Mathematics - I

Palindrome Numbers

× 12 → 21

× 432 → 234

✓ 131 → 131

✓ 1441 → 1441

✓ 5 → 5

2 3,4 3 2

int a = 23432

String s = a+" ";

✓ 22 → 22

[String length N → O(N)]

```
int rev = 0;
int n = 1441

int ld = n % 10;
rev = rev * 10 + ld;
n = n / 10;
```

n = 1441
rev = 0

ld = 1441 % 10 = 1
rev = 1
n = 1441 / 10 = 144

ld = 144 % 10 = 4
rev = 1 * 10 + 4 = 14
n = 144 / 10 = 14

N

$\boxed{O(\log N)}$

(total no. of digits = $\log_{10} n + 1$)

131 → ($\log 131$)

10 → $\log_{10} 10 = 1 + 1 = 2$

20 → $\log_{10} 10 = 1.\!\sim + 1 = 2.\!\sim \Rightarrow 2$

100 → $\log_{10} 100 = 2 \log_{10} 10 = 2 + 1 = 3$

GCD or HCF of Two Numbers

int a = 24 → $\boxed{12}$

int b = 36

(24, 36)

O(min(a, b))

2, 7 → 1

5, 30 → 5

10, 15 → 5

36, 30 → 6

36 → 2, 2, 3, 3

30 → 2, 3, 5 → 2*3 = 6

```
for (int i = min(a, b) ; i > 1 ; i--) {
    if (a % i == 0 && b % i == 0)
        return i

}
return 1 ;
```

$\underline{(24, 36)}$

$24 \to 23 \to 22 \ldots\ldots 13 \to \underline{12}$

Euclid GCD

$$\left[\gcd(a, b) = \gcd(a-b, b) \right]$$

$a > b$

$$g(36, 24) = g(36-24, 24)$$
$$= g(12, 24)$$

$$\gcd(24, 12) = \gcd(12, 12)$$

$$\gcd(7, 2) = \gcd(7-2, 2)$$
$$= \gcd(5, 2)$$

$$\gcd(5, 2) = \gcd(5-2, 2) = \gcd(3, 2)$$

$$\gcd(3, 2) = \gcd(1, 2)$$

$$\gcd(2, 1) = \underline{\gcd(1, 1)}$$

$$\gcd(a, b) = \underline{p}$$

$$p * i = a$$
$$p * j = b$$

$(a-b) = p_i - p_j = P\underline{(i-j)}$

$60, 24 \downarrow 36, 24 \downarrow 12, 24$

$\gcd(a, b) = \gcd(a-b, b)$

$\downarrow$

$\gcd(a, b) = \underline{\gcd(a \% b, b)}$

$100, 9 \to 9, 1$

$10^6 \downarrow 10^5 \downarrow 10^4 \ldots 1$

$\log(10^6) \downarrow \boxed{6}\underline{\log_{10} 10}$

$24, 12 \downarrow 12, 12$

$23, 4 \downarrow 19, 4 \downarrow 15, 4 \to 11, 4 \to 7, 4 \to \underline{3, 4}$

$23 \% 4, 4$

LCM of Two Numbers

$$LCM = \frac{a * b}{\boxed{12}}$$

24 → 24, 48, 72, 96

36 → 36, 72, 108,

$\boxed{12}$

144

144

$24 = 2 * 2 * 2 * 3$

$36 = 2 * 2 * 3 * 3$

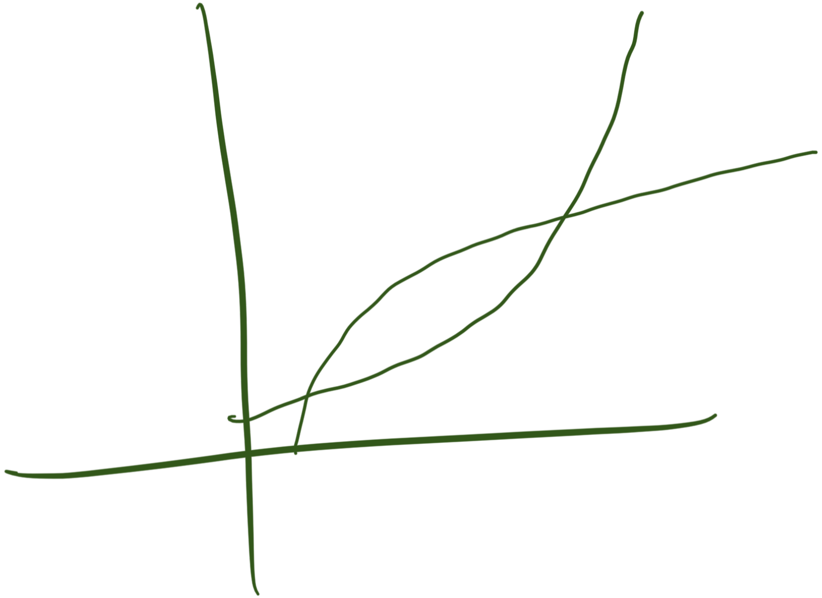
2	24, 36
2	12, 18
3	6 9
2	2, 3
3	

72.

$$\left[LCM = \frac{a * b}{HCF} \right]$$

$gcd(a, b)$

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



Trailing Zeros in Factorial

1043 → 0

100 → 2

1020 → 1

$2 * 5 = \underline{10}$

$5! = 5 * 4 * 3 * 2 * 1 = 12\underline{0}$

$\underline{Ans = 1}$

$10! = \underline{10} * 9 * \underline{8} * 7 * \underline{6} * \underline{5} * \underline{4} * 3 * \underline{2} * 1 = 2$

$15! = 15 * 14 \ldots\ldots 10 * 9 \ldots\ 6 \times 5 * 4 \ldots 1$

$= \underline{3}$.

$20! = 4$

$n/5$ X

$14! = 2$

$5! = 1$

$10! = 2$

$15! = 3$

$20! = 4$

$25! = 6$

$5 * 5$

$25 * 24 \ldots 20 \times \ldots 15 \ldots * 10 * \ldots 5 \times \ldots 1$

5 4 3 2 1

$30! = 7$

$\frac{n}{5} + 1$

5 5 5

$125! \text{ --- } 120$

125 * ... 100 * ... 75 * ... 50 * ... 25 * ... 20 * ... 1

divide by

25 20 15 10 5 4 ...

$\boxed{5}$ 4 3 2 1 0 ...

/5

1 0 0 0 0

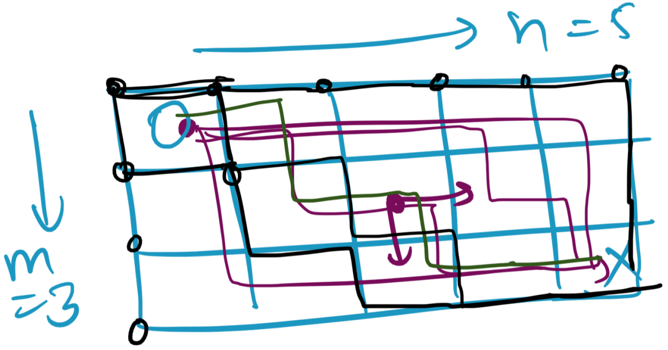
while n>0

[res += n/5
n/5]

$n = \frac{125}{5} = \boxed{25}$ $\frac{25}{5} = \boxed{5}$ $\frac{5}{5} = \boxed{1}$

$25 + 5 + 1 = \boxed{31}$

Unique Paths in a Grid



$m * n$

$2^{m \cdot n}$

$f(m, n)$

$f(m-1, n) + f(m, n-1)$

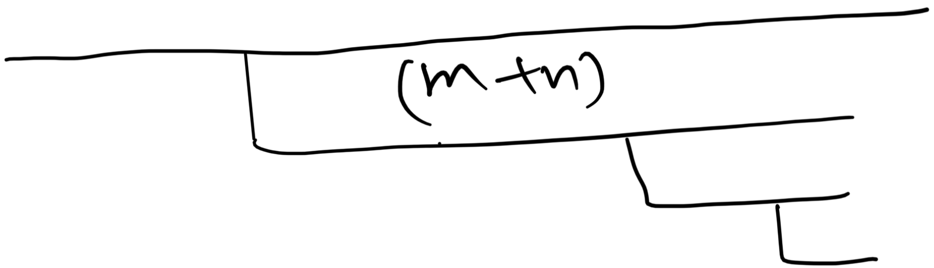
$m \rightarrow$ rows

$n \rightarrow$ cols

total steps $\rightarrow (m+n)$

8

$^{5}C_{2}$



in m+n total steps you need to come down m times.

P > C

$^{m+n}C_{m}$

$2^{m \cdot n}$

$\boxed{m > n}$

$$\frac{(m+n)!}{m!\,n!}$$

(m+1)

$$= \frac{(m+n) * (m+n-1) \cdots \cancel{m!}}{\cancel{m!} * n!}$$

(m+n-1)

$$= \frac{(m+1) * (m+2) * (m+3) \cdots (m+n)}{1 * 2 * 3 \cdots n}$$

total n times $\boxed{O(n)}$

$\boxed{\text{Why?}}$

```
int res = 1
for(int i=1; i<n; i++)
    res = res * (m+i) / i ;
}
```

$^{m+n}C_m = {^{m+n}C_n}$

Practice Problems

1. Learn about Mean, Median Mode.
2. Learn about Arithmetic & Geometric Progression.
3. Learn about Binary, Octa and Hexagonal Number systems and solve Base conversion Problems.
4. Proof of Euclidean GCD
5. Basics of Basics of Permutations & Combination.
6. Write a Program to calculate the square roots of an equation.
7. https://www.interviewbit.com/courses/programming/math/