# Prime Generation and primality test using 2x+1 and Summation of a constant

by: Mar Detic

**Abstract:**

We introduce another way to enumerate primes up to N using 2x+1 and the summation of a constant. By which can also be used for primality test of a given integer.

Definition:

For all x integer, where x is equal $2a+1$ and a is equal to $(\frac{x-1}{2})$. And the multiples of a prime can be written as $(\frac{x-1}{2})$ adding to the summation of a constant c multiplied by 2 adding 1; thus $((\frac{x-1}{2})+\sum_{i=1}^{n} x)\times 2+1$ , which means the congruence $((\frac{x-1}{2})+\sum_{i=1}^{n} x)\times 2+1\equiv 0 \mod x$ .

By definition above we're gonna use the formulae:

Let $a = \{a_1, a_2, \ldots a_{n-1}\}$ a set of integers

n is a tuple (sequence)where:

$$(((a_k+\sum_{i=1}^{n} c)\times 2)+1)\leq a_k$$

## **On prime generation(**prime sieve**)**

Let say we are given an integer **a**:

a= 10

since we need to find all primes less than a well use the list $\{a_1, a_2, \ldots a_{n-1}\}$; thus {1,2,3,4,5,6,7,8,9}

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **x** | | 3 | 5 | 7 | --------- | --------- | --------- | --------- | --------- | --------- | --------- |
| $a_k$ | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| $a_k+\sum_{i=1}^{n} x$ | n=1 | 4 | Here we skip since the functio n will give 7 7(2)+1=15 which is > a | Here we skip since the functio n will give10 10(2)+1=2 1 which is > a | Here we skip since 4 is on the $a_1$ | Here we gonna skip since the function will add up if multiplied by 2 then added 1 is greater than a<br>meaning instead of listing all $\{a_{1,\ldots} a_{n-1}\}$ we can list only up $\frac{a_k}{2}$ since $(((\frac{a_k}{2})\times 2)+1)>a_k$ | | | | | |
| | n=2 so on | Here we skip since the functio n will give 7 7(2)+1=15 which is > a | | | | | 6ojljlpo hltoj59u h05ej'n 89'juuy | | | | |

Checking if $a_k \neq (a_{k-(k-1)} + \sum_{i=1}^{n} x)$ ; if true x is prime

## **On primality test (**trial division using the prime generation above**)**

example:
Given integer a, we check first if even or not.
a=100

we'll gonna use the method from prime generation above but we'll gonna use the limit since we know that the largest factor of a number is the squareroot; so $(a=\sqrt{a}) \Rightarrow (a_k=10)$

Checking if $a \, mod((a_k \times 2)+1)$ ; if true **a** not is prime

--------------------------------------------------------------------------------
As you can see above we started generating primes from 3 because:

if we consider 1 as prime:

| | |
|---|---|
| $1 \Rightarrow \frac{1-1}{2} \Rightarrow \frac{0}{2}$ | thus the x above will start at 0 then if we feed 0 to the $x + \sum_{i=1}^{n} p$ where x is 0 and p is 1. |
| $0 + \sum_{i=1}^{n} 1$ | this set will produce an integer a where 2a+1 will produce all odd and even integer.<br>So we can say this function is the prime of primes for all odd integer. |

if we consider 2 as prime:

| | |
|---|---|
| $2 \Rightarrow \frac{2-1}{2} \Rightarrow \frac{1}{2}$ | thus the x above will start at $\frac{1}{2}$ then if we feed $\frac{1}{2}$ to the $x + \sum_{i=1}^{n} p$ where x is $\frac{1}{2}$ and p is 2. |
| $\frac{1}{2} + \sum_{i=1}^{n} 2$ | this set will produce a where 2a+1,we'll produce all even integer that if divide by 2 is equal to all odd integer.<br>Which be written as $2 \times (0 + \sum_{i=1}^{n} 1)$ ,where n is only odd integer(including primes).<br>So we can say this function is the prime of primes for all even integer. So if we don't consider 1 as prime then so is 2 we can't consider as prime. |

**note:**

**and the gaps of primes is bounded by how many multiple of primes between 2 given primes**

example:

89,97 gap is 8

(89-1)/2=44

(97-1)/2=48 44,{45,46,47}48 ; thus 3 is the gap

Now to calculate the gaps; the formula is:

$$2x+2$$

Where x is equals **(a-b)-1**;where a is the larger prime and b is the smaller prime.