CSE141 Introduction to Programming
Fall'16

Assignment #2 — Dr. Imran Rauf
Due: Sep 16, 2016 — TA: Yusra Haider

Instructions

- Write your name and ERP id on top of each sumbitted file.
- For questions 1–4, upload a single text file (`.txt`) with your answers.
- For programming problems, upload a separate `.java` file for each program.
- Late submission: There will be 20% penalty for up to *one* day late submissions, 50% for *two* days late submissions. *No submission will be accepted after two days past the due date.*
- Plagiarism: Students are expected to perform their work individually unless otherwise specified by the instructor. Assignments may be discussed in general terms with other students and the students may receive assistance from the instructor, TA, or classmates. Assistance does not mean obtaining solutions and modifying them; this is considered plagiarism.

1. Suppose that `i` and `j` are both of type **`int`**. What is the value of `j` after each of the following statements is executed?

   (a) `for (i = 0,j = 0; i < 10; i++)j += i;`

   (b) `for (i = 0,j = 1; i < 10; i++)j += j;`

   (c) `for (j = 0;       j < 10; j++)j += j;`

   (d) `for (i = 0,j = 0; i < 10; i++)j += j++;`

   Explain each answer.

2. The sum $1/1+1/4+1/9+1/16+\ldots+1/n^2$ converges to a constant as n grows to infinity. (Indeed, the constant is $\pi^2/6$, so this formula can be used to estimate the value of π.) Which of the following for loops computes this sum? Assume that n is an **`int`** initialized to 1000000 and `sum` is a **`double`** initialized to 0.0.

   (a)
   ```
   for (int i = 1; i <= n; i++)
       sum = sum + 1 / (i * i);
   ```

   (b)
   ```
   for (int i = 1; i <= n; i++)
       sum = sum + 1.0 / i * i;
   ```

   (c)
   ```
   for (int i = 1; i <= n; i++)
       sum = sum + 1.0 / (i * i);
   ```

   (d)
   ```
   for (int i = 1; i <= n; i++)
       sum = sum + 1 / (1.0 * i * i);
   ```

   Explain your answers.

3. What is the value of `m` and `n` after executing the following code? Explain your answer and reasoning.

```
int n = 123456789;
int m = 0;
while (n != 0) {
   m = (10 * m) + (n % 10);
   n = n / 10;
}
```

4. What does the following program do? Explain your answer.

```
public static void main(String[] args) {
   int n = Integer.parseInt(args[0]);
   int x = 1;
   while (n >= 1) {
      System.out.println(x);
      x = 2 * x;
      n = n / 2;
   }
}
```

Programming Questions

5. Write a program `gcd.java` that finds the greatest common divisor (gcd) of two integers using *Euclid*'s algorithm, which is an iterative computation based on the following observation: if x is greater than y, then if y divides x, the gcd of x and y is y; otherwise, the gcd of x and y is the same as the gcd of $x\%y$ and y.

6. **RGB to HSB converter**. Write a program `RGBtoHSV.java` that takes an RGB color (three integers between 0 and 255) and transforms it to an HSB color (three different integers between 0 and 255).

7. **Checksums**. The *International Standard Book Number (ISBN)* is a 10 digit code that uniquely specifies a book. The rightmost digit is a checksum digit which can be uniquely determined from the other 9 digits from the condition that $d_1 + 2d_2 + 3d_3 + \cdots + 10d_{10}$ must be a multiple of 11 (here d_i denotes the ith digit from the right). The checksum digit d_1 can be any value from 0 to 10: the ISBN convention is to use the value X to denote 10. Example: the checksum digit corresponding to 020131452 is 5 since is the only value of d_1 between 0 and and 10 for which $d_1+2*2+3*5+4*4+5*1+6*3+7*1+8*0+9*2+10*0$ is a multiple of 11. Write a program `ISBN.java` that takes a 9-digit integer as a command-line argument, computes the checksum, and prints the 10-digit ISBN number.