

15.1Sieve of Eratostheneschallenge

Print all the prime numbers in a given range:

- To print prime numbers till 50
- Make an array of 1-50 numbers [remove 1]
- Mark the multiples of prime numbers
- At last, the unmarked numbers will be the prime numbers.

	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

★ start with
square of
number
for i start with i²
2 → 4, ... till 50
3 → 9, ...

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47

Code:

```

void primeSieve(int n) {
    int prime[100] = {0};

    for (int i = 0; i <= n; i++) {
        if (prime[i] == 0) {
            for (int j = i * i; j <= n; j += i) {
                prime[j] = 1;
            }
        }
    }

    for (int i = 2; i <= n; i++) {
        if (prime[i] == 0) {
            cout << i << " ";
        }
    }
    cout << endl;
}

```


② Prime Factorisation using Sieve:

$\text{spf}[i] \rightarrow$ smallest prime factor of i

```
while (n != 1) {
    print spf[n]
    n = n / spf[n]
}
```

20 $\xrightarrow{2}$ 10 $\xrightarrow{2}$ 5 $\xrightarrow{5}$ 1

Code:

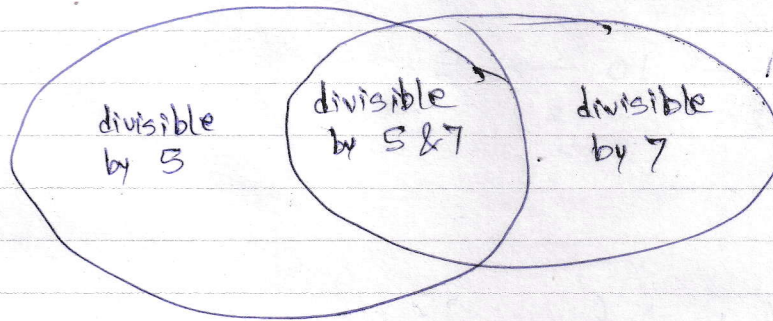
```
void primefactor(int n) {
    int spf[100] = {0};
    for (int i = 2; i <= n; i++) {
        spf[i] = i;
    }

    for (int i = 2; i <= n; i++) {
        if (spf[i] == i) {
            for (int j = i * i; j <= n; j += i) {
                if (spf[j] == j) {
                    spf[j] = i;
                }
            }
        }
    }

    while (n != 1) {
        cout << spf[n] << " ";
        n = n / spf[n];
    }
    cout << endl;
}
```


15.2 Inclusion - Exclusion Principle

How many numbers between 1 and 1000 are divisible by 5 or 7?



Code:

```
int divisible (int n, int a, int b) {  
    int c1 = n/a;  
    int c2 = n/b;  
  
    int c3 = n/(a*b);  
  
    return c1 + c2 - c3;  
}
```


15.2

Euclid Algorithm to find GCD (Greatest common divisor) HCF

$$24 = 2 \times 2 \times 2 \times 3$$

$$42 = 2 \times 3 \times 7$$

$$\begin{array}{c} 2 \times 3 \\ \boxed{= 6} \end{array}$$

When we subtract
two number then
the GCD
doesn't change

$$42 - 24 = 18$$

$$18$$

$$42 - 24 = 18$$

$$24 - 18 = 6$$

$$18 - 6 = 12$$

$$12 - 6 = 6$$

$$6 - 6 = 0$$

GCD (HCF)

$$42 \% 24 = 18$$

$$24 \% 18 = 6 \leftarrow \text{GCD}$$

$$18 \% 6 = 0$$

```
int gcd (int a, int b) {
```

```
    while (b != 0) {
```

```
        int rem = a % b;
```

```
        a = b;
```

```
        b = rem;
```

```
    }
```

```
    return a;
```

```
}
```