

CMSC 113 – COMPUTER SCIENCE 1
Lab#3 Conditions & Loops – Practice

Note: Before you start this lab make sure you have read Section 1.3 from your text.

In this lab you will practice instances where conditions and loops are used to do some useful computations.

Task # 1: Review: The following table contains some typical examples of using while- and for- loops. Please spend a few minutes to get a good understanding of loops.

<i>compute the largest power of 2 less than or equal to n</i>	<pre>int power = 1; while (power < n/2) { power = 2 * power; } System.out.println(power);</pre>
<i>compute a finite sum (1 + 2 + ... + n)</i>	<pre>int sum = 0; for (int i = 1; i <= n; i++) { sum += i; } System.out.println(sum);</pre>
<i>compute a finite product (n! = 1 x 2 x ... x n)</i>	<pre>int product = 1; for (int i = 1; i <= n; i++) { product *= i; } System.out.println(product);</pre>

Task#2: Determine the values in m and n after executing the following program fragment:

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

After executing the above, the values in m and n will be:

m = _____ n = _____

Please confirm your answer with another student in class.

Task#3: Greatest Common Divisor – GCD

The GCD of two numbers, say a and b , is defined as the largest number that divides both of them without leaving any remainder. For example,

GCD of 15 and 25 is 5

GCD of 18 and 12 is 6

GCD of 33 and 28 is 1

GCD of 210 and 45 is 15

First, make sure you understand the concept of a GCD. To test your understanding write down the GCD of the following:

GCD of 21 and 14 is _____

GCD of 9 and 36 is _____

Euclid, who authored *Elements* (circa 300 BC) devised an algorithm to compute the GCD of two numbers. It is regarded as the oldest known algorithm!

Here is an algorithm for computing the GCD of two numbers a and b :

```
while (a ≠ b)
  if a > b
    a ← a - b
  else
    b ← b - a
```

At the end of the above loop, both a and b will contain the GCD (why both?). Write a Java program, **GCD.java**, that inputs two numbers a and b and outputs the GCD of a and b . It should use the above algorithm to compute the answer. Here is an example run:

```
$ java GCD 15 25
```

```
The GCD of 15 and 25 is 5
```

```
$ java GCD 33 28
```

```
The GCD of 33 and 28 is 1
```

Once done, try out all the examples on this page and confirm your answers.

Your Lab#3 is done. There is nothing to submit, just send an e-mail to your instructor. Please, read Section 1.3 of your text to learn about other ways of designing and using loops.