CS & IT ENGINEERING

Programming in C

Functions and Storage Classes

Lec-04 Recursion -02

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- Recursion

Decimal to binary

	Rem
$n \rightarrow$	$n\%2$
$n/2 \rightarrow$	✓

	n	Rem
2	26	
2	13	0 ✓
2	6	1
2	3	0
2	1	1
	0	1

$$2 \overline{)26} \; 13$$

$$0$$

$$2 \overline{)13} \; 6$$

$$12$$

$$1$$

```
void f(int n){
    if(n is small)
    {
      Easy case
      Can be ans. directly
      No recursion is needed
    }
    else {
      n is large.
      Not easy to solve.
      rec. is needed
    }
}
```

$n>0$

void f(int n){

if(n==0 || n==1)

{

printf("%d",n);

return;

}

else {

f(n/2);

printf("%d",n%2);

}

}

why?

a^b

$3^{10} = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$

$= 3 \times 3^9$ $\quad a^b \Rightarrow a \times a^{b-1}$

$f(a, b)\ \{$

rec $\Rightarrow$

3

a^b

$a, b > 0$

~~$b > 0$~~

```
int f(int a, int b)
{
    if( b is small)
    {
        return a;        // a^1 = a
    }
    else {
        return a x a^(b-1)
    }
}
```

1

f(a, b-1)

Rec : To cal. no. of digits in a number. $(n \geq 0)$

i/p : n : 2

o/p : 1

n : 3

o/p : 1

n : 125

o/p : 3

n : 1278

o/p : 4

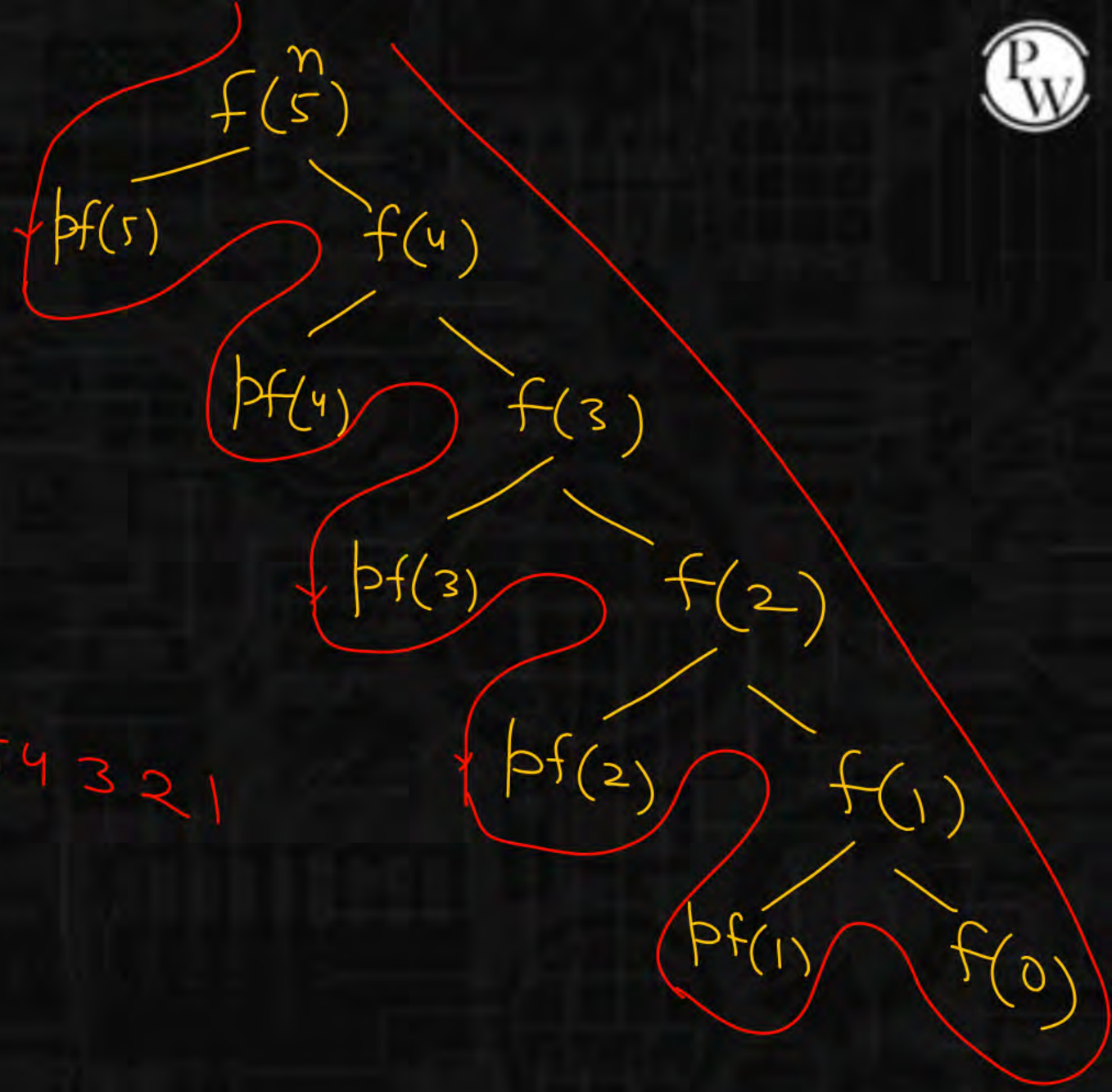
```
int f(int n){
    if ( n <= 9)
    {
        return 1 ;
    }
    else {
    return 1 + f(n/10);
    }
}
```

1. Decimal to Hexa-decimal
2. Decimal to octal

Q.1

```
void f(int n)
  {
      if(n<=0)
      return;
      printf("%d",n);
      f(n-1);
  }
```

What is the output of f(5)



5 4 3 2 1

Q.2

```
void f(int n)
  {
      if(n<=0)
      return;
      f(n-1);
      printf("%d",n);
  }
```

What is the output of f(5)

12345

Statements written after recursive call execute in opposite order of function calls

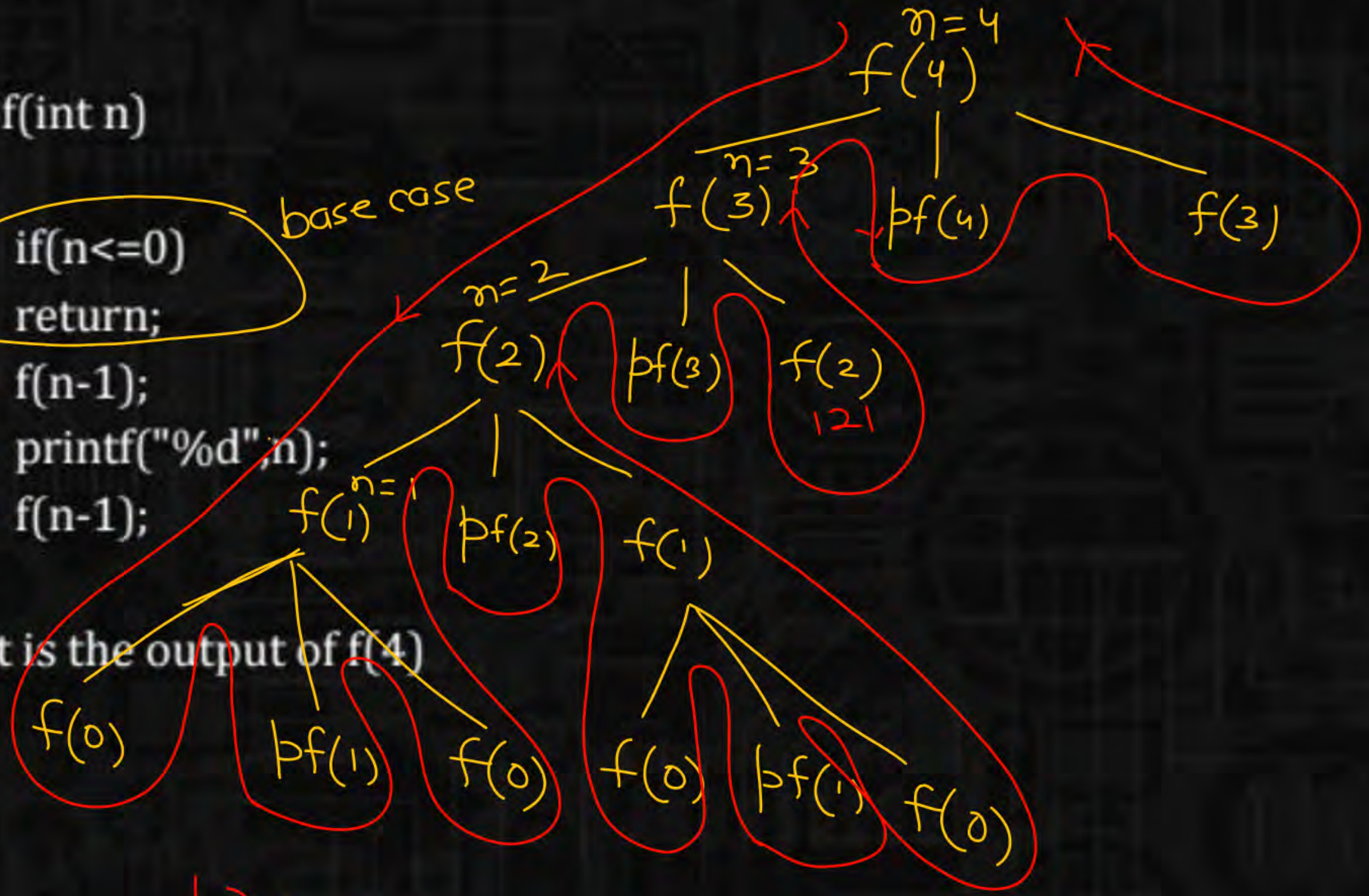
$f(5) \rightarrow f(4) \rightarrow f(3) \rightarrow f(2) \rightarrow f(1)$

Q.3

```
void f(int n)
  {
      if(n<=0)
      return;
  1.  f(n-1);
  2.  printf("%d",n);
  3.  f(n-1);
  }
```

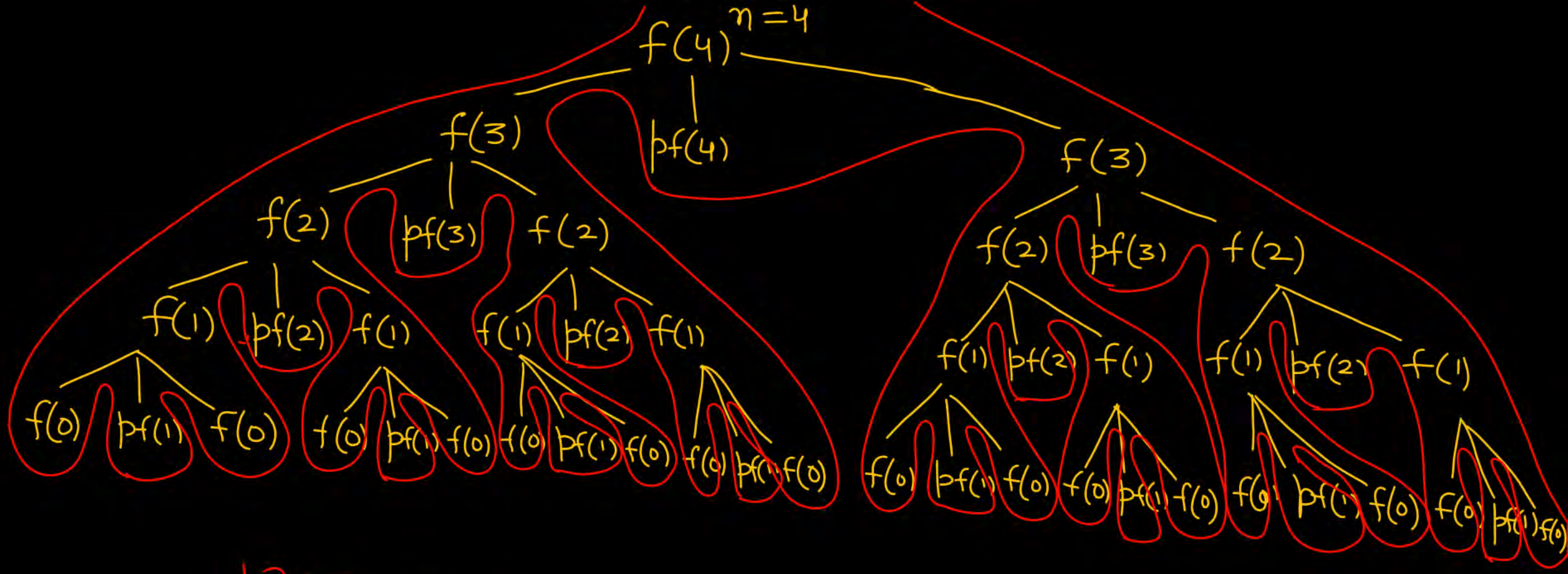
base case

What is the output of f(4)



121 3 121 4 1213121

f(3)

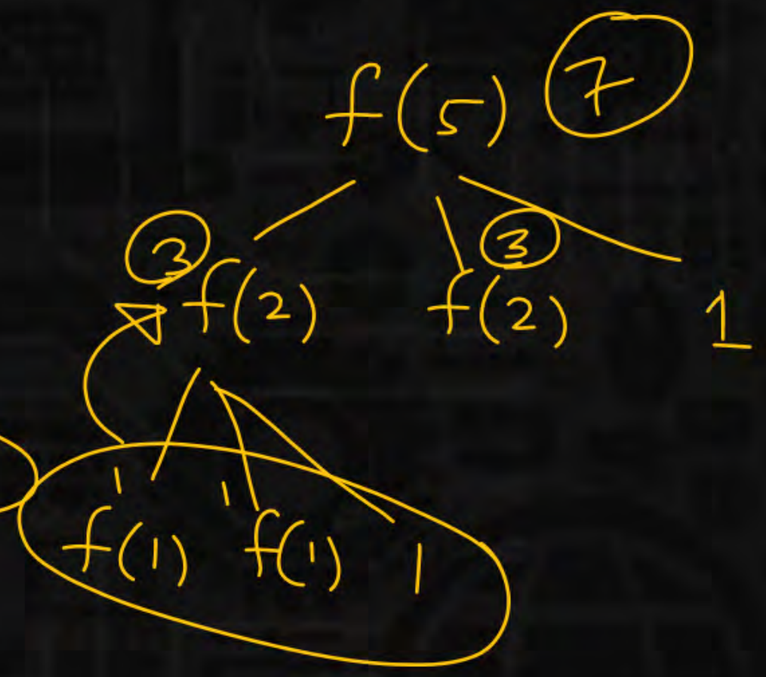


1213121 4 1213121

Q.4

```
int f(int n)
  {
      if(n<=1)
      return n;
      return f(n/2) + f(n/2) + 1;
  }
```

What is the output of f(5)



Q.5

```
int f(int n)
  {
      if(n<=1)
      return n;
      return f(n/2) + n/2 ;
  }
```

What is the output of f(12)

```
main() {
    int res;
    res = f(12);
}
```

f(12) = 11

f(6) = 5 + 6

f(3) = 2 + 3

f(1) = 1 + 1

1

Q.6

```
int f(int n)
  {
      if(n<=1)
      return n;
      if(n%2)
      return f(n/2) + n;
      return f(n/3) + n;
  }
```

output of f(22) ?

odd

Even

$n/2 = 0$

if(0)

if(1)

else

if(0)

else

$f(22) \to 33$

$f(7) + 22$ ||

$f(3) + 7$ 4

$f(1) + 3$ 1

1

return

Q.6

```
int f(int n)
    {
        if(n<=1)
        return n;
        if(n%2)
        return f(n/2) + n;
        return f(n/3) + n;
    }
```

output of f(22) ?

5

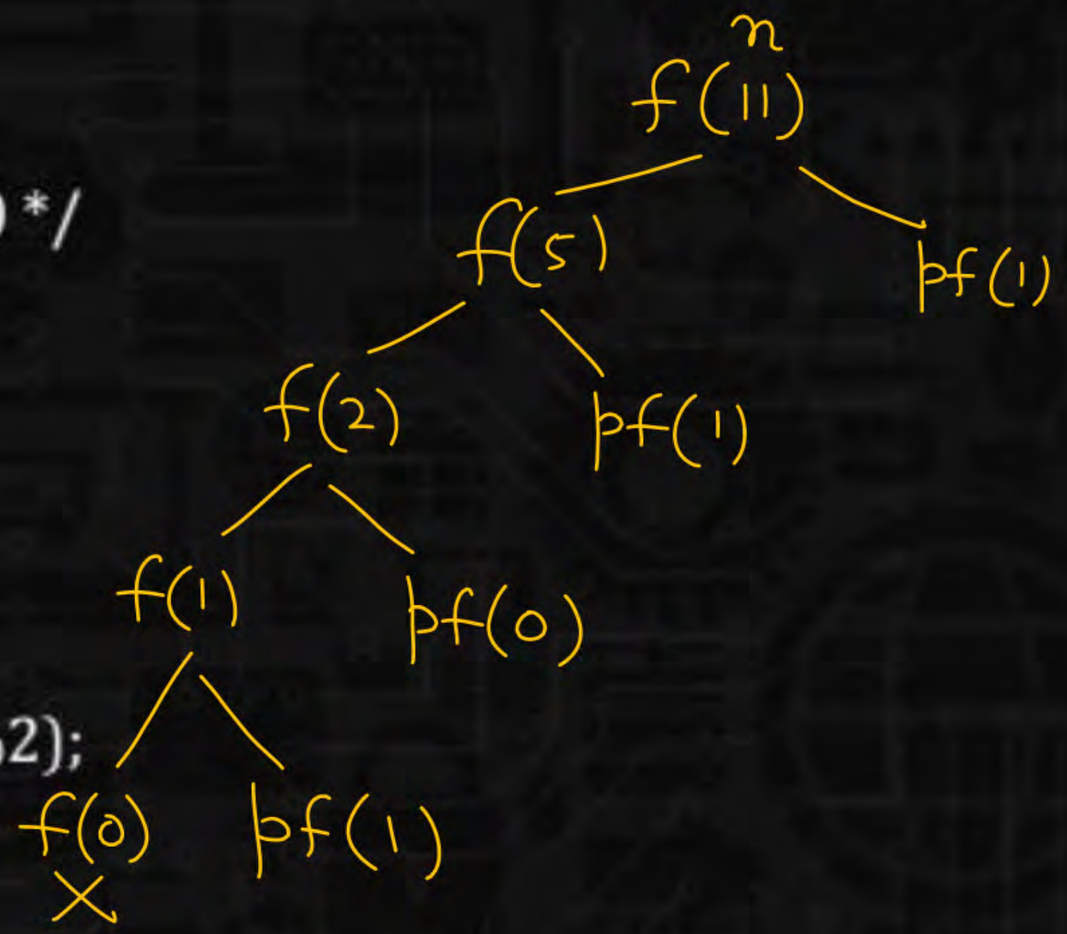
```
if(n % 2)
{
return f(n/2) + n ;
}
```

Q.7

Consider the code :

```
/* Assume that n>=0 */
void fun(int n)
  {
      if(n==0)
      return ;
      fun(n/2);
      printf("%d",n%2);
  }
```

output of f(11)?



Q.8

Consider the following C program :

```
void foo(int n , int sum) {
    int k=0,j=0;
    if(n==0)
    return;
    k=n%10;
    j=n/10;
    sum=sum + k;
    foo(j,sum);
    printf("%d",k);
}
void main(){
int a=2048,sum=0;
foo(a,sum);
printf("%d",sum);
}
```

Output?

A. 8, 4, 0, 2, 14

B. 8,4,0,2,0

C. 2,0,4,8,14

D. 2,0,4,8,0

Q.8

Consider the following C program :

```
void foo(int n , int sum) {
    int k=0,j=0;
    if(n==0)
    return;
    k=n%10;
    j=n/10;
    sum=sum + k;
    foo(j,sum);
    printf("%d",k);
}
void main(){
int a=2048,sum=0;
foo(a,sum);
printf("%d",sum);
}
```

Output?

k=0 j=0

k=8

j=201

8
4
0
2

A. 8, 4, 0, 2, 14

B. 8,4,0,2,0

C. 2,0,4,8,14

D. 2,0,4,8,0

foo (2048, 0)

foo (204, 8)

n: 2048

sum: 80

Q.9

```
void main()
{
    static int var=5;
1.  printf("%d",var--);
2.  if(var)
        main();
3.}
```

var

0 | ~~2~~ ~~3~~ ~~1~~ ~~5~~ ~~4~~

54321

main
pf(1), var = var - 1 ⇒ 0
if(0)

main
pf(2), var = var - 1
if(1)

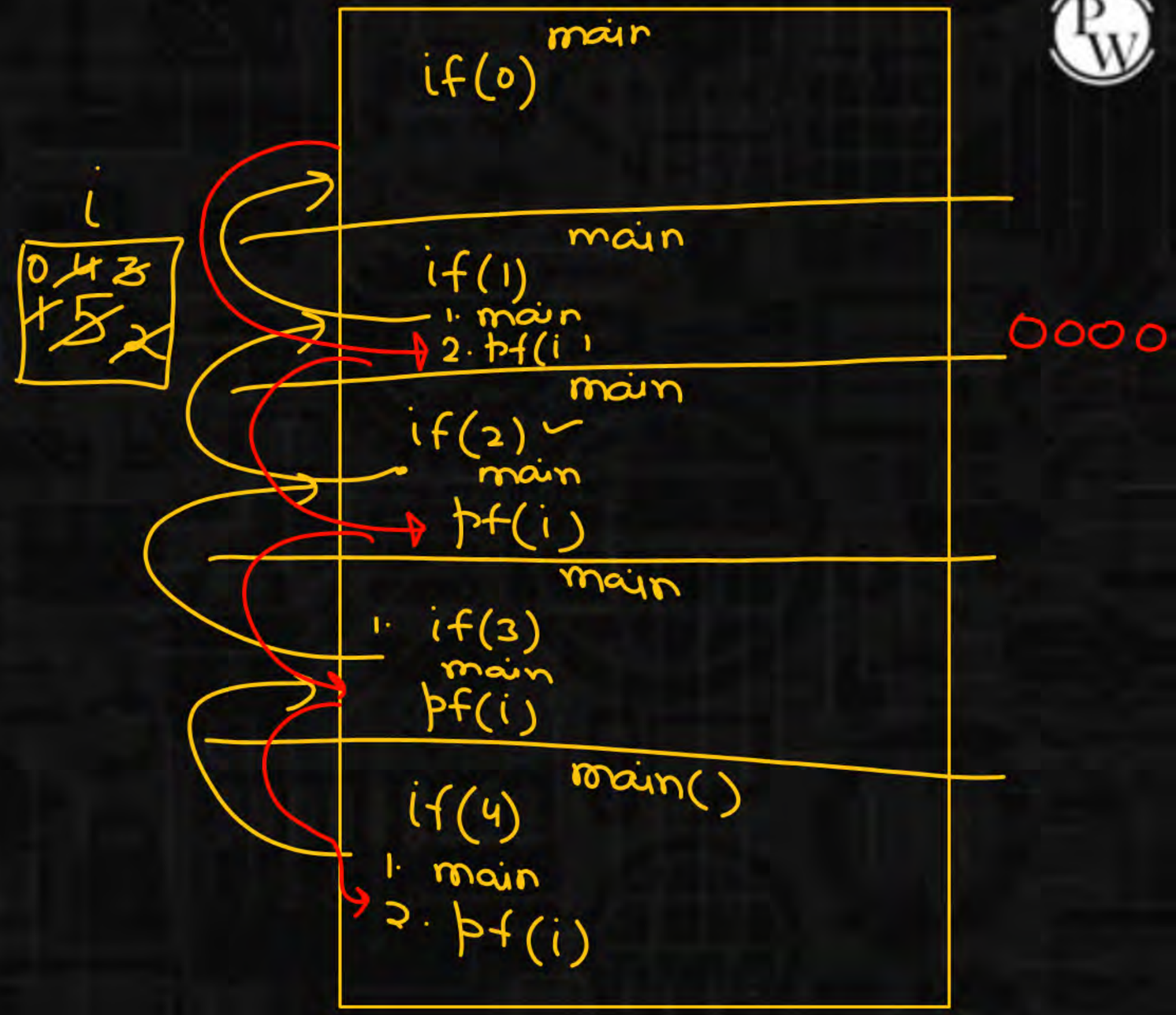
main
pf(3)
var = var - 1
if(2) ✓

main
pf(4)
var = var - 1
if ✓

main
1. printf(5)
var = var - 1
2 if ✓
3

Q.10

```
void main()
 {
   static int i =5;
    if(--i)
      {
        main();
        printf("%d",i);
      }
 }
```



Anna 24
Ghante
Chaukanna

Recursion
+
static variable

Respect

Q.11

12-29 HW

predict the output

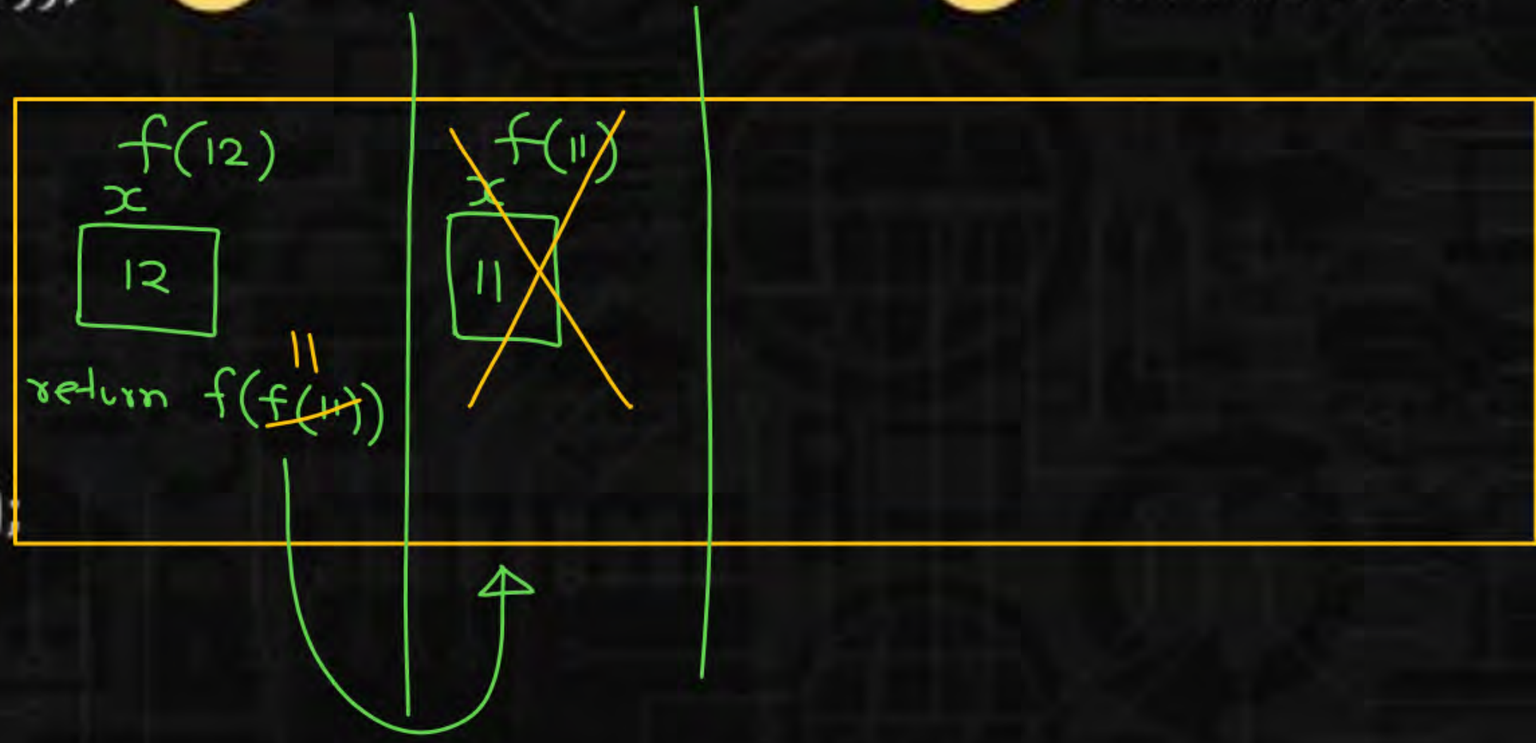
```
int f[redacted](int x)
    {
        if(x%2==0)
            return f[redacted](f[redacted](x-1));
    else
            return(x++);
    }
int main()
    {
        printf("%d",f(12));
[redacted]
        return 0;
    }
```

A. 10

B. 11

C. 12

D. None of these



Q.12

```
int fun(int a,int b)
    {
        if(b==0)
        return 0;
        if(b%2==0)
        return fun(a+a,b/2);
        return fun(a+a,b/2) + a;
    }

int main()
    {
        printf("%d",fun(4,3));
        getchar();
        return 0;
    }
```

A. 12

B. 81

C. 64

D. 8

Q.13 Consider the following C function :

```
int f(int n)
 {
   static int r=0;
   if(n<=0)
   return 1;
   if(n<3)
   {
     r=n;
     return f(n-2) + 2;
   }
   return f(n-1) + r;
 }
```

what is the value of f(5)

A. 5

B. 7

C. 9

D. 18

Q.14 Consider the following recursive C function

```
unsigned int foo(unsigned int n, unsigned int r)
 {
   if(n>0)
   return (n%r) + foo(n/r , r);
else
   return 0;
 }
```

output of foo(513,2)

A. 9

B. 8

C. 5

D. 2

Q.15 Which of the following statements is/are valid?

A. return a+b;

B. return a,b,c;

C. return (a,b,c);

D. All of them

Q.16

```
int fun(int x)
 {
   if(x>3)
   return fun(x-4) + fun(x-1) + 1;
   return 1;
 }
```

Find the value returned by fun(12)

Q.17

Predict output of following program

```
#include <stdio.h>
int fun(int n)
{
   if (n == 4)
   return n;
   else return 2*fun(n+1);
 }
int main()
 {
   printf("%d ", fun(2));
   return 0;
 }
```

A. 4

B. 8

C. 16

D. error

Q.18 Consider the following recursive function fun(x, y). What is the value of fun(4, 3)

```
int fun(int x, int y)
{
    if (x == 0)
    return y;
    return fun(x - 1,  x + y);
}
```

A. 13

B. 12

C. 9

D. 10

Q.19 What does the following function do?

```
int fun(int x, int y)
{
  if (y == 0)   return 0;
  return (x + fun(x, y-1));
}
```

A. x + y

B. x + x * y

C. x * y

D. pow(x, y)

Q.20 What does fun2() do in general?

```
int fun(int x, int y)
{
   if (y == 0)   return 0;
   return (x + fun(x, y-1));
}

int fun2(int a, int b)
{
   if (b == 0) return 1;
   return fun(a, fun2(a, b-1));
}
```

A. x * y

B. x + x * y

C. pow(x, y)

D. pow(y, x)

Q.21 Output of following program?

```
#include<stdio.h>
void print(int n){
    if (n > 4000)
    return;
    printf("%d ", n);
    print(2*n);
    printf("%d ", n);
}
int main()
{
    print(1000);
    getchar();
    return 0;
}
```

A. 1000 2000 4000

B. 1000 2000 4000 4000 2000 1000

C. 1000 2000 4000 2000 1000

D. 1000 2000 2000 1000

Q.22 What does the following function do?

```
int fun(unsigned int n)
{
   if (n == 0 || n == 1)
      return n;

   if (n%3 != 0)
      return 0;
   return fun(n/3);
}
```

A. It returns 1 when n is a multiple of 3, otherwise returns 0

B. It returns 1 when n is a power of 3, otherwise returns 0

C. It returns 0 when n is a multiple of 3, otherwise returns 1

D. It returns 0 when n is a power of 3, otherwise returns 1

Q.23 Predict the output of following program

```
#include <stdio.h>
int f(int n)
{
   if(n <= 1)
      return 1;
   if(n%2 == 0)
      return f(n/2);
   return f(n/2) + f(n/2+1);
}
 int main()
{
   printf("%d", f(11));
   return 0;
}
```

A. Stack Overflow

B. 3

C. 4

D. 5

Q.24 Consider the following C function:

```
int f(int n)
{
  static int i = 1;
  if (n >= 5)
    return n;
  n = n+i;
  i++;
  return f(n);
}
```

The value returned by f(1) is

A. 5

B. 6

C. 7

D. 8

Q.25 Consider the following C function.

```
int fun (int n)
{
  int x=1, k;
  if (n==1) return x;
  for (k=1; k<n; ++k)
  x = x + fun(k) * fun(n – k);
  return x;
}
```

The return value of fun(5) is _____.

A. 0

B. 26

C. 51

D. 71

Q.26 Consider the following recursive C function. If get(6) function is being called in main() then how many times will the get() function be invoked before returning to the main()?

```
void get (int n)
{
  if (n < 1) return;
  get(n-1);
  get(n-3);
  printf("%d", n);
}
```

A. 15

B. 25

C. 35

D. 45

Q.27 What will be the output of the following C program?

```
void count(int n)
{
   static int d = 1;
   printf("%d ", n);
   printf("%d ", d);
   d++;
   if(n > 1) count(n-1);
   printf("%d ", d);
}
int main()
{
   count(3);
}
```

A. 3 1 2 2 1 3 4 4 4

B. 3 1 2 1 1 1 2 2 2

C. 3 1 2 2 1 3 4

D. 3 1 2 1 1 1 2

Q.28 What will be the output of the C program?

```
#include<stdio.h>
int main()
{
  function();
  return  0;
}
void function()
{
  printf("Function in C is awesome");
}
```

A. Function in C is awesome

B. no output

C. Runtime error

D. Compilation error

Q.29 What will be the output of the C program?

```
#include<stdio.h>
int main()
{
   main();
   return 0;
}
```

A. Runtime error

B. Compilation error

C. 0

D. None of these


THANK YOU GW
SOLDIERS !