, and initialize them with positive values such that `denominator`< `numerator`. Then implement the code using `while` loop.

Exploratory problem [this problem is optional and not to be graded] :
The following code was written to output zeroes in every line.

```
class Zero
{
        public static void main(String args[])
        {
                int i,j;
```

```
                    i = 2;
                    j = -2;

                    System.out.println("i+j+i+j");
                    System.out.println("i+j"+"i+j");
                    System.out.println("i+j"+i+j);
                    System.out.println("i+j"+(i+j));
                    System.out.println((i+j)+i+j);
                    System.out.println(i+j+(i+j));
                    System.out.println((i+j)+(i+j));
                    System.out.println((i+j+i+j));
                    System.out.println(i+j+i+j);
            }
}
```

But, it prints zeroes in some lines and in some, it doesn't. Try to understand the reason for the output of the above code.