Assignment 1

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Download all latex-tikz codes from

https://github.com/KarthikRamneti/C−DS/blob/main/assignment1/assgn1.tex

1 Problem

(Q 27) Consider the following C function.

```
#include <stdio.h>
int r(){
      static int num = 7;
      return num−−;
}

int main(){
      for (r();r();r())
            printf("%d",r());
      return 0;
}
```

Which of the following values will be displayed on execution of the programs?

1) 41
2) 52
3) 63
4) 630

2 Solution

Answer : C) 52

Explanation:
A static variable is a variable that persists its value across the various function calls. Static variables are variables that remain in memory while the program is running i.e. their lifetime is the entire program run.
Here, **num** is the static variable and is initialized with the value = 7.

Execution Order of for loop is:

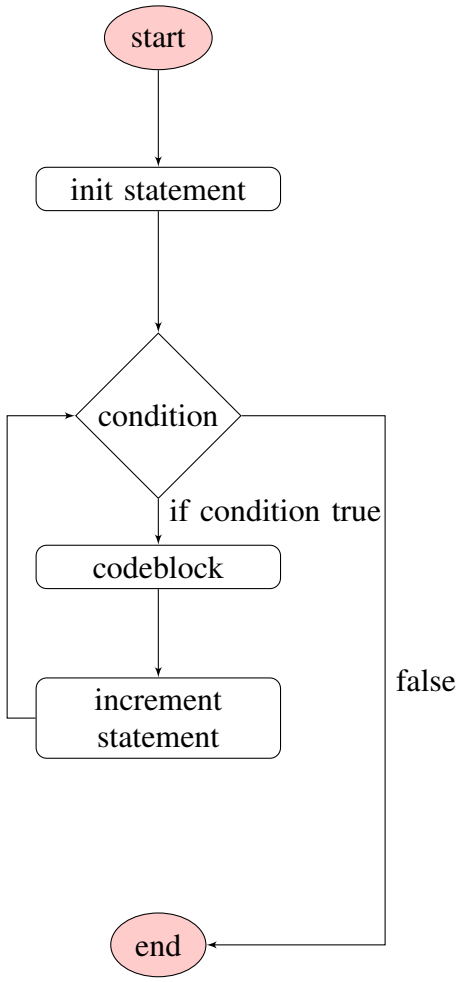

Fig. 4: Execution Order of the for loop

3 Problem

Here, if **r()** is called first time then the **"num"** static varible is initiated with 7 and **num--** decrements the value of the **num** variable by 1 after returning the value **num** and if called next time, the **"num"** static varible is not initiated with 7.
So, At the first r() call, num = 7 and r() returns 7, after the first call num value becomes 6 and in the second call, num = 6, and r() return 6, after the first call num value becomes 5
The execution of program is as follows and prints 52.

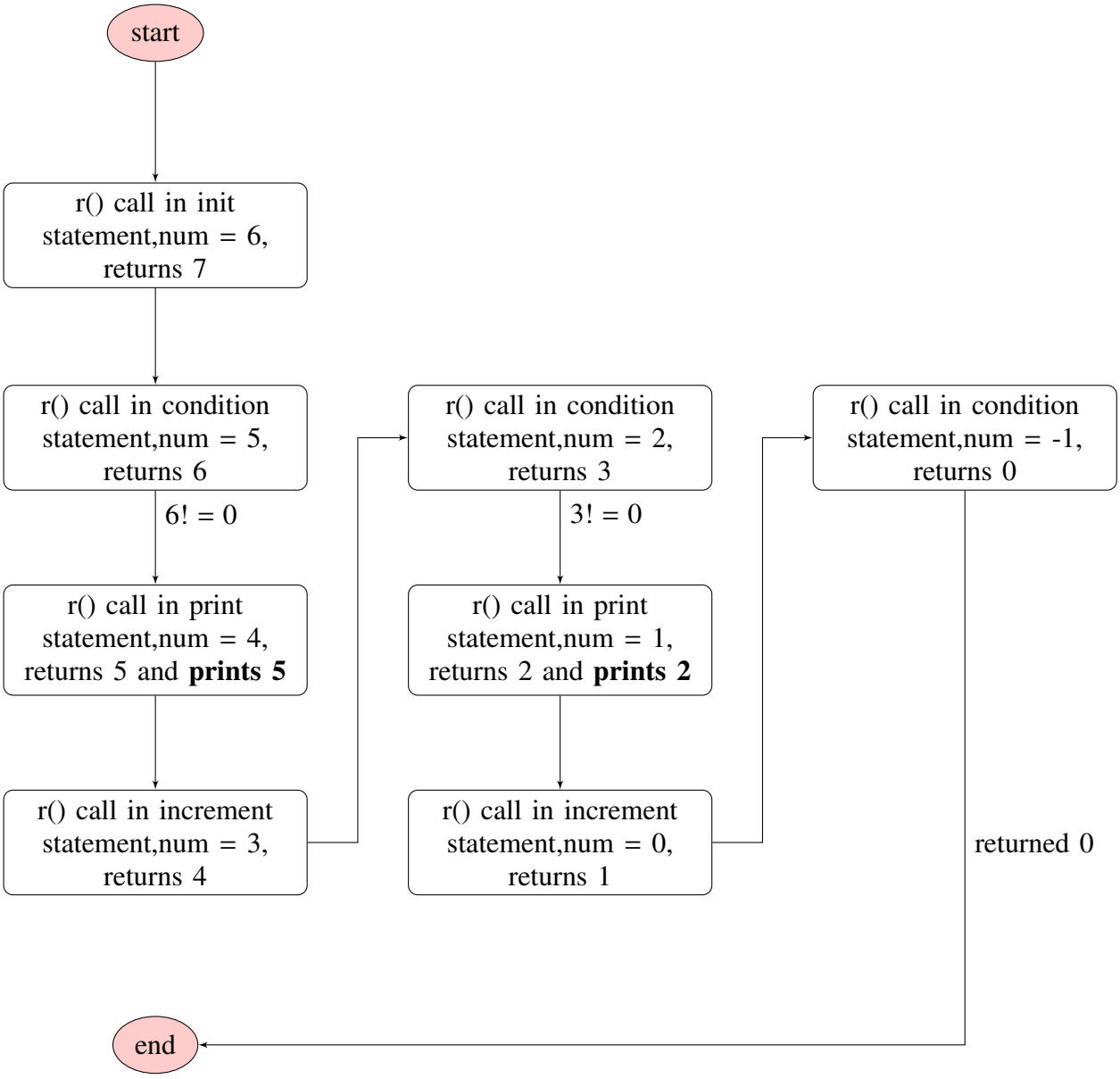

Fig. 4: Program Execution Timeline

4 General Mathematical formula

If the static variable num is initialised to a number of the form **3k+1**, where $k >= 0$. Then the initialization call in for loop runs one time, the condition call, code block call and the increment call in the for loop runs k times because after this r() returns 0, so the condition statement will be false and the for loop terminates.Therefore the print statement is called k times. So it prints (num-2)(num-2-3)....2.

If the static variable num is initialised to a number which is not of the form **3k+1**, then the for loop runs indefinitely because the r() call in the condition statement will never return 0.

$$Output = \begin{cases} (num-2)(num-5)....2 & num = 3k+1 \\ runs\,infinetly & else \end{cases}$$

If num = 3k+1

$$Output = \sum_{k=1}^{k=\frac{n-1}{3}} 10^{k-1} \times (3k-1)$$