Phi (Φ) function - Euler's totient

Phi (Φ) function, also known as Euler's totient function, is an arithmetic function that counts the positive integers up to a given integer n that are relatively prime to n. In other words, the function returns the number of integers from 1 to n-1 that have no common factor with n other than 1.

The phi function is written as Φ(n) or ϕ(n). Here are the mathematical formulas to calculate phi function:

1. If p is a prime number, then `Φ(p) = p - 1`
2. If p and q are distinct prime numbers, then `Φ(pq) = (p - 1)(q - 1)`
3. For a general n, let p1, p2, ..., pm be the distinct prime factors of n. Then,

```
Φ(n) = n * (1-1/p1) * (1-1/p2) * ... * (1-1/pm)
```

Example of JavaScript code to calculate phi function Φ(n):

```
// Compute phi function Φ(n)
function phi(n) {
    let result = n; // Initialize result with n

    // Check for all prime factors smaller or equal to sqrt(n)
    for (let i = 2; i*i <= n; i++) {
        if (n % i == 0) {
            while (n % i == 0) {
                n /= i;
            }
            result -= (result / i);
        }
    }

    // If n has a prime factor greater than sqrt(n)
    if (n > 1) {
        result -= (result / n);
    }

    return result;
}
```

Note:

This implementation of phi function uses a well-known algorithm called Euler's Totient Function Formula.

Funny note:

Christian Goldbach in a letter to the Euler make a discussion. The "Goldbach Conjecture" read more

- $2m = p + q$
- $p \geqq m$
- $q \leqq m$

He calculate the chance of q & p can be prime number ...
Calculation power speed = ($\ln n \ll \sqrt{n}$) {i think: n log n^2, not sure}