# Lab assignment 16.4

# Primes

**Inside your SingleDimensionalArrays project, create a new class called Primes**

**Write a program that computes prime numbers using the “Sieve of Eratosthenes” method.**

Your constructor will have one parameter that takes in an array containing a large (*N* <= 1000) number of booleans in the constructor.

The **Sieve** prime number generator uses an ingenious method, which does not involve any type of division, by using the following steps:

**Step 1:** Initialize all numbers in the array, starting with 2, as primenumbers. Ignore number 1.

**Step 2:** Check the first number, **2**, to see if it is prime.

Since it is designated prime, change all the multiples of 2 to **Not Prime**.

**Step 3:** Check the next number, **3**, to see if it is prime.

Since it is designated prime, change all the multiple of 3 to **Not Prime**.

**Step 4:** Continue this process, until the upper limit is reached.

Imagine that a small upper limit of 21 is requested.

The “Sieve” will work with **Pr** (**Pr**ime) and **NP** (**N**ot **P**rime) as follows:

**STEP 1** Initialize all elements to **Prime**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr | Pr |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |

**STEP 2** Change all multiples of **2** to **Not Prime**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx | Pr | Pr | NP | Pr | NP | Pr | NP | Pr | NP | Pr | NP | Pr | NP | Pr | NP | Pr | NP | Pr | NP | Pr |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |

**STEP 3** Change all multiples of **3** to **Not Prime**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx | Pr | Pr | NP | Pr | NP | Pr | NP | NP | NP | Pr | NP | Pr | NP | NP | NP | Pr | NP | Pr | NP | NP |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |

**STEP 4** Repeat this process until the upper limit is reached

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| xx | **Pr** | **Pr** | NP | **Pr** | NP | **Pr** | NP | NP | NP | **Pr** | NP | **Pr** | NP | NP | NP | **Pr** | NP | **Pr** | NP | NP |
| 1 | **2** | **3** | 4 | **5** | 6 | **7** | 8 | 9 | 10 | **11** | 12 | **13** | 14 | 15 | 16 | **17** | 18 | **19** | 20 | 21 |

**Prime Numbers left are: 2, 3, 5 ,7, 11, 13, 17, 19**