

# CS & IT ENGINEERING

Chapter 02

Programming in C

Control Flow Statements  
Lec- 03



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## TOPICS TO BE COVERED

Iterative Statements-II

1) \n : It moves the cursor from its current position to the beginning of next line (New line)

```
printf("Hello Dosto");
```

```
printf("Welcome to C programming");
```

Hello Dosto Welcome to C programming

```
printf("Hello Dosto\n");  
printf("Welcome to C Programming");
```

box of  
\n



Hello Dosto -  
Welcome to C Programming

```
printf("Hello Dosto ");
printf("\nWelcome to C Programming");
```

Hello Dosto –  
Welcome to C Programming

2] \t :

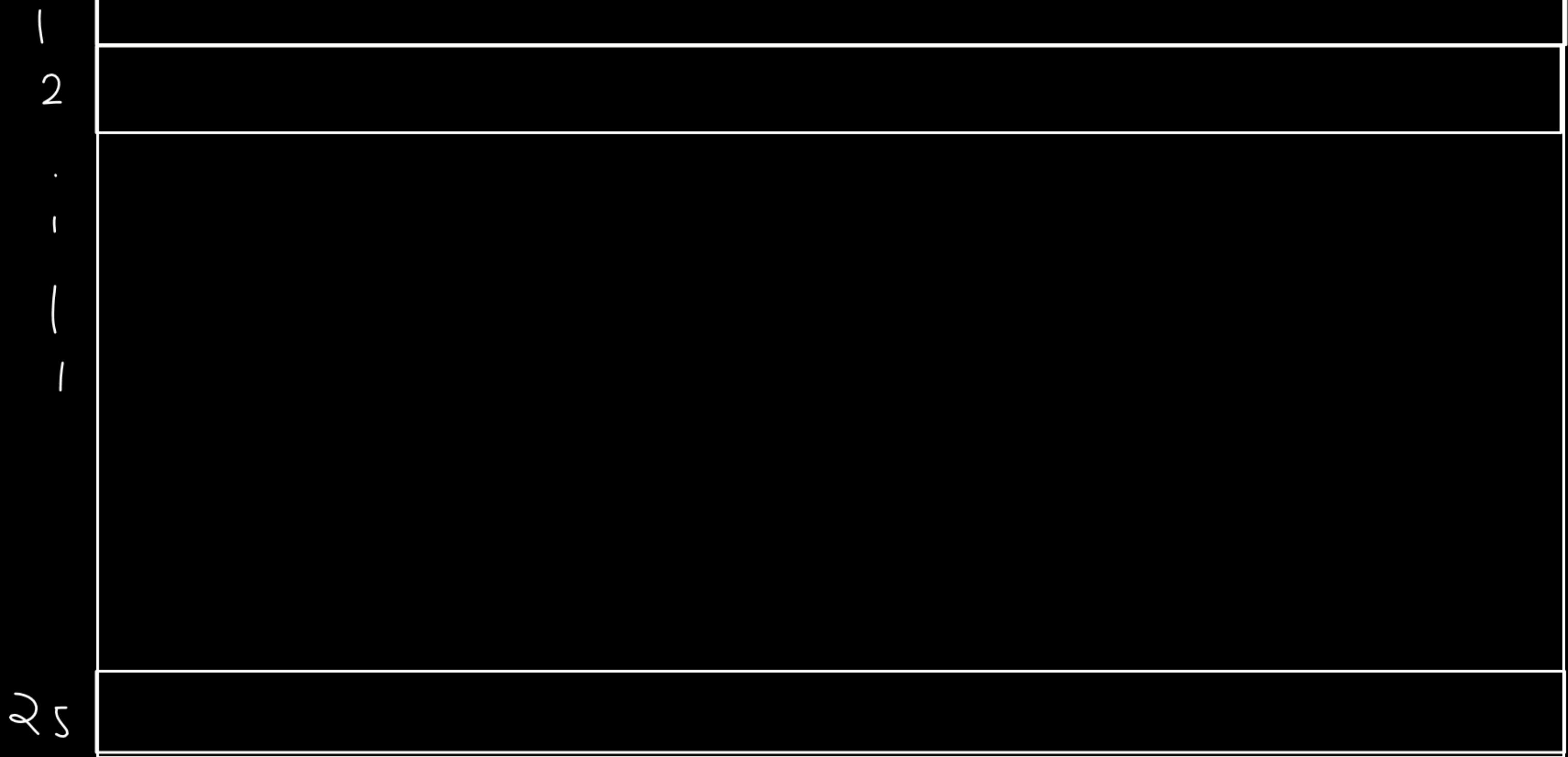
① void main() {  
    printf("Welcom\t");  
}

② void main() {  
    printf("Hello\t o");  
}



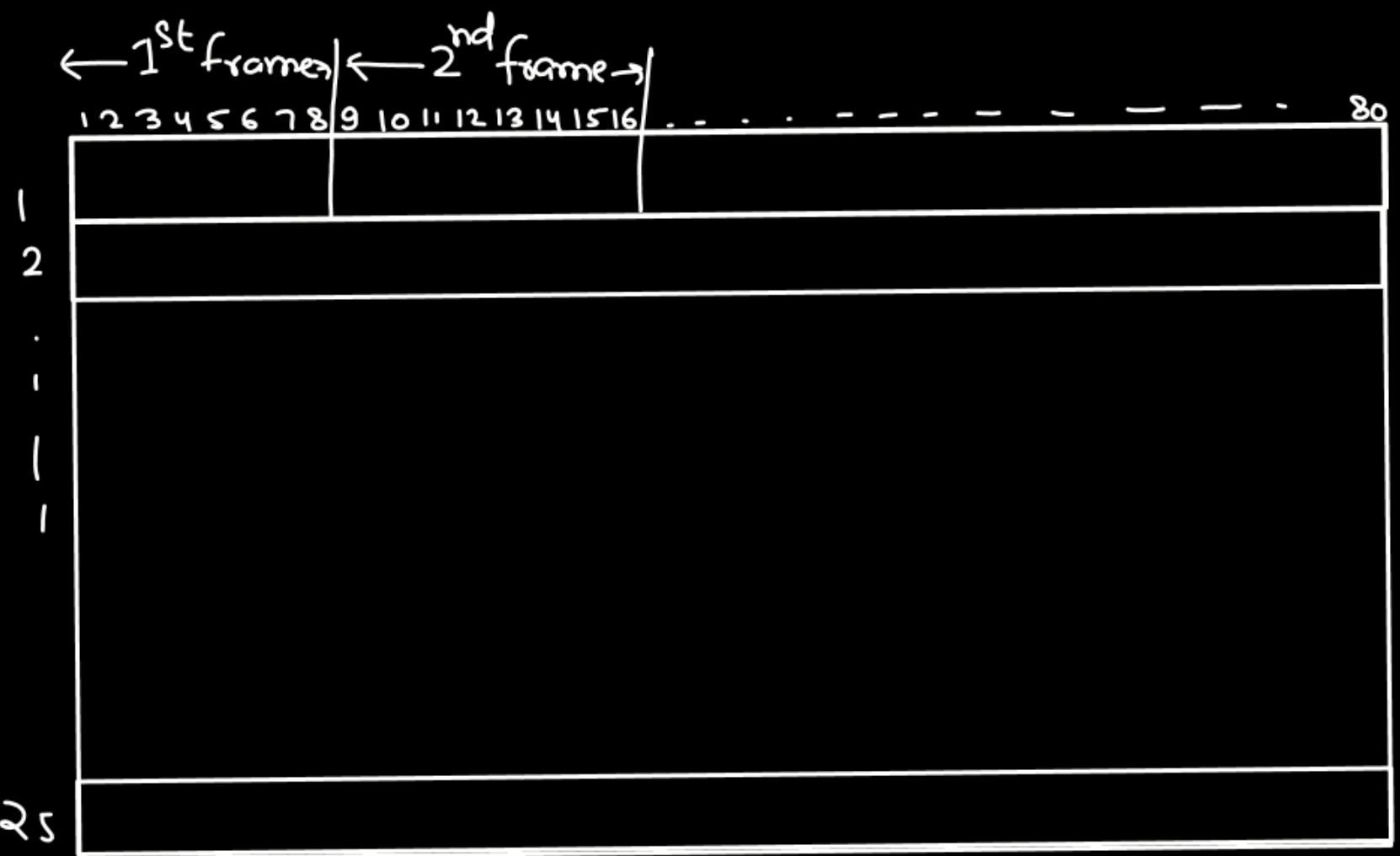
screen → 25 rows, 80 cols.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 . - . - - - - - - - - - - - - 80



8 char  $\Rightarrow$  1 frame

\t : It moves the cursor to next Available frame



`printf ("Welcom\t e");`

1

2

3

4

5

6

7

8

<sup>2</sup> space

9

10

11

12

13

14

15

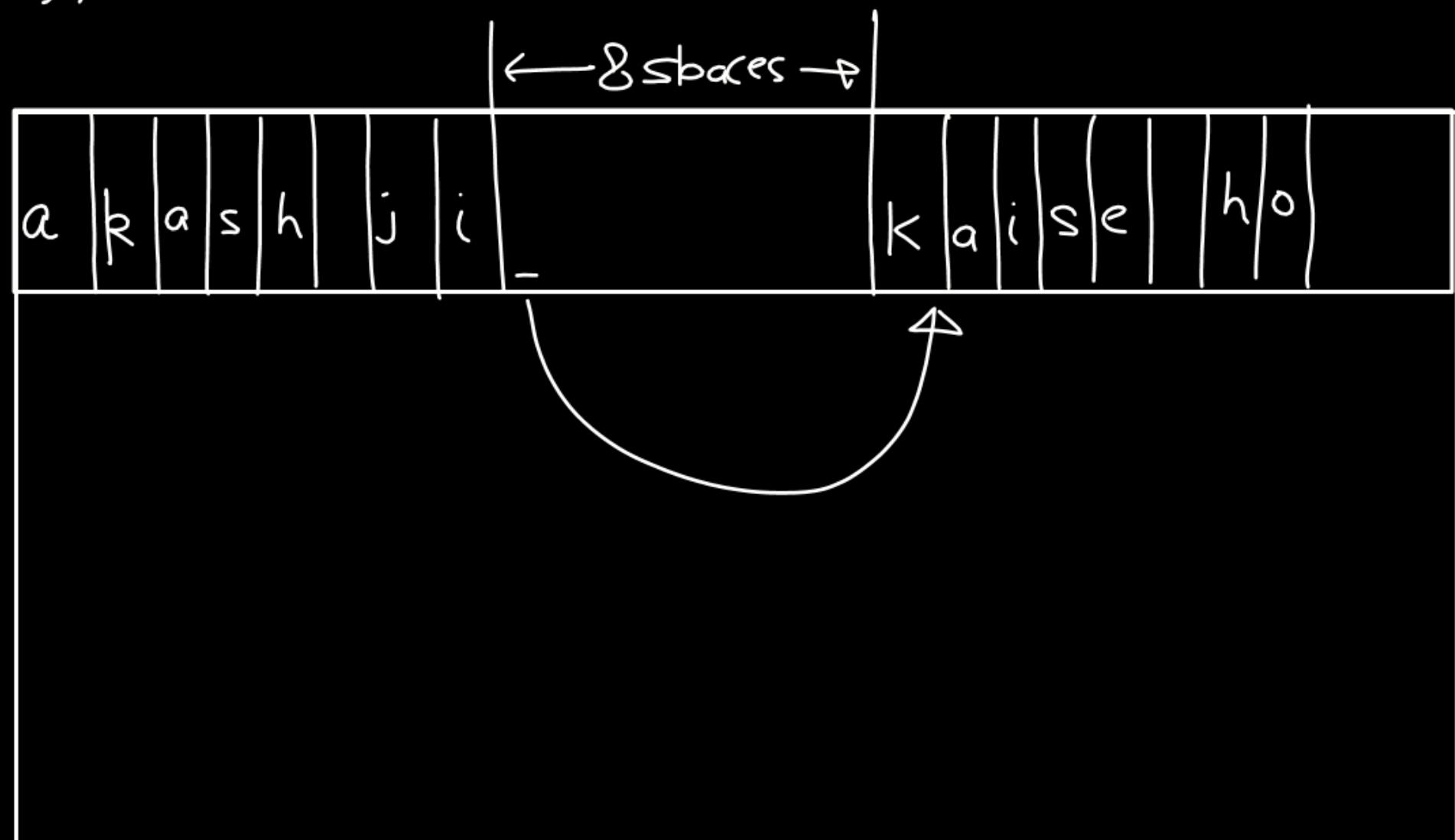
16

w	e	l	c	o	m			e									



① printf("Hello\\t"); 4 space

② printf ("akash jit kaise ho");



for loop

1)

```
for(i=1; i<=3; i++)  
{  
    Code  
}  
}
```

$i = 1, 1 \leq 3 \rightarrow$  Code will execute  
 $i = 2, 2 \leq 3 \rightarrow$  Code will execute  
 $i = 3, 3 \leq 3 \rightarrow$  Code will execute  
 $i = 4, 4 \leq 3 \rightarrow$  False

$\underbrace{i = 1, 2, 3}_{3 \text{ times}}$  Code will execute

3 times

Q:

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

$i = \underbrace{1, 2, 3, 4, 5, 6, 7, 8, 9, 10}_{\text{10 times}}$     Code will execute

3.

```
for(i=1; i<=n; i++)
```

```
{
```

code

```
}
```

n times



what could be code ?

4.

```
for( j=1; j<=4; j++ )  
{  
    printf("Pankaj");  
}
```

O/P of this code :

It will print Pankaj  
4 times

4.

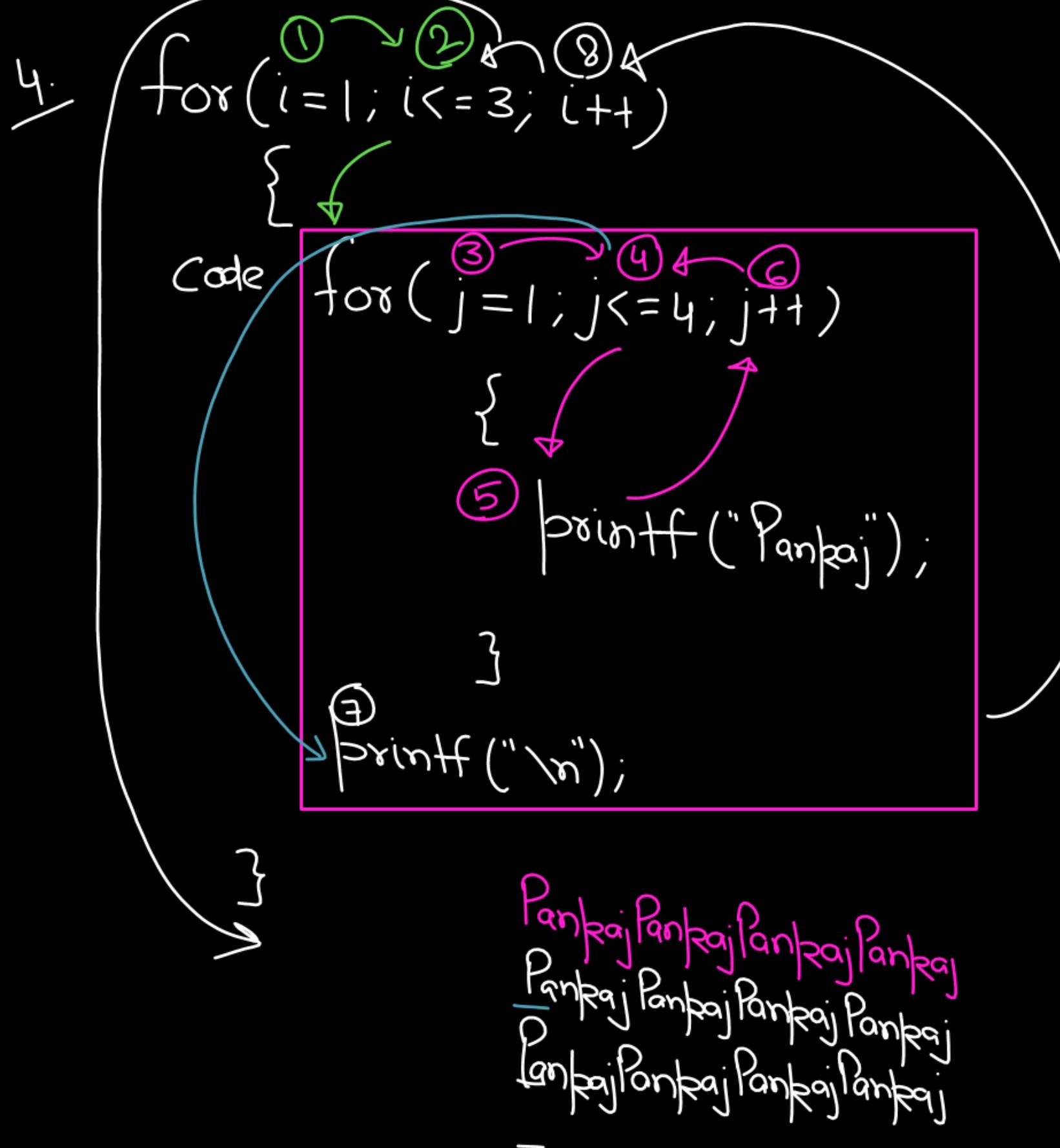
```
for( j=1; j<=4; j++ )  
{  
    printf("Pankaj");  
}
```

```
for( i=1; i<=3; i++ )  
{
```

Code

}

i = 1  $\Rightarrow$  code will execute  
i = 2  $\Rightarrow$  code will execute  
i = 3  $\Rightarrow$  code will execute



Condition	
$i = 1$	$i \leq 3 \Rightarrow$ true ✓
	Code → loop ✓
	Code → printf ✓
	$\backslash n$
$i = 2$	$i \leq 3 \Rightarrow$ true ✓
	Code → loop ✓
	Code → printf ✓
	$\backslash n$
$i = 3$	$i \leq 3 \Rightarrow$ true ✓
	Code → loop ✓
	Code → printf ✓
	$\backslash n$
$i = 4$	$i \leq 3 \Rightarrow$ false
	then Newline
$i = 5$	$i \leq 3 \Rightarrow$ false
	then Newline
$j = 1$	$j \leq 4 \Rightarrow$ true ✓
$j = 2$	$j \leq 4 \Rightarrow$ true ✓
$j = 3$	$j \leq 4 \Rightarrow$ true ✓
$j = 4$	$j \leq 4 \Rightarrow$ true ✓
	{ pf ✓ }
$j = 5$	$j \leq 4 \Rightarrow$ false
	then Newline
$j = 1, 2, 3, 4$	$j = 1, 2, 3, 4 \Rightarrow$ pf ✓
$j = 5$	$j = 5 \Rightarrow$ Newline
$j = 6$	$j = 6 \Rightarrow$ Newline

Q

i=1

for (1  $i=1$ ; 2  $i \leq 3$ ; 3  $i++$ )  
{  
 for (4  $j=1$ ; 5  $j \leq 4$ ; 6  $j++$ )  
 {  
 printf (" %d%d", 7  $i$ , 8  $j$ );  
 }  
 printf ("\n");  
}

i=1

11121314  
21222324  
31323334

-

i	condition	j = 1, 2, 3, 4, X
1	$i \leq 3 \Rightarrow \text{code}$	Newline 21 22 23 24 j = 1, 2, 3, 4, X
2	$i \leq 3 \Rightarrow \text{code}$	Newline 31 32 33 34 j = 1, 2, 3, 4, X
3	$i \leq 3 \Rightarrow \text{code}$	Newline 41 42 43 44 j = 1, 2, 3, 4, X
4	$i \leq 3 \rightarrow \text{False}$	

```

for ( ①→②←④
      i=1; i<=3; i++)
  {
    }

```

Code ③

```

for( j=1 ; j<=4 ; j++)
{
    printf ("PanRaj");
}

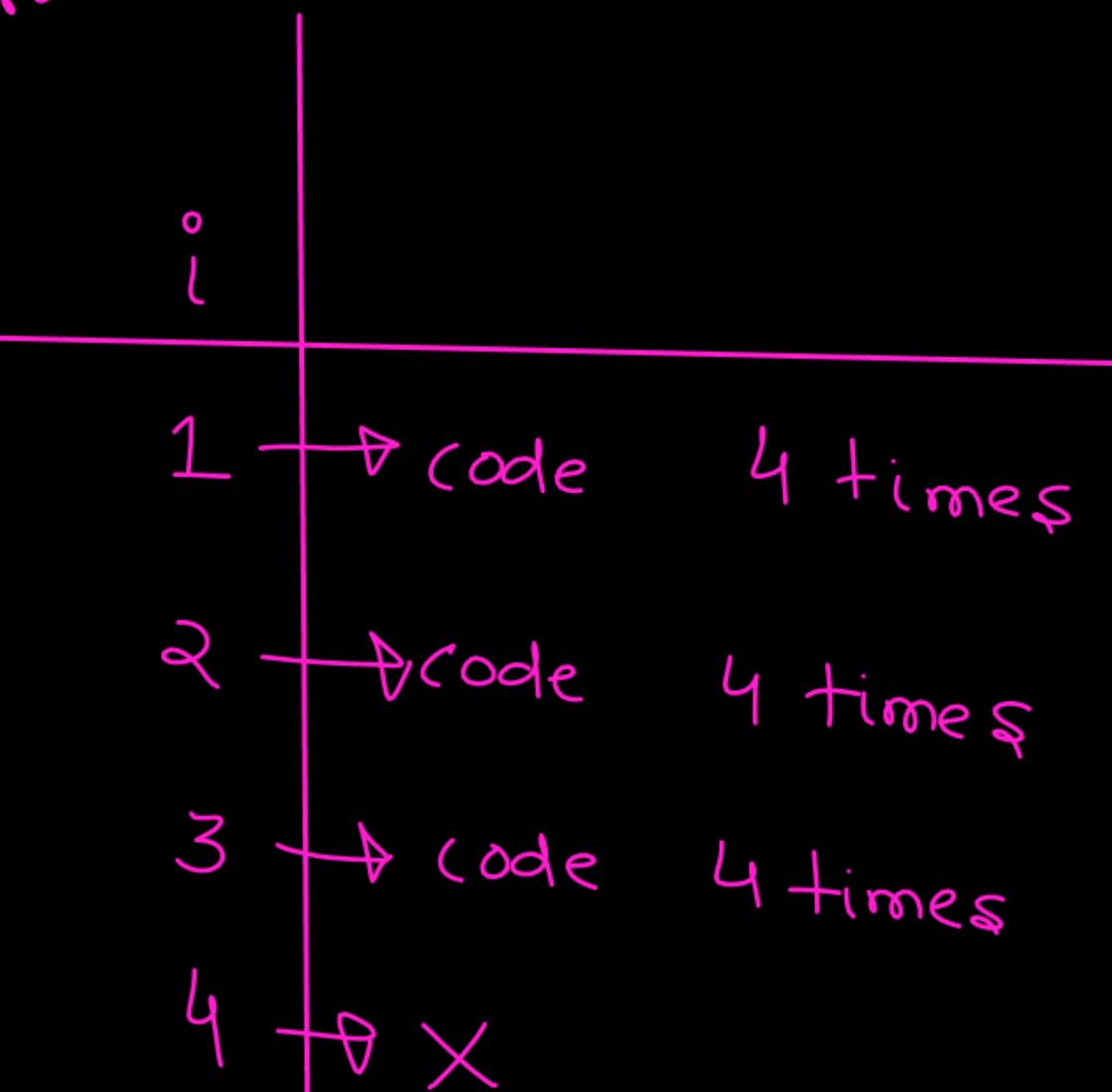
```

}

$i=1 \Rightarrow 4$   
 $i=2 \Rightarrow 4$   
 $i=3 \Rightarrow 4$

} for each value  
of  $i$   
⇒ 4 times  
of  $j$

4 times printing





Q

```
for ( i=1; i<=3; i++)  
{  
    for( j=1; j<=10; j++)  
    {  
        printf("Hello");  
    }  
}
```

$$i = 1 \rightarrow 10$$

$$i = 2 \rightarrow 10$$

$$i = 3 \rightarrow 10$$

$$10 + 10 + 10$$

$$= 3 \cdot 10$$

$$= 30 \text{ times}$$

27/1

Q

```
for (i=1; i<=n; i++)
```

```
{
```

```
    for (j=1; j<=4; j++)
```

```
{
```

```
        printf("Hello");
```

```
}
```

```
}
```

i = 1 → 4

i = 2 → 4

i = 3 → 4

.

.

i = n → 4

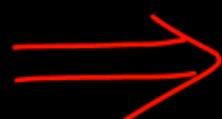
$$\begin{aligned} & 4 + 4 + 4 + \dots + 4 \text{ (n times)} \\ & = 4n \text{ times} \end{aligned}$$

~~Q~~  
 for( $i=1; i \leq n; i++$ )  
 {  
     for( $j=1; j \leq n; j++$ )  
     {  
         printf("Pankaj");  
     }  
 }

$i=1 \rightarrow n$  times ( $j=1$  to  $n$ )  
 $i=2 \rightarrow n$  times ( $j=1$  to  $n$ )  
 $i=3 \rightarrow n$  times ( $j=1$  to  $n$ )  
 .  
 .  
 $i=n \rightarrow n$  times ( $j=1$  to  $n$ )

$$\begin{aligned}
 & n + n + n + \dots + n \text{ (n times)} \\
 & = n \times n \\
 & = n^2 \text{ times}
 \end{aligned}$$

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



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

```
for( i=1; i<=n; i=i+2)
```

```
{
```

```
    printf("Pankaj");
```

```
}
```

$1 + \lfloor \log_2 n \rfloor$

```
1. for( i= 1; i<= n; i++)
   {
       for( j= 1; j<= n; j= j*2)            $\Rightarrow$   $n \cdot (1 + \lfloor \log_2 n \rfloor)$ 
       {
           printf("Pankaj");
       }
   }
```

times

2.

```
for( i=1; i<=n; i=i*2)
{
    for( j=1; j<=n; j++)
    {
        printf("Pankaj");
    }
}
```

$1 + \lfloor \log_2 n \rfloor$  times

$n$  times

$\Rightarrow (1 + \lfloor \log_2 n \rfloor) \cdot n$

times

```

3:   for ( i=1; i<=n; i=i+2) → 1 + log2n
    {
      for( j=1; j<=n; j=j+2) → 1 + log2n
      {
        printf("Pankaj");
      }
    }

for each value of i
inner loop execute some
no. of times

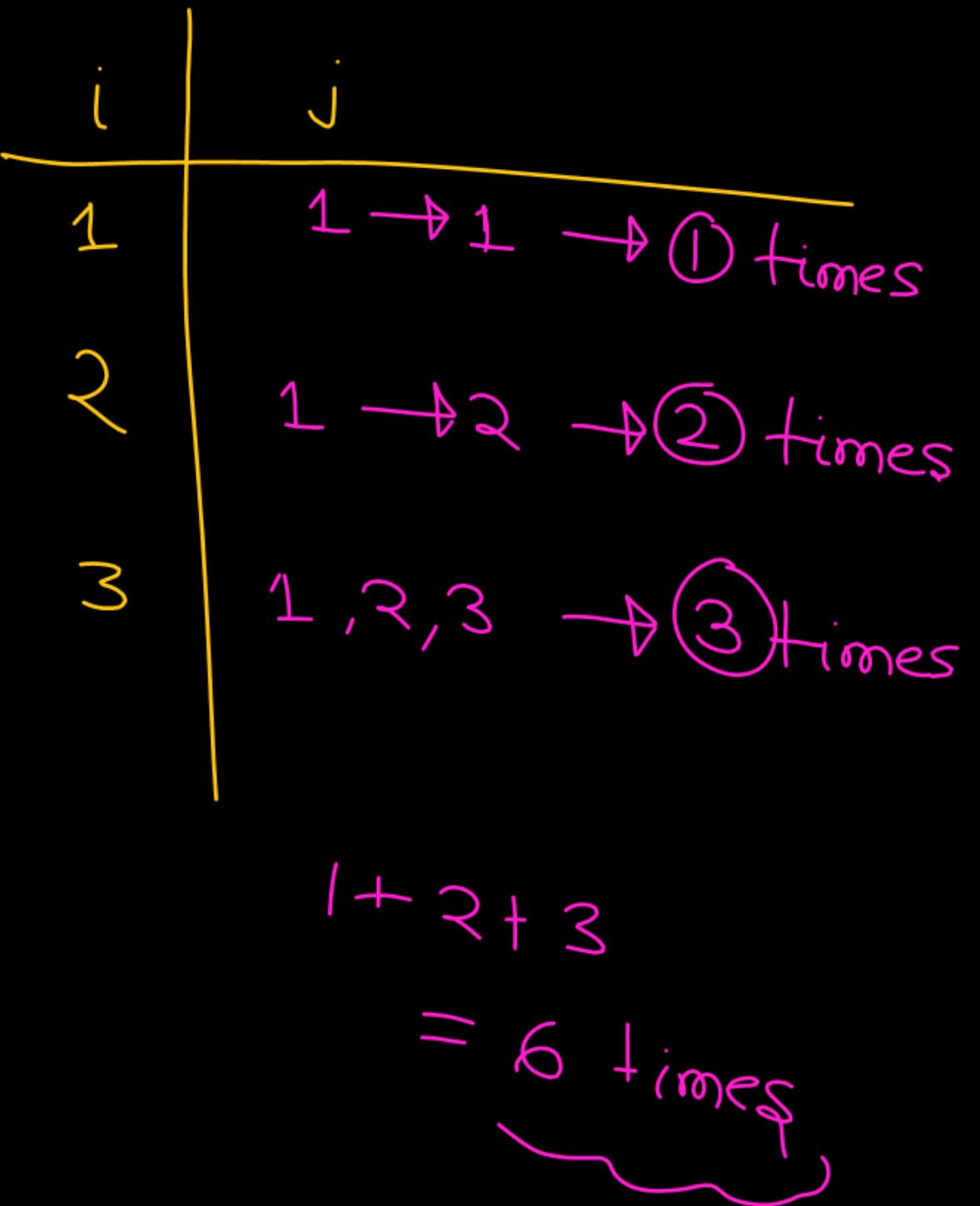
```

Independent loop      nested

```

for( i=1; i<= 3; i++)
{
    for( j=1; j<= i; j++)
    {
        printf("Pankaj");
    }
}

```



## loop unfolding

①

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

```
{
```

```
    for(j=1; j<=i; j++)
```

```
{
```

```
    printf("Pankaj");
```

```
}
```

## Dependent loops

i = 1	j = 1; j <= 1; j++	→ ① time
i = 2	j = 1; j <= 2; j++	→ ② times
i = 3	j = 1; j <= 3; j++	→ ③ times
.	.	
.	.	
i = 10	j = 1; j <= 10; j++	→ 10 times

1 + 2 + 3 + ... + 10

$$\Rightarrow \frac{10 \times 11}{2} = 55$$

$$\textcircled{1} \quad 1+2+3+\dots+n = \frac{n(n+1)}{2}, \quad \sum_{i=1}^n i = \frac{n(n+1)}{2}$$

$$\textcircled{2} \quad 1^2+2^2+3^2+\dots+n^2 = \frac{n(n+1)(2n+1)}{6}, \quad \sum_{i=1}^n i^2 = \frac{n(n+1)(2n+1)}{6}$$

$$\textcircled{3} \quad 1^3+2^3+3^3+\dots+n^3 = \left[ \frac{n(n+1)}{2} \right]^2, \quad \sum_{i=1}^n i^3 = \left[ \frac{n(n+1)}{2} \right]^2$$

$$\begin{array}{ccccccccc} T_1 & T_2 & T_3 & & & & T_n \\ a, & a+d, & a+2d, & \dots & \dots & \dots & a+(n-1)d \end{array}$$

A.P

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

$$S_n = \frac{n}{2} [\text{first term} + \frac{\text{last term}}{\text{term}}]$$

$$\begin{aligned} T_2 - T_1 &= T_3 - T_2 \\ d &= d \end{aligned}$$

$$a, ar, ar^2, ar^3, \dots, ar^{n-1}$$

G.P

$$T_n = a \cdot r^{n-1}$$

r  $\Rightarrow$  Common ratio

$$T_1 = a, T_2 = ar, T_3 = ar^2$$

$$\frac{T_2}{T_1} = \frac{T_3}{T_2}$$

$$\frac{ar}{a} = \frac{ar^2}{ar}$$

$$S_n = \frac{a(1-r^n)}{1-r}$$

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

$$S_\infty = \frac{a}{1-r}$$

↳

```
for( i=1 ; i<=n ; i++ )
```

```
{
```

```
    for( j=1 ; j<=2*i ; j++ )
```

```
{
```

```
        printf("Pankaj");
```

```
}
```

```
}
```

$i = \checkmark$        $i = \checkmark$        $i = \checkmark$   
 $j = 1 \text{ to } 2$        $j = 2 \text{ to } 4$        $j = 3 \text{ to } 6$   
②                          ③                          ④  
 $4 - 2 + 1$   
 $i = n$   
 $j = n \text{ to } 2n$

$2n - n + 1$   
① + 1

$$S_n = \frac{n}{2} [a_1 + l] = \frac{n}{2} [2 + (n+1)] = \frac{n(n+3)}{2}$$

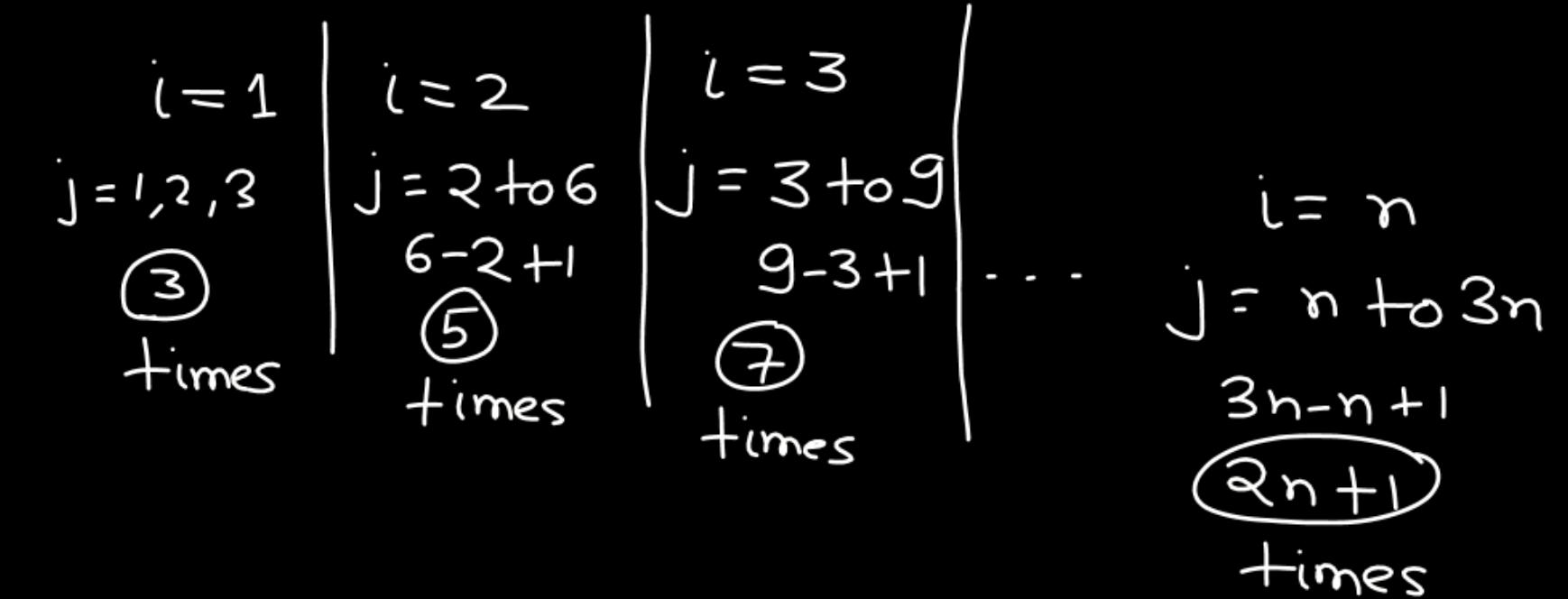
$2 + 3 + 4 + \dots + (n+1)$   
↓  
 $2 + 3 + 4 + \dots + n + (n+1)$

[n terms]

```

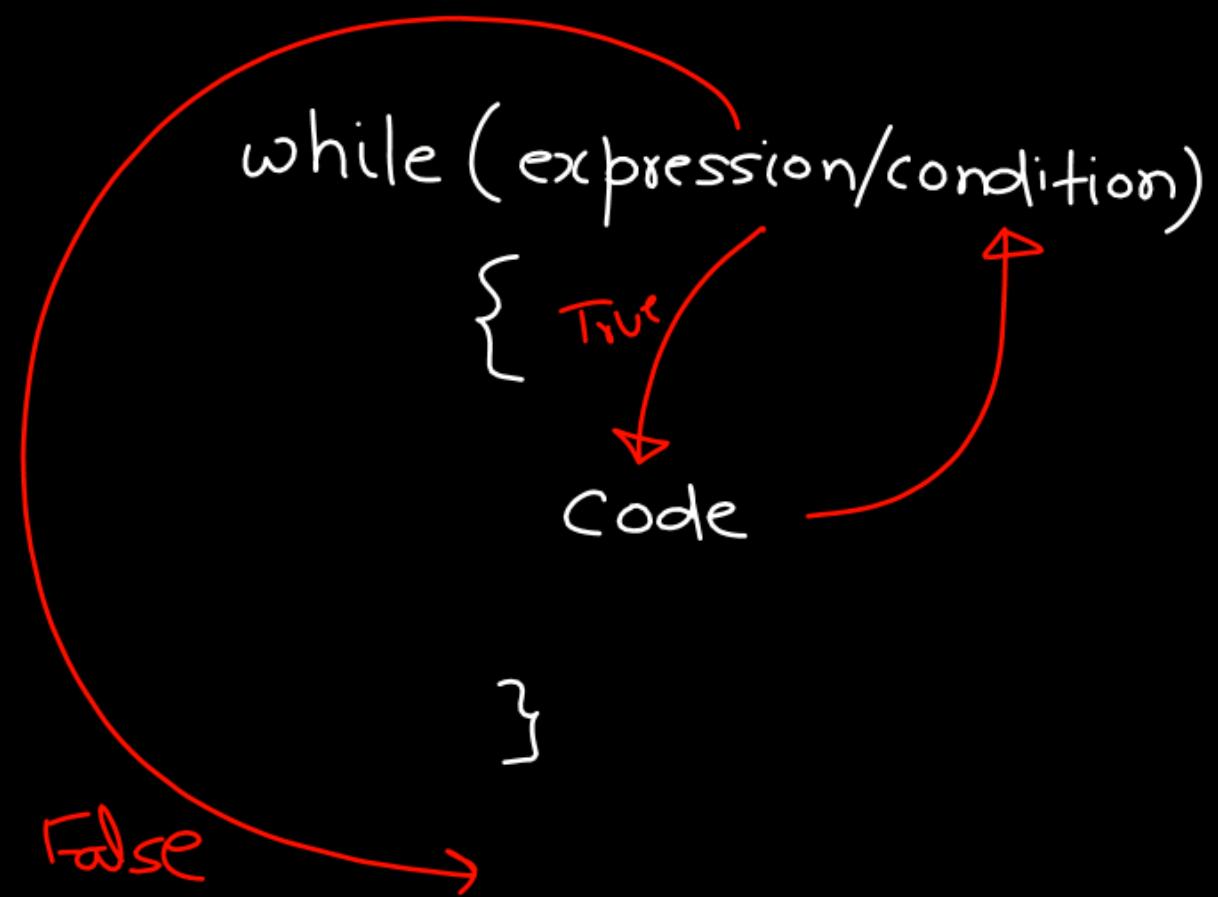
2.   for( i=1; i<=n; i++)
    {
        for( j = i ; j <= 3*i ; j++)
        {
            printf("Pankaj");
        }
    }

```



$$\begin{aligned}
 & 3 + 5 + 7 + \dots + (2n+1) \quad [n \text{ terms}] \\
 S_n &= \frac{n}{2} [a_1 + l] \\
 &= \frac{n}{2} [3 + 2n+1] \\
 &= \frac{n}{2} (2n+4) \\
 &= \frac{n}{2} \cdot 2(n+2) = n(n+2)
 \end{aligned}$$

## While loop

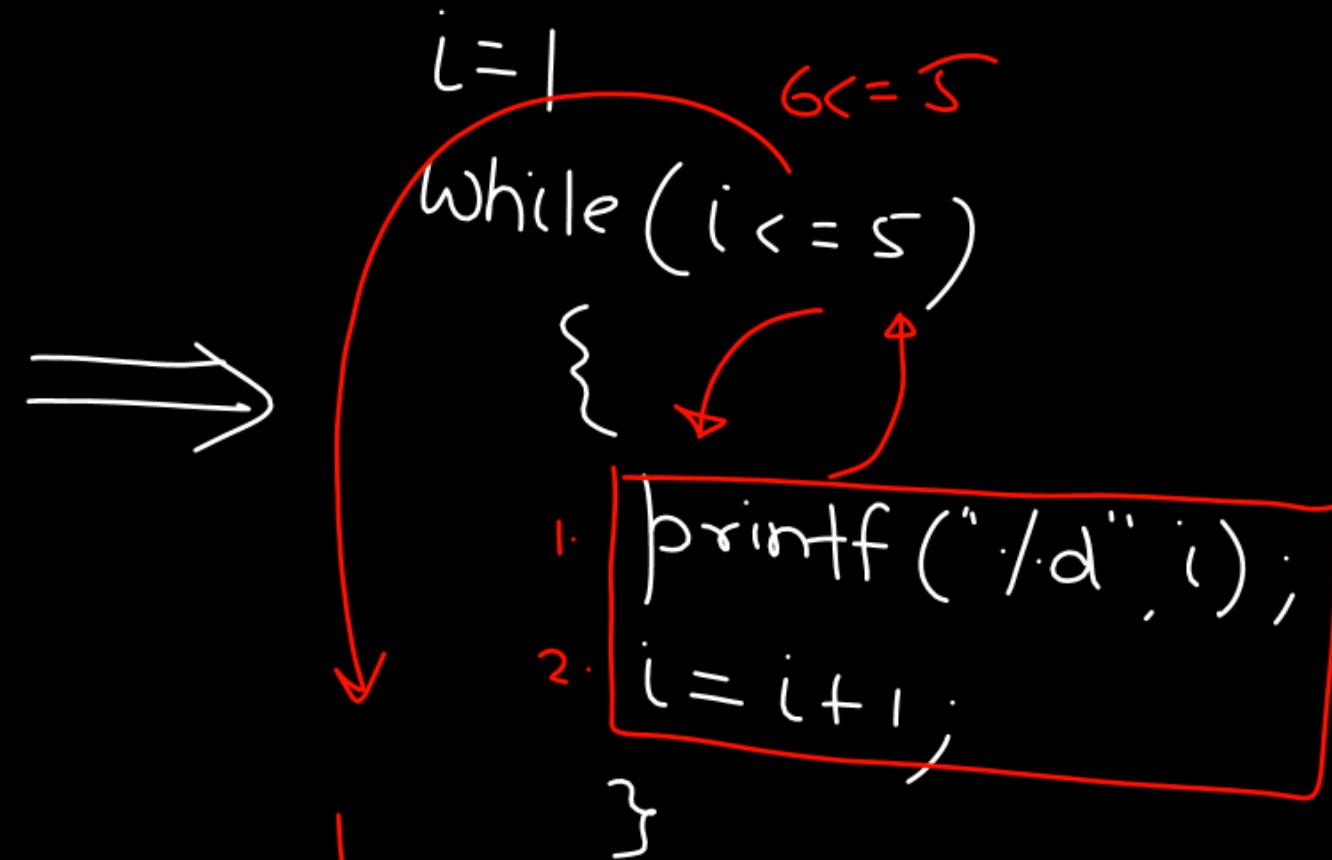


```

for( i=1; i<=5; i++)
{
    printf( "%d", i);
}

```

12345



i		
1	$1 \leq 5 \rightarrow \text{true} \rightarrow \text{pf},$	1
2	$2 \leq 5 \rightarrow \text{true} \rightarrow \text{pf}$	2
3	$3 \leq 5 \rightarrow \text{true} \rightarrow \text{pf}$	3
4	$4 \leq 5 \rightarrow \text{true} \rightarrow \text{pf}$	4
5	$5 \leq 5 \rightarrow \text{true} \rightarrow \text{pf}$	5

```
int i = 1;  
while (++i < 5)  
{
```

```
    printf ("%d", i);  
}
```

234

i 1 2 3 4 5

1] ++i  $\Rightarrow$  2

2  $2 < 5 \rightarrow \text{true} \rightarrow \text{pf}$  ②

2] ++i  $\Rightarrow$  3

3  $3 < 5 \rightarrow \text{true} \rightarrow \text{pf} \rightarrow 3$

3] ++i  $\Rightarrow$  4

4  $4 < 5 \rightarrow \text{true} \rightarrow \text{pf} \rightarrow 4$

4] ++i  $\Rightarrow$  5

5  $5 < 5 \rightarrow \text{false} \times$

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

Compiled  
Ud ke baat  
mazega

Not optional

both : for, while  $\Rightarrow$  pre-condition checking

↓      ↓  
①      ②

```
do {  
    Code  
} While(expression);
```

```
int i = 11  
do {
```

```
    printf("Pankaj");
```

```
} while(i < 10);
```

do-while  $\Rightarrow$  Post-condition

Checking

It will execute atleast  
1 times.

Pankaj

$11 < 10 \Rightarrow \text{false}$

Not optional

switch  
& statement

