ESC101 : Fundamental of Computing

Lab 6 for 9th September 2008

From this lab onwards, you will have to write JAVA programs which receive input from command-line (terminal). This was demonstrated during the lecture of 8th September.

1. **Computing x^y without any multiplication** (marks=10)
   Write a java program that computes x^y (x raised to y) without using any explicit multiplication. You have to design and use the following methods. Consider x, y as positive integers.

   - **Add** : a method to compute and return addition of two numbers.
   - **Mulitply** : a method to compute and return product of two numbers using the method **Add**.
   - **Power** : a method that computes and returns x^y using method **Multiply**.

2. **Mersenne Prime** (marks=10)

   A positive integer m is called a `Mersenne number` if m can be expressed as $m = 2^n - 1$, where n is an integer. For example, $1 = (2^1 - 1)$, $3(= 2^2 - 1)$, $7(= 2^3 - 1)$ are all `Mersenne number`. A `Mersenne number` $m(= 2^n - 1)$ is called a `Mersenne prime` if both m and n are prime numbers.

   For example, $31 = 2^5 - 1$ is a `Mersenne prime` , because 31 and 5 are both prime number. Similarly, $3(= 2^2 - 1)$ and $7(= 2^3 - 1)$ are `Mersenne prime` .

   But $15(= 2^4 - 1)$ is not a `Mersenne prime` because neither 15 nor 4 is a prime number. Similarly, $2047 = 2^{11} - 1$ is not a `Mersenne prime` because $2047(= 23 \times 89)$ not a prime number even though 11 is a prime number.

   Write a Java program to generate all Mersenne primes between 2 and 2^{31}. Your program has to design and use the following methods:

   - **GenerateMersenneNumber:** a method that takes a number n as input and returns the corresponding `Mersenne number` $2^n - 1$.
   - **isPrime:** a method that takes an integer n as input and returns 1 if the number is a prime number. Otherwise returns 0.

   Hint: Generate all the primes between 2 and 32 using method (ii). For each prime number generated, compute the corresponding Mersenne number using method (i). Use method (ii) again to check if the Mersenne number computed is also a prime number ...