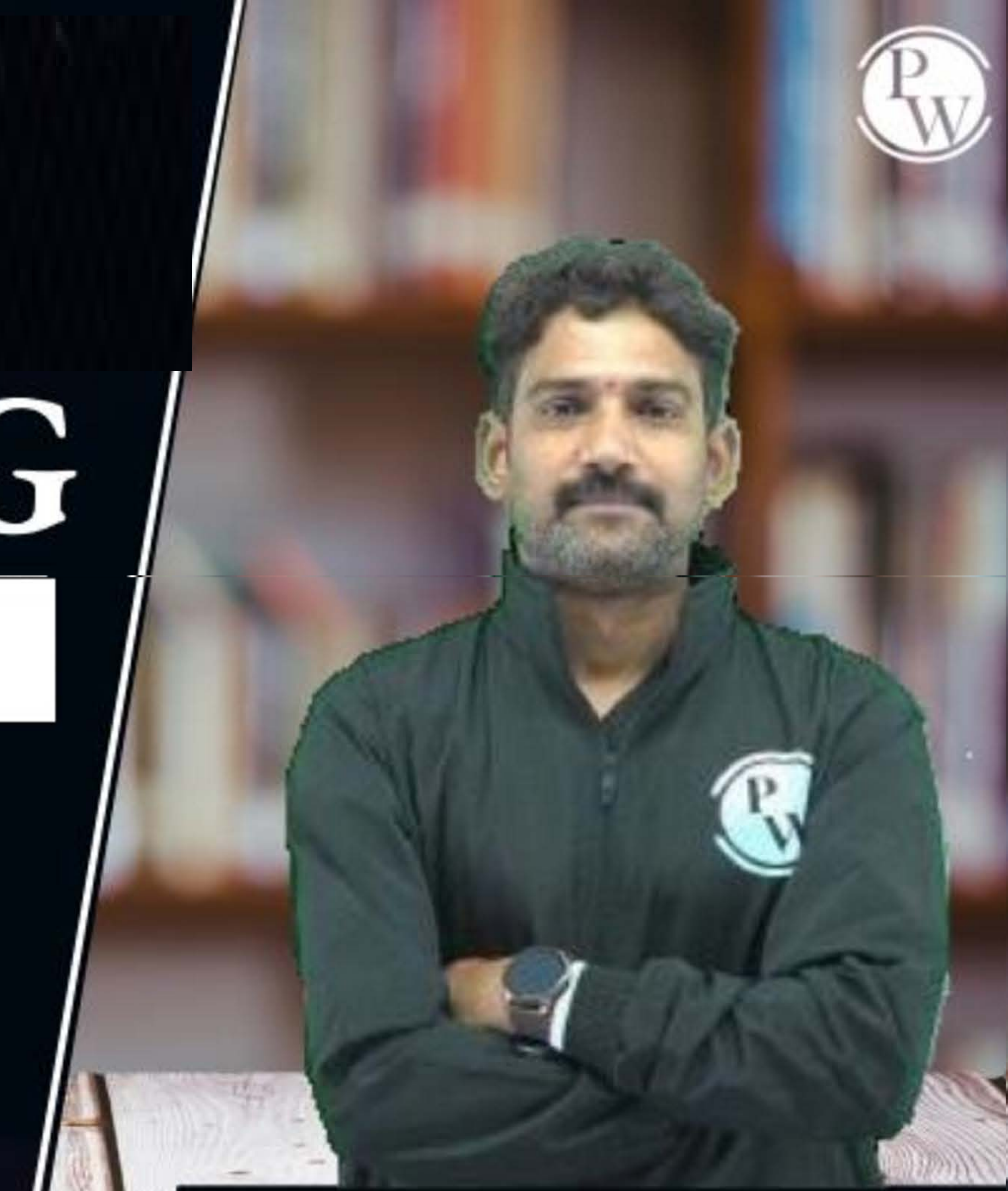
CS & IT [redacted]

ENGINEERING

C Programming

Control Statements [redacted]

Lecture No.- 04



By- Satya sir

Recap of Previous Lecture

- Switch Control Statement
- Iterative Control statements
  - do-while loop ✓
  - while loop ✓
  - for loop

Topics to be Covered

- While loop examples
- for loop
- Nested loops
- GATE PYQS

Topic : Iterative Control Statements - 2

Example-1

```
int i=5, j=-2;
while( i--, ++j )
    printf(" %d %d \n", i, j);
```

$$i: \boxed{\cancel{5}\ \cancel{4}\ 3} \qquad j: \boxed{\cancel{-2}\ \cancel{-1}\ 0}$$

while(5, -1) ≅ while(-1) TRUE

while(4, 0) ≅ while(0) FALSE

O/p: 4 -1

Topic : Iterative Control Statements - 2

Example-2

a: ~~5~~ ~~6~~ ~~7~~ ~~8~~ ~~9~~ ~~10~~ 11

b: 2

c: ~~7~~ ~~6~~ ~~5~~ ~~4~~ ~~3~~ ~~2~~ 1

d: ~~5~~ ~~4~~ ~~3~~ ~~2~~ ~~1~~ ~~0~~ -1

```
int a, b, c, d;
a = Printf("GATE \n");
b = Printf("%d \t", a);
c = b+a;
d = c-b;
while (a++, b, --c, d--)
    Printf("%d %d %d %d \n", a,c,b,d);
```

o/p:

```
GATE
5...  6 6 2 4
7 5 2 3
8 4 2 2
9 3 2 1
10 2 2 0
```

Escape sequence	Meaning
\n	New line
\t	tab Space (4 spaces)
\0	NULL character
\b	Back Space
\r	Carriage return

while(5, 2, 6, 5) ≡ while(5) ⇒ TRUE

while(6, 2, 5, 4) ≡ while(4) TRUE

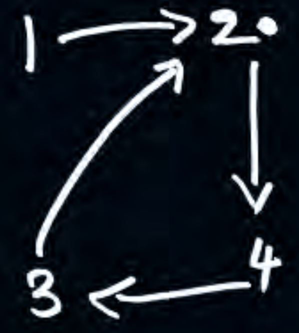
while(7,2,4,3) = TRUE

while(8,2,3,2) = TRUE

while(9,2,2,1) = TRUE

while(10,2,1,0) = FALSE

Topic : Iterative Control Statements - 2



for( ) Loop : Entry control (or) Pre-test loop.

Syntax:

```
        //1            //2             //3
for( Expression1 ; Expression2 ; Expression3 )
{
    statements; //4
}
```

Example:

```
            int i;
      ①      ②       ③
for( i=1 ; i<5; i++)
    Printf("%d", i); ④
```

1<5 TRUE

2<5 TRUE

3<5 TRUE

4<5 TRUE

5<5 False.

O/p: 1 2 3 4

- only (; ;) are Mandatory in for => for(; ;)
- Exp1, Exp2, Exp3 all are optional
- Expression1 will Execute only one time, at beginning or first iteration.
- Decision Making is done based on Expression2 Result.
- Expression3 is an Expression to avoid infinite Execution
- The sequence of Execution: Exp1 → Exp2 → for block → Exp3 → Exp2 → for → Exp3 → Exp2 → for → Exp3 ..... Exp2 False.

Topic : Iterative Control Statements - 2

Example-1

```
int i=1, j=4;

for(i, j ; i<=5, j>1 ; i++, j--)

    Printf("%d %d", i, j);
```

→ Right Most for decision making

i

~~1~~ ~~2~~ ~~3~~ 4

j

~~4~~ ~~3~~ ~~2~~ 1

j>1 ⇒ 4>1 True
3>1 True
2>1 True
1>1 False

O/p: 142332

Example-2

i ~~1~~ ~~3~~ ~~5~~ ~~7~~ ~~9~~ 11

```
int i=1;

for( i ; i<=10; i+=2) ;

    Printf("%d", i);
```

O/p: 11

1<=10 True
3<=10 True
5<=10 True
7<=10 True
9<=10 TRUE
11<=10 False

```
for(Exp1; Exp2; Exp3);

≡   for(Exp1; Exp2; Exp3)
      {
          ;      // Empty loop
      }
```

Topic : Iterative Control Statements - 2

GATE 2024

#Q. Consider the following C program:

```
int main() {
int a=6;
int b = 0;
while (a<10)  {
a = a / 12+1 ;
a += b ;}
printf ("%d", a);
return 0 ; }
```

a ~~6~~ 1

b 0

6<10 True

$a = 6/12+1 \Rightarrow 0+1 = 1$

$a = a+b = 1+0 = 1$

1<10 True

$a = 1/12+1 = 0+1 = 1$

$a = a+b = 1+0 = 1$

⇒ 'a' is always being '1'

1 < 10 True always.

o/p:

Which one of the following statements is CORRECT?

A. The program prints 9 as output

B. The program prints 10 as output

[✓ C. The program gets stuck in an infinite loop]

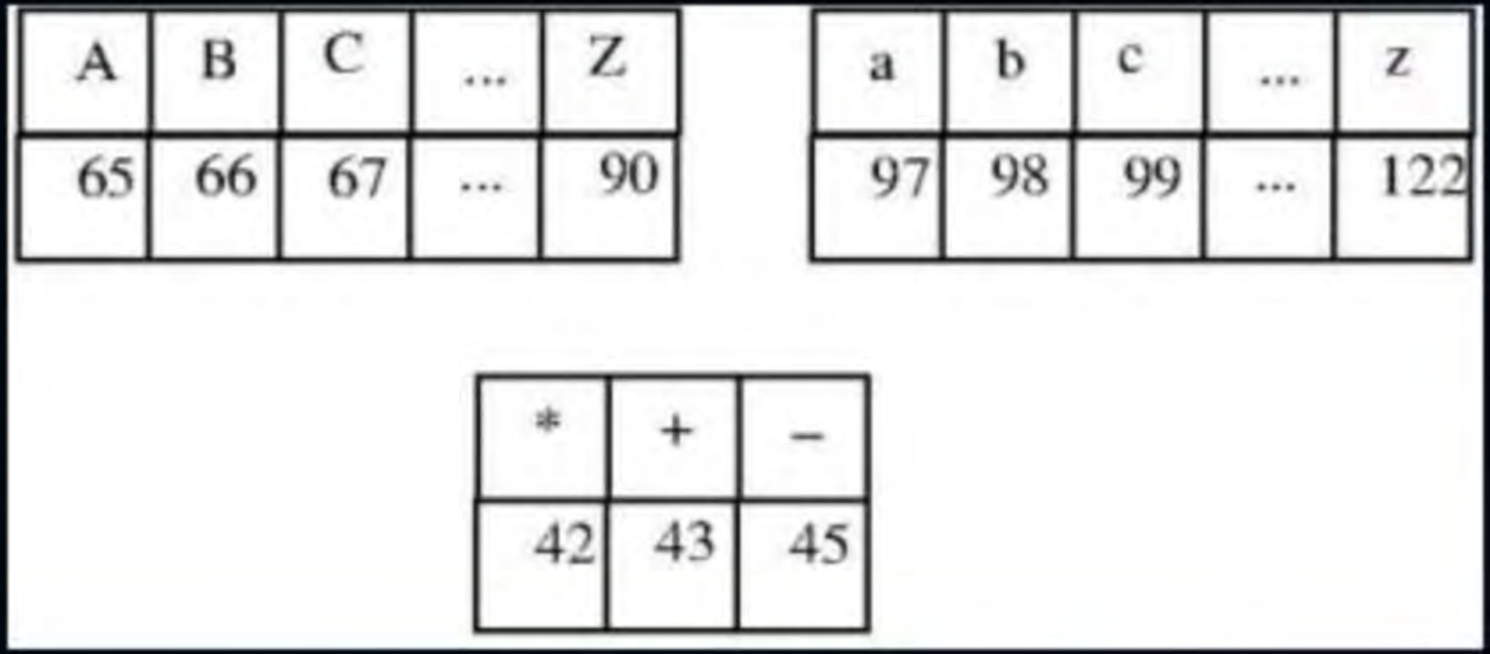
D. The program prints 6 as output

Topic : Iterative Control Statements - 2

#Q. What is printed by the following ANSI C program?

GATE 2022

```
#include<stdio.h>
int main(int argc, char *argv[]){
  char a = 'P';
  char b = 'x';
  char c = (a & b) + '*';
  char d = (a | b) - '-';
  char e = (a ^ b) + '+';
  printf("%c %c %c\n", c, d, e);
  return 0;
}
```



A	B	C	...	Z
65	66	67	...	90

a	b	c	...	z
97	98	99	...	122

*	+	–
42	43	45

ASCII encoding for relevant characters is given below

A. z K S

B. * – +

C. 122 75 83

D. P x +

Topic : Iterative Control Statements - 2

#Q. Consider the following C program:

GATE 2019

```
#include <stdio.h>
int main() {
    float sum = 0.0, j=1.0, i=2.0;
    while (i/j > 0.0625) {
        j=j+j;
        sum=sum+i/j;      ① ② ③
        printf("%f\n", sum);
    }                  ④ ⑤
    return 0;
}
```

The number of times the variable sum will be printed, when the above program is executed, is ________

Sum: 0.0

j: ~~1.0~~ ~~2.0~~ ~~4.0~~ ~~8.0~~ ~~16.0~~ 32.0

i: 2.0

$2.0 / 1.0 > 0.0625$ True $j = 1.0 + 1.0 = 2.0$

$2.0 / 2.0 > 0.0625$ True $j = 2.0 + 2.0 = 4.0$

$2.0 / 4.0 > 0.0625$ True $j = 4.0 + 4.0 = 8.0$

$2.0 / 8.0 > 0.0625$ True $j = 8.0 + 8.0 = 16.0$

$2.0 / 16.0 > 0.0625$ True $j = 16.0 + 16.0 = 32.0$

$2.0 / 32.0 > 0.0625 \Rightarrow 0.0625 < 0.0625$ False

$$\frac{1}{16} = \frac{0.125}{2} = 0.0625$$

Topic : Iterative Control Statements - 2

$j = \cancel{0}\cancel{1}\cancel{2}\cancel{3}4 ---- 40$

$Sum = \cancel{0}\cancel{1}\cancel{2}\cancel{3}\cancel{4}\underline{5}$

#Q. Consider the following C code. Assume that unsigned long int type length is 64 bits.

GATE 2018

```
unsigned long int fun(unsigned long int n) {
        unsigned long int i, j=0, sum = 0;
        for( i=n; i>1; i=i/2) j++;
        for( ; j>1; j=j/2) sum++;
        return sum;
}
```

$n = 2^{40}$

$i = 2^{40} > 1 \text{ True} \Rightarrow \underbrace{i = \frac{2^{40}}{2} = 2^{39} > 1 \text{ True} \Rightarrow i = \frac{2^{39}}{2} = 2^{38} > 1 \text{ True} \Rightarrow i = \frac{2^{38}}{2} = 2^{37} ---- j = \frac{2^1}{2} = 1}$

$j = \underbrace{1+1+1+1+1+ ---- +1}_{40 \text{ times}}$

The value returned when we call fun with the input 2^{40} is:

Sum Value ?

$\boxed{\text{ANS: } 5}$

$j = 40 > 1$ True, sum=1, $j = \frac{40}{2} = 20$

$20 > 1$ True, sum=2, $\frac{20}{2} = 10$

$10 > 1$ True, sum=3, $\frac{10}{2} = 5$

$5 > 1$ T, sum=4, $\frac{5}{2} = 2$

$2 > 1$ True, Sum=5, $\frac{2}{2} = 1$

$\underline{1 > 1 \text{ False}}$

Topic : Iterative Control Statements - 2

#Q. Consider the following C program.

GATE 2017

m ~~10~~ ~~11~~ 12

n ~~11~~ ~~10~~ 0

n1 ~~11~~ 10

```
#include<stdio.h>
int main () {
    int m=10;
    int n, n1;
    n=++m;      n=11
    n1=m++;     n1=11
    n--;
    --n1;
    n-=n1;      n=n-n1 ⇒ 10-10=0
    printf("%d", n);
    return 0;
}
```

The output of the program is ___0___

Topic : Iterative Control Statements - 2

H/W

#Q. Which combination of the integer variables x, y and z makes the variable a get the value 4 in the following expression?

GATE 2008

```
a = ( x > y ) ? (( x > z ) ? x : z) : (( y > z ) ? y : z )
```

(A) $x = 3, y = 4, z = 2$

(B) $x = 6, y = 5, z = 3$

(C) $x = 6, y = 3, z = 5$

(D) $x = 5, y = 4, z = 5$

Topic : Iterative Control Statements - 2

#Q. Consider the following ANSI C program.

H/W

GATE 2021

```
int main()
{
    int i, j, count;
    count=0;
    i=0;
    for (j=-3; j<=3; j++)                  {
        if (( j >= 0) && (i++))
            count = count + j;             }
    count = count +i;
    printf("%d", count);
    return 0;
}
```

Which one of the following options is correct?

A. The program will not compile successfully

B. The program will compile successfully and output 10 when executed

C. The program will compile successfully and output 8 when executed

D. The program will compile successfully and output 13 when executed

Topic : Iterative Control Statements - 2

H/W

GATE 2015

#Q. Consider the following C program:

```
int main()
{
    int i, j, k = 0;
    j=2 * 3 / 4 + 2.0 / 5 + 8 / 5;
    k-=--j;
    for (i=0; i<5; i++)   {
        switch(i+k)       {
            case 1:
            case 2: printf("\n%d", i+k);
            case 3: printf("\n%d", i+k);
            default: printf("\n%d", i+k);     }
    }
    return 0;      }
```

The number of times printf statement is executed is ________.

H/W

#Q. What will be the output of the following C program segment?

GATE 2012

```
char inChar = 'A';
  switch ( inChar ) {
    case 'A' : printf ("Choice A \ n");
    case 'B' :
    case 'C' : printf ("Choice B");
    case 'D' :
    case 'E' :
    default : printf ("No Choice");
  }
```

A. No Choice

B. Choice A

C. Choice A
   Choice B No Choice

D. Program gives no output as it is erroneous

Topic : Iterative Control Statements - 2

H/W

#Q. Let x be an integer which can take a value of 0 or 1. The statement if(x = =0) x = 1; else x = 0; is equivalent to which one of the following?

GATE 2004

(A) x = 1 + x;

(B) x = 1 – x;

(C) x = x – 1;

(D) x = 1 % x;

2 mins Summary

- While loop
- for loop
- GATE PYQ's

THANK - YOU