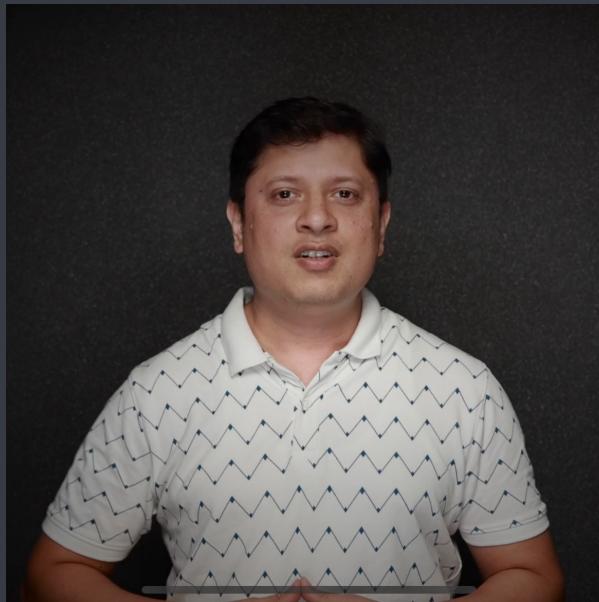


C Language

Recursion



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Agenda

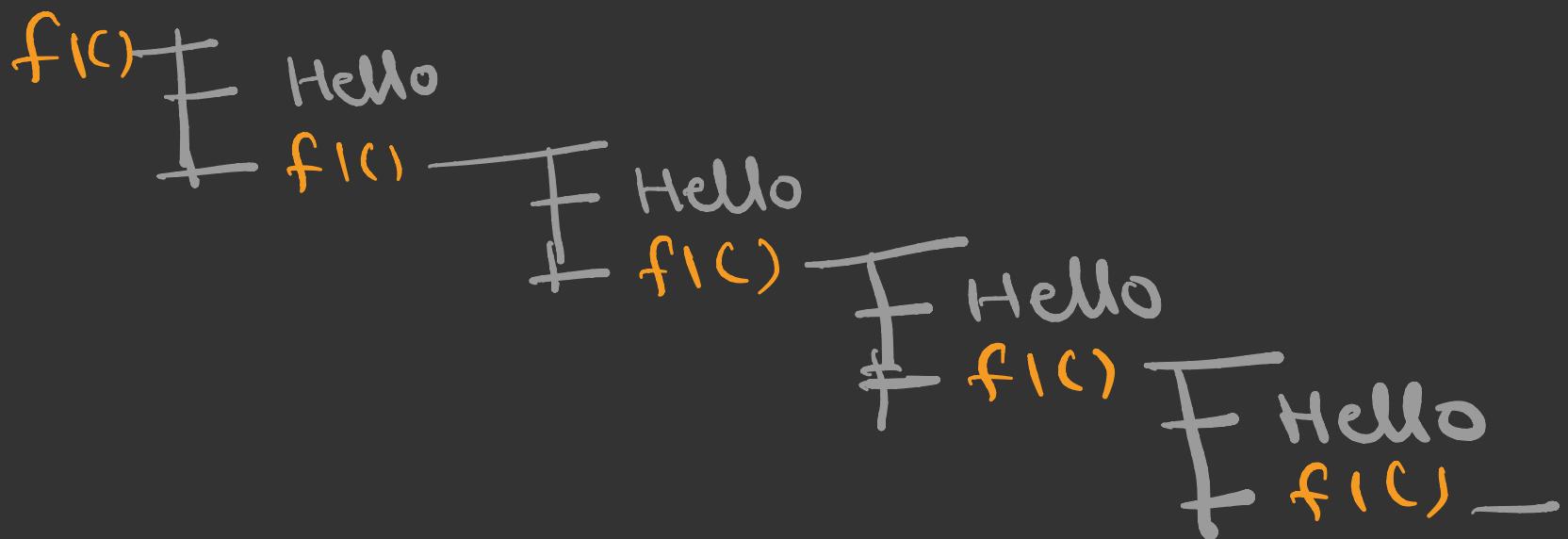
- ① What is a recursion?
- ② Recursion Tree | Tracing code
- ③ How to approach recursive solution?
- ④ Few examples

What is a recursion?

- Function calling itself is called recursion
- A recursive method solves a problem by calling a copy of itself to work on a smaller problem.
- It is important to ensure that the recursion terminates.

```
void f1() {  
    printf("Hello");  
    f1();  
    printf("Bye");  
}
```

```
void f2() {  
    printf("A");  
}
```



```

void f1()
{
    int a;
    printf("Enter a number");
    scanf("%d", &a);
    if(a>0)
        f1();
    printf("%d", a);
}

```

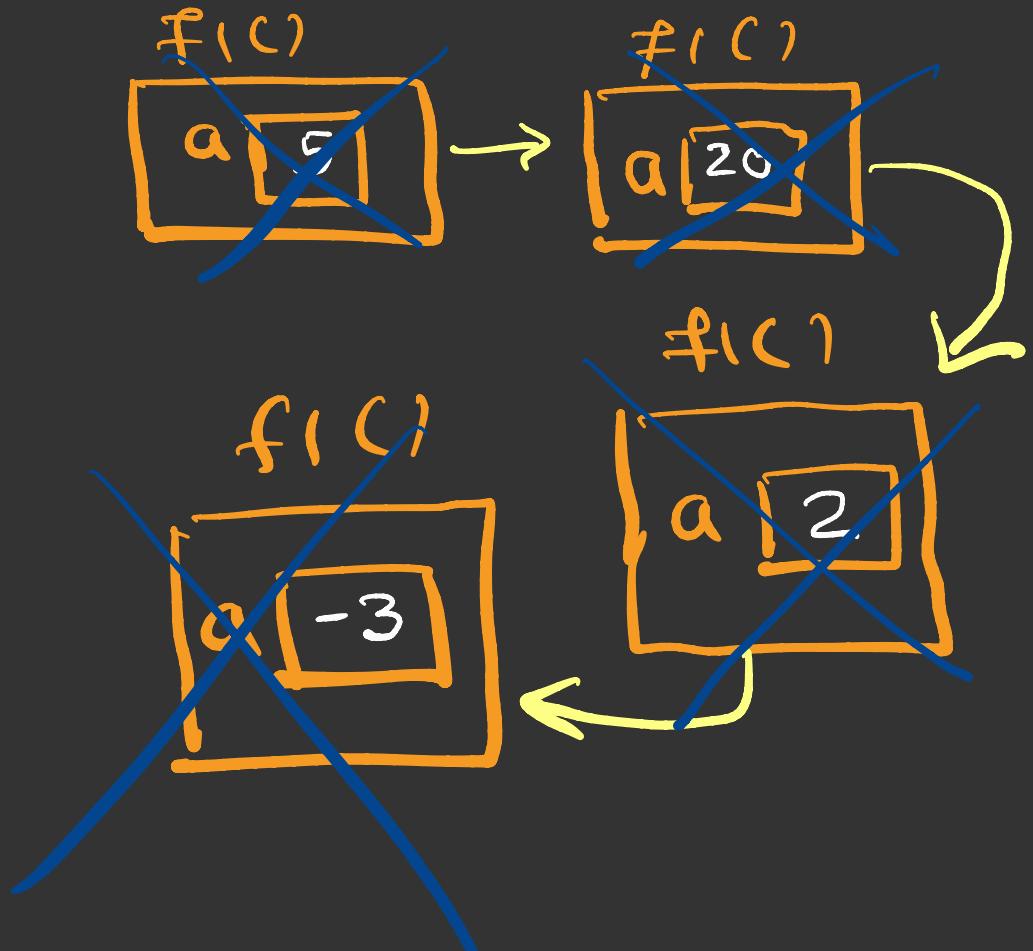
Enter a number 5

Enter a number 20

Enter a number 2

Enter a number -3

-3 2 20 5



- Each time the function call itself with a slightly simpler version of the original problem.
- Recursive code is generally shorter and easier to write than iterative code.
- Solution to some problems are easier to formulate recursively.

```
int main()
```

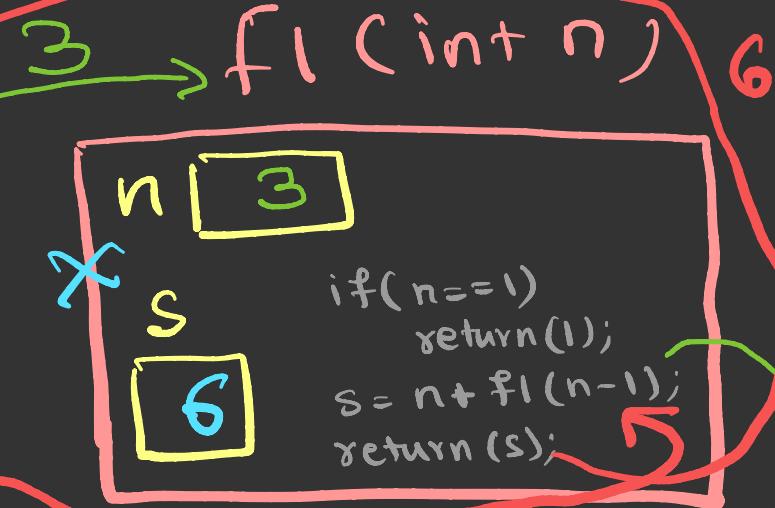
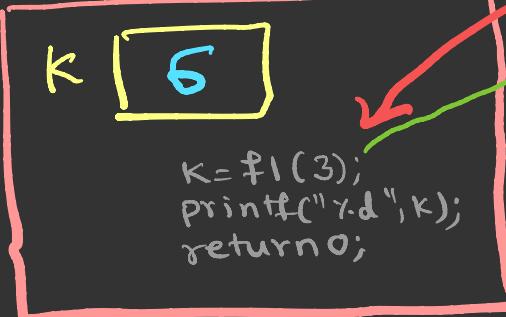
```
{  
    int K;  
    K=f1(3);  
    printf("%d",K);  
    return 0;  
}
```

```
int f1(int n)
```

```
{  
    int s;  
    if(n==1)  
        return(1);  
    s=n+f1(n-1);  
    return(s);  
}
```

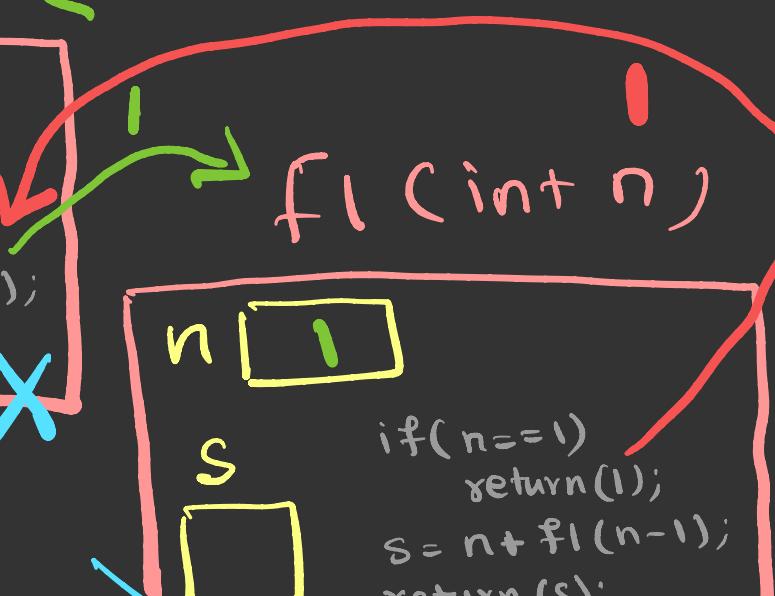
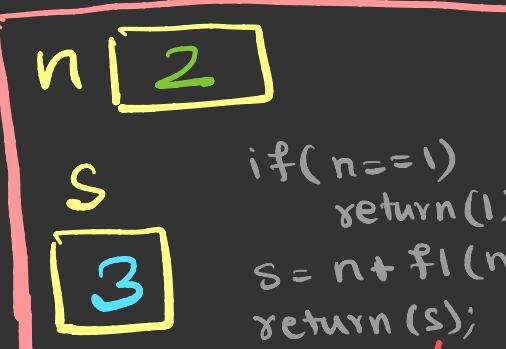
6

main()



3

f1(int n)



3

2

1

$$f_1(1) \rightarrow 1$$

$$f_1(2) \rightarrow 3 \rightarrow 2 + f_1(1)$$

$$f_1(3) \rightarrow 6 \rightarrow 3 + f_1(2)$$

$$f_1(4) \rightarrow 10 \rightarrow 4 + f_1(3)$$

$$f_1(5) \rightarrow 15 \rightarrow 5 + f_1(4)$$

$$f_1(6) \rightarrow 21 \rightarrow 6 + f_1(5)$$

$$f_1(n) \rightarrow \rightarrow n + f_1(n-1)$$

$$f_1(100)$$

$$\hookrightarrow 100 + f_1(99)$$

$$\hookrightarrow 99 + f_1(98)$$

↓

$$98 + f_1(97)$$

⋮

$$f_1(1) \rightarrow 1$$

$$f_1(n) = \begin{cases} n > 1 & n + f_1(n-1) \\ n = 1 & 1 \end{cases}$$

How to approach a Recursive Problem?

Write a recursive function to calculate sum of first n natural numbers.

- ① $\text{sum}(n) \quad 1+2+3+\dots+n$
 - RC
② $n + \text{sum}(n-1) \quad 1+2+3+\dots+n-1$
+ n
 - BC
③ $n = -1 \quad |$

```
int sum(int n)
{
    if (n==1)
        return 1;
    return n + sum(n-1);
}
```