

CD (Greatest common Divisor)

$\text{gcd}(a, b) = x$ if

$$a \div x = 0$$

$$b \div x = 0$$

(12, 10)

X	12	10
1	1	1
2	2	2
3	3	X
4	4	X
5	X	5

$$\text{gcd} = 2$$

(20, 10)

X	20	10
1	1	1
2	2	2
5	5	5
10	10	10

$$\text{gcd} = 10$$

Find gcd (24, 34)

$$\begin{array}{r}
 1 \\
 24 \overline{) 34} \\
 \underline{24} \\
 10 \overline{) 24} \\
 \underline{20} \\
 4 \overline{) 10} \\
 \underline{8} \\
 2 \overline{) 4} \\
 \underline{4} \\
 0 \overline{) 2}
 \end{array}$$

Euclidian Algorithm

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

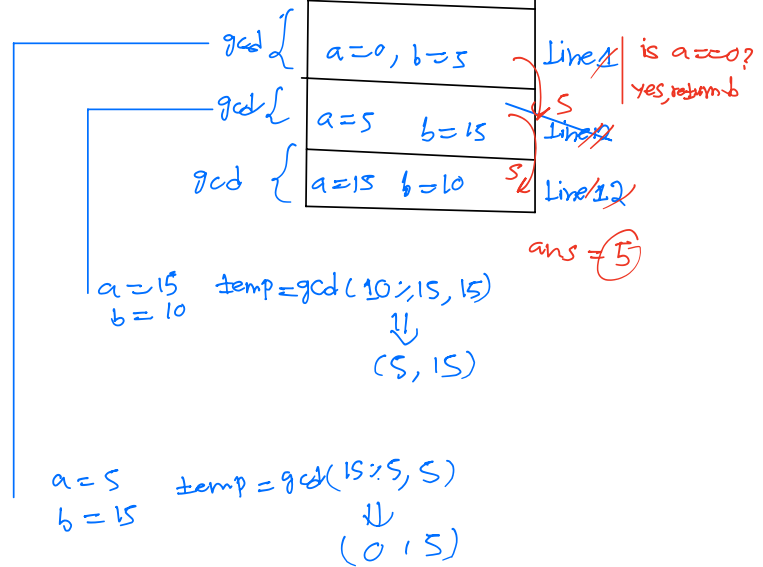
We have $\text{gcd}(0, b) = b$

continue this until you get any of the above zero;

```
def gcd(a,b):
    if a==0:
        return b
    temp = gcd(b%a,a)
    return temp
```

stack calls

find gcd(15,10)



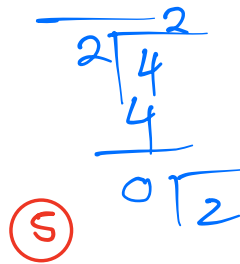
Analysis: if the number is getting divided by '2' every time, it takes longer until it reaches zero

$\text{gcd}(18, 42)$

- (1) $18 \overline{) 42}$
18
—
24
- (2) $14 \overline{) 18}$
14
—
4
- (3) $4 \overline{) 14}$
12
—
2

—

④



⑤

$$\Rightarrow \max(18, 42)$$

$$5 < \log_2(42) < 6$$

Number of steps to
reach to $a=0$;

$$i, \log_2 \max(a, b)$$

$$\Rightarrow \text{Time complexity} = O(\log_2 N)$$

$$\text{Space complexity} = O(1)$$