$$\text{Sum} \rightarrow 1+2+3 = 6$$

$$[1, 2, 3]$$

$$1+2+3+4$$

$$\text{Running sum} \rightarrow 1+2 = 3+3 = 6+2 = 8$$

$$n = \underline{3}$$

Running Sum for loop

```java
Scanner s = new Scanner(System.in);
int n = s.nextInt();

int sum = 0;
for(int i = 0; i < n; i++){
    int num = s.nextInt();

    sum = sum + num;
    System.out.print(sum + " ");
}
```

$$\text{Sum} = \underline{0}$$

$$i = 0 < 3 \ T$$

$$0 + 1 = 1$$

$$i = 1 < 3 \ T$$

$$1 + 2 = 3$$

$$i = 2 < 3 \ T$$

$$3 + 3 = 6$$

num
$$\rightarrow 1$$
$$\rightarrow 2$$
$$\rightarrow 3$$

$$i = \underline{3} < 3 \ F$$

$$op \rightarrow \boxed{1 \quad 3 \quad 6}$$
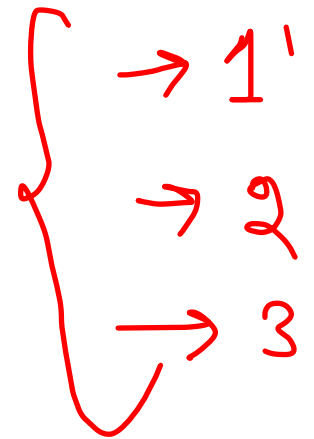
Fibbonacci Series

0 1 1 2 3 5 8 13 21 ---------

a b c
   a b c

$a + b = C$

$b = a$

$c = b$

a	b	c
0	1	1
1	1	2
1	2	3
2	3	5
3	5	8
5	8	13
8	13	21
13	21	-

add last two to get the next.

F(0) F(1) F(2) F(3) (4)   (5)   (6)   (7)   (8) - - - -

0   1   1   2   3   5   8   13   21 - - - -

n=5

a = 0

b = 1

c = a+b;

a = b;

b = c;

```
Scanner s = new Scanner(System.in);
int n = s.nextInt();

int a = 0;
int b = 1;
int c;

for(int i = 0; i < n; i++){
    c = a +b;
    a = b;
    b = c;
}
System.out.print(a);
```

a	b	c
0	1	1
1	1	2
2	2	3
3	3	5
4	5	8

0 → a
2 → c

0< 5>4

i	a	b	c
0		1	1
1	1	2	2
2	2	3	3
3	3	5	5
4	(5)	8	8
			13

While loop:

Syntax

```
initialization
while (condition){
    //Statement
    upgrade
}
```

$1 \to 10$

```
int i = 1
while ( i ≤ 10){
    Syso(i);
    i++;
}
```

Print 0 to n

```java
Scanner s = new Scanner(System.in);
int n = s.nextInt();

int i = 0;
while(i <= n){
    System.out.println(i);
    i++;
}
```

Printing 5 to N(While Loop)

```java
Scanner s = new Scanner(System.in);
int n = s.nextInt();

int i = 5;
while(i <= n){
    System.out.println(i);
    i++;
}
```

Print 4,13,22,31.....n

```java
Scanner s = new Scanner(System.in);
int n = s.nextInt();

int i = 4;
while(i <= n){
    System.out.println(i);
    i+=9;
}
```

HW_Print till n for this Series 5,11,17,23,29..

```java
Scanner s = new Scanner(System.in);
int n = s.nextInt();

int i = 5;
while(i <= n){
    System.out.println(i);
    i+=6;
}
```

HW_Print In Range(x and y)

```java
Scanner s = new Scanner(System.in);
    int x = s.nextInt();
    int y = s.nextInt();

    int i = x;
    while(i <= y){
        System.out.println(i);
        i++;
    }
```

$$n = 5$$
$$r = 2$$

$$\Rightarrow (n-r)^{3}$$

Permutation , $\quad {}^{n}P_{r} \rightarrow \dfrac{n, r}{}$

formula $\rightarrow \dfrac{n!}{(n-r)!} = \dfrac{5!}{3!} = \dfrac{[5 \times 4] \times \cancel{3 \times 2 \times 1}}{3 \times 2 \times 1} = 20 \text{ bf}$

factorial $\rightarrow$ multiply till no. becomes 1. $\begin{bmatrix} \rightarrow n \text{-----} x1 \\ \rightarrow 1 \text{------} xn \end{bmatrix}$

$$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

$$n = 6$$
$$r = 2$$

$$= \frac{n!}{(n-r)!} = \frac{6!}{4!} = \frac{6 \times 5 \times 4!}{4!} = 30$$

$$(n-r) = (6-2) = 4$$

$$n > (n-r)$$

(i)
$$\begin{bmatrix} 6 > 4 \checkmark \\ 5 > 4 \checkmark \end{bmatrix}$$
$$4 > 4 \times$$

$$n; > (n-r); i--$$

ans $*$ i

$$n = 7 \quad r = 3$$
$$(n-r) = 4$$

$$\frac{7!}{4!}$$

$$\Rightarrow \frac{7 \times 6 \times 5 \times 4!}{4!}$$

$npr = 1$

$i = 7 > 4 \; T$

$1 \times 7 = 7$

$i = 6 > 4 \; T$

$7 \times 6 = 42$

$i = 5 > 4 \; T$

$42 \times 5 = \boxed{210}$

$i = 4 > 4 \; \times$

```
Scanner s = new Scanner(System.in);
int n = s.nextInt();
int r = s.nextInt();

int npr = 1;
for(int i = n; i > (n-r); i--){
    npr *= i;
}
System.out.println(npr);
```

$n = 20$

```
Scanner s = new Scanner(System.in);
int t = s.nextInt();
for(int i = 0; i < t; i++){
    int n = s.nextInt();

    int steps = 0;

    while(n > 0){
        if(n % 2 == 0){
            n -= 1;
        }
        else{
            n -= 3;
        }
        steps++;
    }
    System.out.println(steps);
}
```

Steps →10

2
→10
→15

1) $20 - 1 \Rightarrow 19$

2) $19 - 3 = 16$

3) $16 - 1 = 15$

4) $15 - 3 = 12$

5) $12 - 1 = 11$

6) $11 - 3 = 8$

7) $8 - 1 = 7$

8) $7 - 3 = 4$

9) $4 - 1 = 3$

10) $3 - 3 = 0$

→o/p
→o/p

$n = 15$

$15 - 3 = 12$
$12 - 1 = 11$
$11 - 3 = 8$
$8 - 1 = 7$
$7 - 3 = 4$
$4 - 1 = 3$
$3 - 3 = 0$

$n = 10 - 1 = 9$ ✓
$9 - 3 = 6$ ✓
$6 - 1 = 5$ ✓
$5 - 3 = 2$ ✓
$2 - 1 = 1$ ✓
$1 - 3 = -2$ ✓

$n = 10$
9
6
5
2
1

10^3 $n=3$ power $=1$ $n=0$ 10^0

$i=0 < 3$ T $i=0 < 0$ F

$1 \times 10 = \underline{10}$ power $= 10$ o/p

$i=1 < 3$ T

$10 \times 10 = 100$

$i=2 < 3$ T   for (int $i=0$; $< n$; $i++$) {

$100 \times 10 = \underline{1000}$ power $= 10$;

$i=3 < 3$ F   }

Syso (power);

Tribbonaci series

$a = 0$ $\rbrace$ T(0)

$b = 1$ $\rbrace$ T(1)

$c = 1$ $\rbrace$ T(2)

$d = a + b + c$

$3 \rightarrow result$

result = $a + b + c$;

$a = b;$

$b = c;$

$c = result;$

a	b	c	d
0	1	1	2 (T3)
	1	2	4 (T4)
1	2	4	7 (T5)
1	4	7	13 (T6)
2	4	7	

$n = 123\underline{4} \ \% \ 10 = \underline{4}$

$1234 / 10 = 123$

Print all digits from end

$$10 \overline{)1234} \left(\boxed{\underline{123}} \right) Q$$
$$\underline{1230}$$
$$\boxed{4} \ R$$

$123 \% 10 \to ③$

$123/10 - \underline{12}$

$12 \% 10 - 2$

$12/10 \to \underline{1}$

$1 \% 10 \to \underline{1}$

$1/10 \to 0$

$\% 10 \to$ gives the last digit of a no.

$/10 \to$ remove the last digit from no.

$n = 1432$

$i = 1432 \ ! = 0 \ T$

$\text{digit} = 1432 \% 10 = 2$

$1432 / 10 = 143$

$i = 143 \ ! = 0 \ T$

$143 \% 10 = 3$

$143/10 = 14$

$\boxed{\dfrac{1432}{10}}$

$i = 14 \ ! = 0 \ T$

$14 \% 10 = 4$

$14 / 10 = 1$

$i = 1 \ ! = 0 \ T$

$1 \% 10 = 1$

$1/10 = 0$

```java
Scanner s = new Scanner(System.in);
int n = s.nextInt();

int i = n;
while(i != 0){
    int digit = i % 10; // extract the last digit
    System.out.println(digit);
    i /= 10; // remove the last digit
}
```

$o/p \to \begin{array}{c} 2 \\ 3 \\ 4 \\ 1 \end{array}$

$(0 \ ! = 0 \ F)$

Print steps and update maximum

Sample Input 0

$S = 0$ $max = -100 + 23$

n

```
6
1
2
3
4
5
6
```

```
1        1 > -100
2        2 > 1
3        3 > 2
4        4 > 3
5        5 > 4
6        6 > 5
```

Sample Output 0

6

Sample Input 1

$S = 0$ $max - 100$ 2

n

```
7
2
3
4
5
1
2
10
```

```
1        2 > -100
2        3 > 2
3        4 > 3
4        5 > 4
5        1 > 5  F
         2 > 5  F
         10 > 5  T
```

Sample Output 1

5

```java
Scanner s = new Scanner(System.in);
int n = s.nextInt();

int steps = 0;
int max = -100;

for(int i = 0; i < n; i++){
    int value = s.nextInt();
    if(value > max){
        max = value;
        steps += 1;
    }
}
System.out.println(steps);
}
```