

LCM (Least common Multiple)

$$\begin{array}{r} 4, 6 \\ 2 \overline{) 4, 6} \\ 2 \overline{) 2, 3} \\ 3 \overline{) 1, 3} \\ 1, 1 \end{array}$$

$$\text{LCM} = 12$$

$$\begin{array}{r} 12, 15 \\ 2 \overline{) 12, 15} \\ 2 \overline{) 6, 15} \\ 3 \overline{) 3, 15} \\ 5 \overline{) 1, 5} \\ 1, 1 \end{array}$$

$$\text{LCM} = 60$$

$$\begin{array}{r} 2, 8 \\ 2 \overline{) 2, 8} \\ 2 \overline{) 1, 4} \\ 2 \overline{) 1, 2} \\ 1, 1 \end{array}$$

$$\text{LCM} = 8$$

$$\begin{array}{r} 3, 7 \\ 3 \overline{) 3, 7} \\ 7 \overline{) 1, 7} \\ 1, 1 \end{array}$$

$$\text{LCM} = 21$$

Prime : The numbers that are divisible by itself and by 1. Those numbers are called prime numbers.

Eg: 2, 3, 5, 7, 11

PRIME NUMBERS
2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

Observation :

1) LCM of 2 numbers is always greater than (or) equal to the max of given numbers

Eg: $4, 6 \Rightarrow \text{max } 6 \Rightarrow \text{LCM } 12$
 $12, 15 \Rightarrow \text{max } 15 \Rightarrow \text{LCM } 60$
 $2, 8 \Rightarrow \text{max } 8 \Rightarrow \text{LCM } 8$

2) If any 2 numbers don't have any co-prime in common

Then multiply those 2 numbers

Eg: $3, 7 \Rightarrow 3 \times 7 \Rightarrow 21$

Naive solution

```
int lcm(int a, int b)
{
    int max = Math.max(a, b);
    while(true)
    {
        if (max % a == 0 && max % b == 0)
        {
            break;
        }
        max++;
    }
    return max;
}
```

Time complexity

$$O(a * b - \max(a, b))$$

Effective solution

$$a * b = \text{gcd}(a, b) * \text{lcm}(a, b)$$

$$\frac{a * b}{\text{gcd}(a, b)} = \text{lcm}(a, b)$$

By using Euclidean algorithm we can find $\text{gcd}(a, b)$. So optimal solution is

```
int gcd(int a, int b)
{
    if (b == 0)
        return a;
    else
        return gcd(b, a % b);
}

int lcm(int a, int b)
{
    return (a * b) / gcd(a, b);
}
```

Time complexity

$$O(\log(\min(a, b)))$$