

Assignment-1

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Github repository

<https://github.com/Sadiq0123/C-and-DS/tree/main/Assignment-1>

1 PROBLEM

Consider the following C program:

```
#include <stdio.h>

int counter = 0;
int calc (int a, int b) {
    int c;

    counter++;
    if (b==3) return (a*a*a);
    else {
        c = calc(a, b/3);
        return (c*c*c);
    }
}

int main (){
    calc(4, 81);
    printf ("%d", counter);
}
```

The output of this program is _.

2 SOLUTION

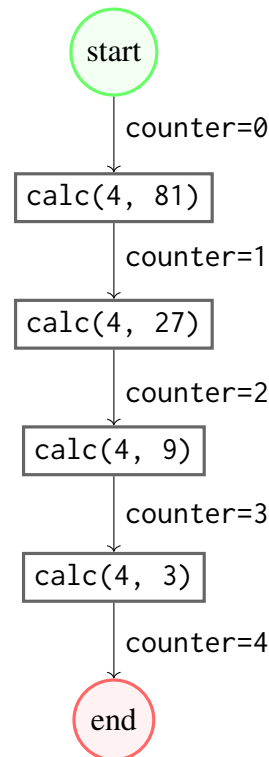
Answer: 4.

The variable counter is a global variable with initial value set to 0, and is incremented by 1 everytime the function calc is called.

The function calc returns a^b only if b is a power of 3; else the function returns nothing. The code behaves this way because eventually the function calls $\text{calc}(a, b/3)$ where $b < 3$, which leads to an infinite recursive call of $\text{calc}(a, 0)$. So, the stack overflow causes Segmentation Fault

error during runtime.

If b is valid, then calc recursively calls itself for $b/3$. So, the total number of times counter is incremented is $\log_3(b)$ times. The following table shows the value of counter at every step.



As $\log_3(81) = 4$, the output of the code would be equal to 4.

The general mathematical relation between input (a, b) and output counter is:
 $\text{counter} = \log_3(b)$