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C Program to Find Sum Of First n Natural Numbers in O(1)
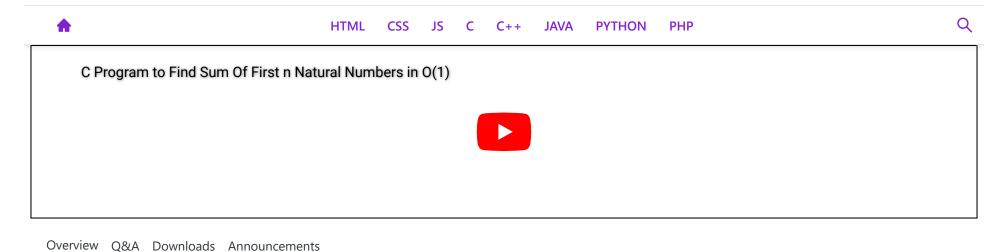
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C Program to Find Sum Of First n Natural Numbers in O(1)

In this tutorial, we will write a program to find the sum of first n natural numbers in O(1) time complexity in C language. An example program is shown below

```c
#include<stdio.h>

int main(){
    int n, sum=0;
    printf("Enter the last natural number you want the sum of\n");
    scanf("%d", &n);
    // Sum = 1 + 2 + 3+ 4+ 5 +....+n

    // Runs in Linear time
    for (int i = 1; i <= n; i++)
     {
         sum +=i;
     }
```

```
    printf("Sum of first %d natural numbers is: %d\n", n, sum);

    return 0;
}
```

Code Snippet 1: Find the Sum of First n Natural Numbers

As shown in a code snippet 1,

1. We have declared an integer variable "n" which will be used to store user input

2. We initialized an integer variable "sum" with the value "0", it will be used to store the sum of natural numbers

3. The "printf" function is used to print "Enter the last natural number you want the sum of" at the run time and "/n" will break the line

4. The "scanf" function is used to get input from user; the "%d" refer to an integer and "n" is the variable in which the user input will be stored

5. The "for" loop is used to iterate for the given value of the variable "n". Every time the loop will iterate the value of the variable "i" will be added into the previous value of "i" and will be stored in the variable "sum".

This program will run in linear times; which means that the program time will keep increasing as the input value increase because the loop is running n times, which is not a good practice. There is another way to write this program which will run in constant times which is shown below.

```
// Runs in Constant time
    sum = (n*n + n)/2;
```

Code Snippet 2: Find the sum of first n natural numbers in constant time

As shown in the code snippet 2,

1. In this, we made a simple expression to perform the required task and the main thing is that this will run in constant times because this expression will run only 1 time for any given input.

The output of the following program is shown below

```
Enter the last natural number you want the sum of
3
Sum of first 3 natural numbers is: 6
```

Figure 1: Program Output

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