

# C in One Shot

## Part – 3

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# Loops in One Shot

[For , While, Do-while]

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# What and Why?

loops → baar baar → repetition

```
printf ("Hello PW \n");
```

```
printf ("Hello PW \n");
```

DRY → do not repeat yourself

initialization      condition      updation/increment

```
→ for(int i=1; i<=5; i=i+1){
    → printf("Hello PW\n");
}
```

6  
5  
4  
3  
2  
1

1

i

Steps:

- 1) Condition check
- 2) Loop ke andar aao
- 3) Updation

[  $i = i + 1 \Leftrightarrow i++$  ] same

Output

- Hello PW
- Hello PW
- Hello PW
- Hello PW
- Hello PW
- 

[3-1]

```
for(int i=1; i<=10; i=i+2){
    printf("Hello World\n");
}
```

H.W. →  $i = i + 3$ ; (1, 4, 7, 10 print hbe so 4 bar)

- Hello World
- Hello World
- Hello World
- Hello World
- Hello World
- 

Step 1: Check condition

Step 2: Go inside loop

Step 3: Updation

11  
9  
7  
5  
3  
1  
i

[3-3]

# For Loop

```
for(int i = 1; i<10; i++){
```

```
    // code
```

```
}
```

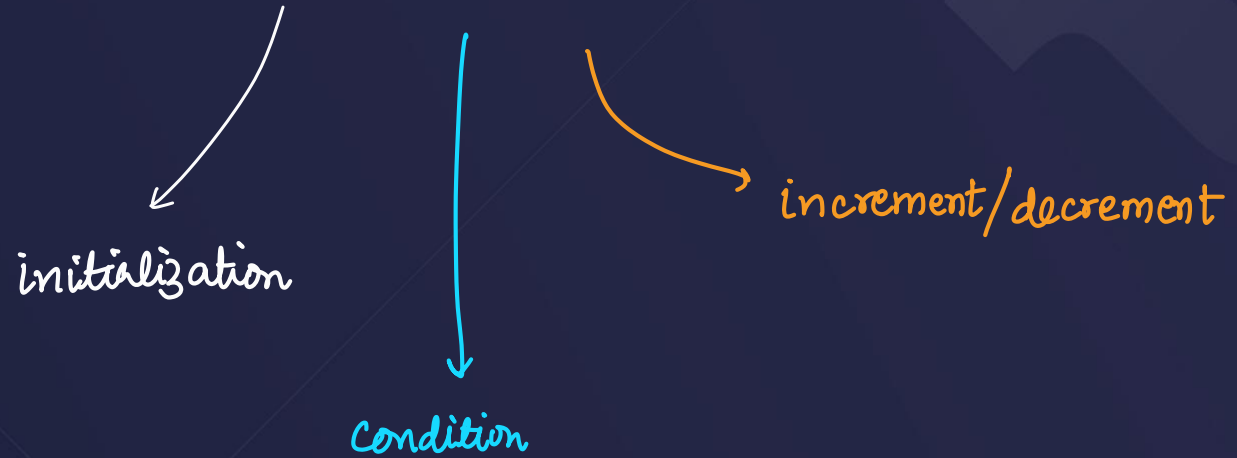
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**Ques** : Print hello world 'n' times. Take 'n' as input from user

[3-2]

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# How for loop works : the various parameters.



scope of variable in [3-4]-[3-5]



**Ques** : Print numbers from 1 to 100

[3-6]

in different lines

Output:

1

2

3

4

.

.

.

.

100

```
for(int i=1;i<=100;i++){  
    printf("%d ",i);  
}
```

i = ~~1~~ 2 3

Output

1\_2\_3\_

4\_5\_6

**Ques** : Print all the even numbers from 1 to 100

[3-7] ↪

```
if ( i % 2 == 0 ) {  
    printf("%d ", i);  
}
```

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**HW** : Print all the odd numbers from 1 to 100  
**[3-8]**

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**Ques** : Print the table of 19.

**[3-9]**

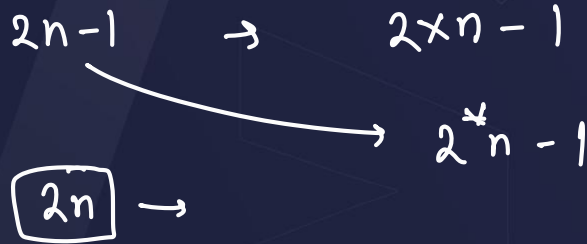
19, 38, 57 . . . . 190

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**HW** : Print the table of 'n'. Here 'n' is a integer which user will input.

[3-10] `int n;`

`scanf("%d", &n);`



**Ques** : Display this AP - 1,3,5,7,9.. upto 'n' terms.

[3-11] 1, 3, 5, 7, 9, 11, 13

2 2 2 2

$$a_n = 1 + (n-1) \cdot 2$$

$$= 1 + 2n - 2 = 2n - 1$$

$d=2$

$a, a+d, a+2d, a+3d, \dots, a+(n-1)d$

first term

common difference

$n^{\text{th}}$  term

```
int i = 1 ; i <= 2n - 1 ; i = i + 2
```

**HW** : Display this AP - 4,7,10,13,16.. upto 'n' terms.

**[3-12]**  
way - 1

**[3-13]**  
way - 2

4, 7, 10, 13, 16 . . . . .

↙  
3

$$a = 4$$

$$d = 3$$

$$a_n = a + (n-1)d$$

$$a_n = 4 + (n-1)3$$

$$= 4 + 3n - 3$$

$$= 3n + 1$$

```
for(int i=4; i<= 3*n+1; i=i+3)
{
    printf("%d ", i);
}
```

**Ques** : Display this GP – 1,2,4,8,16,32,.. upto 'n' terms.

$\times 2$   $\times 2$   $\times 2$   $\times 2$   $\times 2$

$$GP \rightarrow a_n = ar^{n-1}$$

$$= 1 \cdot 2^{n-1}$$

but power use kora to sikhini  
so AP er 2nd way ta use krbo

```
int a = 1;
```

```
for(int i = 1; i ≤ n ; i++) {
```

```
    printf("%d ", a);
```

```
    a = a * 2;
```

```
}
```

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**HW** : Display this GP – 3,12,48,.. upto 'n' terms.

[3-15]

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**Ques** : Display this AP – 100,97,94,..upto all terms which are positive.

[3-17, way - 1] [3-18, way - 2]

100, 97, 94, 91, 88 ...

-3   -3   -3

$$a_n = 100 + (n-1)(-3)$$

$$= 100 - 3n + 3$$

problem → no. of terms → ??

$$= 103 - 3n$$

$$103 - 3n > 0$$

$$\Rightarrow 3n < 103$$

$$\Rightarrow n < \frac{103}{3} \rightarrow$$

$$n < 34.33$$

$$n_{\max} = 34$$

```
// 100 97 94 ....
int a = 100;
for(int i=1;a>0;i++){
    printf("%d_",a);
    a = a - 3;
}
return 0;
```

Output

100 97 94 91 88

[3-18]

94  
97  
100  
a

2  
1  
i

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**HW** : Display this GP - 100,50,25,.. upto 'n' terms.

[3-19]

100 50 25 12.5  
 $\downarrow$   $\downarrow$   $\downarrow$   
 $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$   
~~float~~ ~~int~~ a = 100;

for (int i=1 ; i<=n; i++) {

}

float

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# Loop ke andar jo bhi daalo vo sab repeat hota hai !!

```
for (    ) {
```

```
    line 1;
```

```
    line 2;
```

```
    line 3;
```

```
}
```

shobgula line e repeat hbe

[we can input multiple lines]

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# Break;

↪ It is used to terminate

[3-21]

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**Ques** : WAP to check if a number is prime or not.

25 → composite

solved in **[3-23]**

Prime → n  
 ↓  
 n & 1

Steps: [2 to 24]

$25 \% 2 \rightarrow X$

$25 \% 3 \rightarrow X$

$25 \% 4 \rightarrow X$

$25 \% 5 \Rightarrow 0$

[using loop]

2, 3, 5, 7, 11, 13, 17, 19, 23

**[3-20]-[3-23]**

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```
int n;
printf("Enter a number : ");
scanf("%d",&n);
for(int i=2;i<=n-1;i++){
    if(n%i==0){
        printf("the given number is composite\n");
    }
}
return 0;
```

Round → 'Iterations'

$i \rightarrow 2 \text{ to } 24$   
23 baar loop

$n = 25$



1, 5, 25

~~$i=2$~~   
 ~~$i=3$~~  4 5

[3-20(1)]

[3-20(2)]

12 → 1, 2, 3, 4, 6, 12



Number  $\rightarrow n$

$\rightarrow$  2 to  $n-1$

$\xrightarrow{\text{if}(n \% i == 0)}$  Composite  
 break;

[3-22]

$\boxed{0}$   
 $a$

$\rightarrow$  if ( )  $\rightarrow a = 1;$   
 break;

$\hookrightarrow$  if ( $a == 0$ ) prime  
 else composite

```
int a = 0;
for(int i=2 i<=n-1;i++){
    if(n%i==0){ // i is a factor of n
        a = 1;
        break;
    }
}
if(a==0) printf("the given number is prime\n");
else printf("the given number is composite\n");
return 0;
```

[3-23]

$n$   
↓

$i \rightarrow 2 \text{ to } n-1$

$n=2$

$\rightarrow i \rightarrow 2 \text{ to } 1$

$n=1$

$\rightarrow i = 2 \text{ to } 0$   
LoopX

$\boxed{24}$   
 $n$

$i=2 \rightarrow n-1$

$\boxed{\cancel{0}}$   
 $a$

# Continue; [3-24]

```
for (int i = 1; i <= 100; i++)
{
    if (i % 2 == 0) // even
    { // i is a factor of n
        continue; → Skip Karo us
    }
    printf("%d ", i);
}
```

$i \neq 2, 4$

Output

1 3

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**Ques** : WAP to print odd numbers from 1 to 100.

[3-24]

```
for (int i = 1; i <= 100; i++)  
{  
    if (i % 2 != 0) { // odd  
        printf(    )  
    }  
}
```

Homework : WAP to print all the even numbers from 1 to 100, using continue statement.

[advantage : if we have less data or confusing by for loop  
we can easily solve by while loop]

# While Loop

```
int i = 0;
while(i<10){
    // code
    i++;
```

} output : 0-9

[3-25]

```
for (int i=1 ; i<10 ; i++)
{
    printf ("%d", i);
}
```

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# Infinite Loops :

```
int i = 1;
while (i < 10) {
    printf("%d\n", i);
    i--;
```

3

$i = i - 1$

1

0

-1

-2

-3

[3-26]

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# Do- While Loop

→ Useless  
&  
Semester

```
do {
```

```
//code
```

```
} while ( another == 'y' );
```

do {

==

[3-31]-[3-32]

3 while (condition);

[condition manuk ba na manuk  
1 bar loop cholbei  
tarpor condition check korbe]

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# Predict the output

```
main() {
    int j;
    while ( j <= 10 ) {
        printf ( "\n%d", j );
        j = j + 1;
    }
}
```



[ value of j is not given  
so this code is useless]  
[nothing will come out ]



# Predict the output 11

```
main() {
    int i = 1;
    while ( i <= 10 );
    {
        printf ( "\n%d", i );
        i++;
    }
}
```



Output

- 
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

# Predict the output

```
main() {
    int x = 1;
    while ( x == 1 ) {
        x = x - 1;
        printf ( "\n%d", x );
    }
}
```

0  
1  
~

Output

•  
• 0

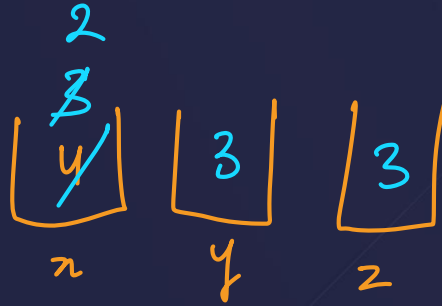
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# Predict the output

```
main() {
    int x = 4, y, z;

    y = --x;
    z = x--;

    printf ( "\n%d %d %d", x, y, z );
}
```



0  
6 2 3 3

$x = 4$   
 $--x \rightarrow x = 3$

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$x++ \Rightarrow x = x + 1; \text{ post}$

$++x \Rightarrow x = x + 1; \text{ pre}$

[3-27] - [3-29]

$x-- \Rightarrow x = x - 1;$

$--x \Rightarrow x = x - 1$

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# Predict the output

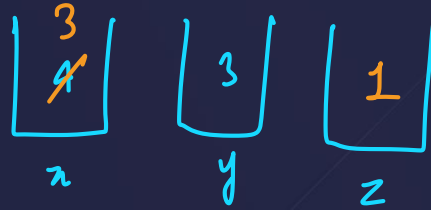
```
main() {
```

```
    int x = 4, y = 3, z;
```

```
    z = x-- - y;
```

```
    printf ( "\n%d %d %d", x, y, z );
```

```
}
```



Output

•  
• 3 3 1

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# Predict the output

```
main() {
    while ( 'a' < 'b' )
        printf ( "\nmalyalam is a palindrome" );
}
```

'a' → 97    'b' 98  
[ascii code]

malayalam  
[---> | <---]

Infinite loop

Output

- 
- ma . . . .
- m - -
- —
- —

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# Predict the output

```
main() {
    int i = 10;
    while ( i = 20 )
        printf ( "\nA computer buff!" );
}
```



[ ekhane (i==20) nei.thats why infinite loop]

Infinite Loop

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# Predict the output

```
main() {
```

```
    int i;
```

```
    while ( i = 10 ) { [same as the previous one]
```

```
        printf ( "\n%d", i );
```

```
        i = i + 1;
```

```
    }
```

```
}
```

Handwritten diagram showing a box containing the value 10, with an arrow pointing to the variable `i` below it.

Output

- 
- 10
- 10
- 10
- 10
- 10
- 10

Infinite Loop



# Predict the output

```
main() {
```

```
    float x = 1.1;
```



```
    while ( x == 1.1 ) {
        printf ( "\n%f", x );
        x = x - 0.1;
    }
```

```
}
```

Output

- 
- 1.1

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# Predict the output

```
main() {
    while ( '1' < '2' )
        printf ( "\nIn while loop" );
}
```

→ Always true

Terminate X

Infinite Loop

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# Predict the output

```
main() {
    int x = 4, y = 0, z;
    while ( x >= 0 ) {
        x--;
        y++;
        if ( x == y )
            continue;
        else
            printf ( "\n%d %d", x, y );
    }
}
```

Handwritten annotations for variable values:

x	y	z
3	1	6

Output

```
0
0 3 1
. 1 3
. 0 4
. -1 5
```

[real output]

## Homework :

# Predict the output

```
main() {  
    int x = 4, y = 0, z;  
    while ( x >= 0 ) {  
        if ( x == y )  
            break ;  
        else  
            printf ( "\n%d %d", x, y ) ;  
            x-- ;  
            y++ ;  
    }  
}
```

[3-30]

output :

. 4 0  
. 3 1

[3-30]

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# Questions using Operators

+ - \* /

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**Ques** : WAP to count digits of a given number.

$n = 19325$

[3-33]

# Hint : 1) / operator

2)  $19325/10 = 1932$  ----> [int will remove the decimal part]

$\text{int count} = 0;$

$n = n/10;$

$\text{count}++;$

Condition  $\rightarrow$   $n \neq 0$  or  $n > 0$

**Ques** : WAP to count digits of a given number.

```
int count = 0;
while(n!=0){
    n = n/10;
    count++;
}
```

$n = 1234$     $123$     $12$     $1$     $0$

Count =  $0$     $1$     $2$     $3$     $4$

-

[3-33]

**Ques** : WAP to print sum of digits of a given number.

$$n = 12345$$

$$\text{Sum} = 1 + 2 + 3 + 4 + 5 = 15$$

# Hint

1) % operator & / operator

$$2) 1 + 2 + 3 + 4 + 5 = 5 + 4 + 3 + 2 + 1$$

[3-34]

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

$$\begin{aligned} \text{Sum} &= \text{Sum} + \text{lastDigit}; \\ n &= n/10; \end{aligned}$$



**Ques :** WAP to print sum of digits of a given number.

Sum = ~~0~~; ~~5~~ 9 ~~12~~ ~~14~~ 15

n = ~~12345~~ ~~1234~~ ~~123~~ ~~12~~ 1 0

ld = n % 10; // ld = 5 4 3 2 1

Sum = Sum + ld;

n = n / 10;

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**HW** : WAP to print sum of all the even digits of a given number.

$$n = 12345$$

[3-35]

$$\text{Sum} = 2 + 4 = 6$$

# Hint : Use the same code, (if condition)

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**Ques** : WAP to print reverse of a given number. & store it.  $n = 1234$   $r = 4321$

Algorithm :

$n$   
~~1234~~  
~~123~~  
~~12~~  
~~1~~  
~~0~~

$r$   
~~0~~  
~~40~~  
~~430~~  
~~4320~~  
~~4321~~

$$r = r + (n \% 10)$$

$$r = r * 10$$

$$n = n / 10$$

[3-36] i did it

# Hints

- 1) Abhi 2 ques
- 2) 10 se multiply

Condition  $\rightarrow$   $n > 0$   
 or  
 $n \neq 0$

[3-37(1)]-[3-38] by CW

**Ques** : WAP to print reverse of a given number.

'Dry Run'

$n = 1234$     $123$     $12$     $1$     $0$

$r = 0$     $1$     $40$     $43$     $430$     $432$     $4320$     $4321$   
 $43210$

```
int r = 0;
while(n>0){
    r = r + (n%10);
    r = r*10;
    n = n/10;
}
```

swap

[3-37(1)]

$r = r/10;$

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**HW** : WAP to print the sum of given number and its reverse.

$$n = 1234 \quad r = 4321$$

$$\text{Sum} = (1234 + 4321) = 5555$$

[3-39]

**Ques** : Print the sum of this series :

$1 - 2 + 3 - 4 + 5 - 6 \dots$  upto 'n'. [3-41]-[3-42]

terms

## terms

### Method - 1

# Hint: loop, if-else

if  $n=1000$  lets say  
then loop will run 1000 times

$$1 + 2 + 3 + 4 \dots \quad n \text{ terms.}$$
$$\frac{n(n+1)}{2}$$

**Ques** : Print the sum of this series :  
 $1 - 2 + 3 - 4 + 5 - 6 \dots$  upto 'n'.

if n is even

$$(1 - 2) + (3 - 4) + (5 - 6) + (7 - 8) \rightarrow n = 8$$

$$-1 + -1 + -1 + -1$$

[3-42]

$$\Rightarrow -4$$

n is even, if  $(n \% 2 == 0)$   
 $Sum = -n/2;$

**Ques** : Print the sum of this series :  
 $1 - 2 + 3 - 4 + 5 - 6 \dots$  upto 'n'.

if n is odd  $\rightarrow$  if  $(n \% 2 \neq 0)$

$$n = 7$$

$$(1 - 2) + (3 - 4) + (5 - 6) + \underbrace{7}_{\substack{\downarrow \\ 7}}$$

$$-1 + -1 + -1 + 7$$

$$\Rightarrow -3 + 7$$

$$\Rightarrow \boxed{-\frac{n}{2} + n}$$



\* **Ques** : Print the factorial of a given number 'n'.

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

$$n! \rightarrow n \text{ factorial}$$

$$10! = 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

$$n! = n \times (n-1) \times (n-2) \times \dots \times 3 \times 2 \times 1$$

$$0! = 1$$

[3-43]

```
int product = 1;
for( i=1; i<=n; i++)
    product = product * i;
```

**Ques** : Print the factorial of a given number 'n'.

```
int product = 1;
for(int i=1; i<=n; i++){
    product = product*i;
}
```

product = ~~1~~~~1~~~~2~~ ~~6~~ ~~24~~  $n=5$   
 $120$   
 $i = \cancel{1} \cancel{2} \cancel{3} \cancel{4} \cancel{5}$   
 $6$

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Done in lecture

# HW : Print the factorials of first 'n' numbers

$$n = 5$$

↳

$$1! = 1$$

$$2! = 2 \times 1 = 2$$

$$3! = 3 \times 2 \times 1 = 6$$

$$4! = 4 \times 3 \times 2 \times 1 = 24$$

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

$$n! = n \times (n-1)!$$

$$1! = 1$$

$$2! = 2 \times 1!$$

$$3! = 3 \times 2!$$

$$4! = 4 \times 3!$$

$$5! = 5 \times 4!$$

$$6! = 6 \times 5!$$

[3-44]

**\*\*Ques** : Print the nth fibonacci number.  
<sub>15<sup>th</sup></sub>

1	1	2	3	5	8	13	21	34	55	89	...
1	2	3	4	5	6	7	8	9	10	11	

$$8^{\text{th}} \text{ term} = 6^{\text{th}} \text{ term} + 7^{\text{th}} \text{ term}$$

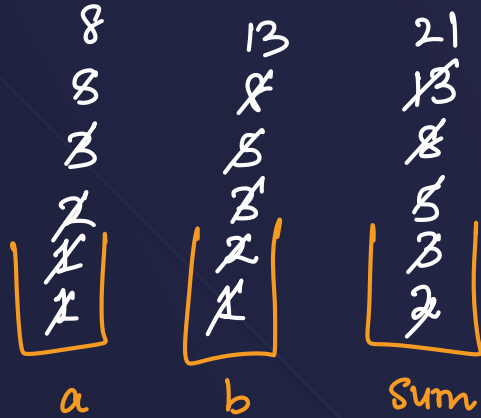
Loops : 1) 3 variables a

```

a = 1;
b = 1;
sum = 0;

loop() {
    sum = a + b;
    a = b;
    b = sum;
}
    
```

**Ques** : Print the nth fibonacci number.



$$\text{Sum} = a + b$$

$$a = b$$

$$b = \text{Sum}$$

**[3-43]-[3-46]**

$n = 6 \rightarrow 21 \rightarrow 8^{\text{th}} \text{ term}$

$n \rightarrow (n+2)^{\text{th}} \text{ fibonacci}$

# HW : Print first 'n' fibonacci numbers.

Output       $n = 7$

The 1<sup>st</sup> fibonacci number is 1

The 2<sup>nd</sup>      —      —      is 1

2

3

[3-47]

5

8

13

**Ques** : Two numbers are entered through the keyboard. Write a program to find the value of one number raised to the power of another.

$$a, b \rightarrow a^b$$

$$\boxed{a=2, b=5} \rightarrow 2^5 = 32$$

$$2^5 = \underbrace{2 \times 2 \times 2 \times 2 \times 2}_{5 \text{ times}}$$

```
int power = 1;
```

```
for ( ) {
```

```
    power = power * a;
```

```
}
```

**Ques** : Two numbers are entered through the keyboard. Write a program to find the value of one number raised to the power of another.

```
int power = 1;
for(int i=1;i<=b;i++){
    power = power * a;
}
```

$a=2, b=5$       power = 1 2 4 8 16 32

$$a^b = \underbrace{a \times a \times a \times a \times a \dots}_{b \text{ times}}$$

$2^n \rightarrow$   
[HW]

$2^1, 2^2, 2^3, 2^4, 2^5, 2^6 \dots 2^n$

[3-49]



**Ques** : Write a program to print all the ASCII values and their equivalent characters of 26 alphabets using a while loop. *(Capital case)*

A → 65

B → 66

C → 67

D → 68

.

:

Z → 90

[3-50]-[3-52]

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**HW** : Write a program to print out all Armstrong numbers between 1 and 500. If sum of cubes of each digit of the number is equal to the number itself, then the number is called an Armstrong number. For example,  $153 = (1 * 1 * 1) + (5 * 5 * 5) + (3 * 3 * 3)$

$$1^3 + 5^3 + 3^3 = 153$$

[3-53]