

Add 1 to a given number

Write a program to add one to a given number. You are not allowed to use operators like '+', '-', '*', '/', '++', '--' ...etc.

Examples:

Input: 12

Output: 13

Input: 6

Output: 7

Yes, you guessed it right, we can use bitwise operators to achieve this. Following are different methods to achieve same using bitwise operators.

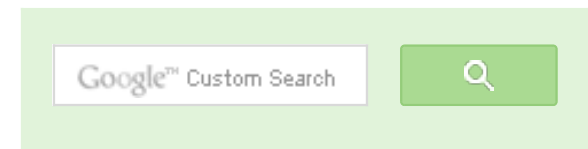
Method 1

To add 1 to a number x (say 0011000111), we need to flip all the bits after the rightmost 0 bit (we get 0011000000). Finally, flip the rightmost 0 bit also (we get 0011001000) and we are done.

```
#include<stdio.h>

int addOne(int x)
{
    int m = 1;

    /* Flip all the set bits until we find a 0 */
    while( x & m )
    {
        x = x^m;
        m <<= 1;
    }
}
```



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```

/* flip the rightmost 0 bit */
x = x^m;
return x;
}

/* Driver program to test above functions*/
int main()
{
    printf("%d", addOne(13));
    getchar();
    return 0;
}

```

Method 2

We know that the negative number is represented in 2's complement form on most of the architectures. We have the following lemma hold for 2's complement representation of signed numbers.

Say, x is numerical value of a number, then

$\sim x = -(x+1)$ [\sim is for bitwise complement]

$(x + 1)$ is due to addition of 1 in 2's complement conversion

To get $(x + 1)$ apply negation once again. So, the final expression becomes $(-\sim x)$.

```

int addOne(int x)
{
    return (- (~x));
}

/* Driver program to test above functions*/
int main()
{
    printf("%d", addOne(13));
    getchar();
    return 0;
}

```

Example, assume the machine word length is one *nibble* for simplicity.

And $x = 2$ (0010),

$\sim x = \sim 2 = 1101$ (13 numerical)

$\sim \sim x = -1101$

Interpreting bits 1101 in 2's complement form yields numerical value as $-(2^4 - 13) = -3$. Applying



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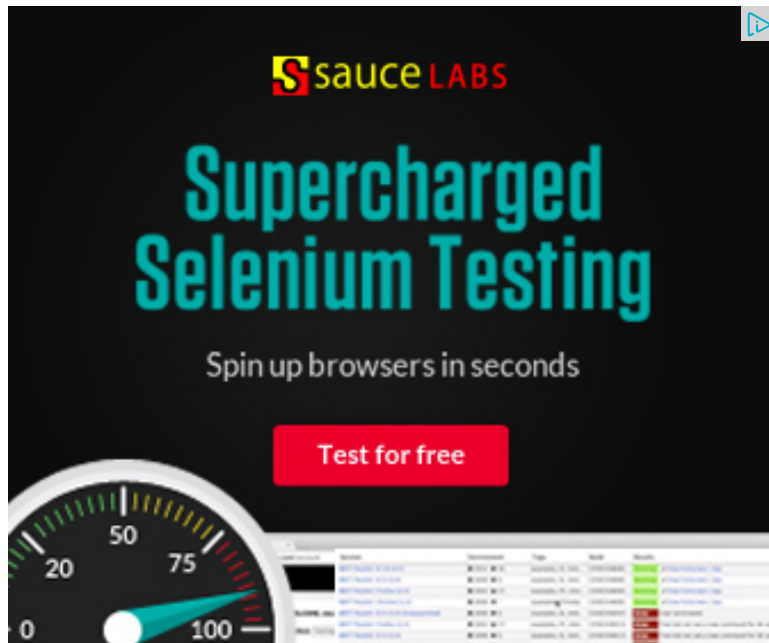
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interpreting the result in 2's complement form yields numerical value as $(2^{32} - 15)$. If applying '-' on the result leaves 3. Same analogy holds for decrement. See [this](#) comment for implementation of decrement.

Note that this method works only if the numbers are stored in 2's complement form.

Thanks to [Venki](#) for suggesting this method.

Please write comments if you find the above code/algorithm incorrect, or find better ways to solve the same problem



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