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# Bit Masking Cheat Sheet

By [hackmykaam](#) in PROGRAMMING CONCEPTS ⓘ

Bit Masking or Bit Manipulation is commonly used for various competitive programming questions, like, finding Unique number in an array of integers where each element occur twice or thrice, and we have print the unique number which appears only once.

There exists many other problems too, which can be easily solved by bit masking or bit manipulation.

Bit Manipulation basically means, we play with the inputs, or numbers bitwise.

We all know, a number can be represented in Binary format, where each bit is either 0 or 1, like, "2" can be represented as "10", or "22" can be represented as "10110".

We are going to discuss here, about the basic bits manipulations, We will discuss some more bit manipulations in further articles.

1. Getting a bit of a number
2. Setting a bit of a number
3. Clearing a bit of a number

Lets start with **getting "i"th bit of a number**, Suppose the given number is 8, and we have to extract its 2nd bit.

Binary representation of "8" : 1000, 0th bit = 0, 1st bit = 0, 2nd bit = 0, 3rd bit = 1.

$N = 8, i = 2$

1000  
& 0100 <— (AND with this mask)  
———

0000 <— if this is "0" then "i"th bit is 0, if it is not zero, then "i"th bit is 1.  
———

result =  $(N \& \text{mask}) ? 1 : 0 = (N \& (1 << i)) ? 1 : 0$

How to get this mask? simply, left shift "1", "i" times, i.e.,  $1 << 2$  (i here is 2), we get, 100. Now, Do the AND operation of the number with mask. If the answer is non-zero then the ith bit is 1, else, ith bit 0.

**Setting "i"th bit of a number**

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The key to success is to focus our con  
mind on things we desire not things w

**Brian Tracy**

Suppose the given number is 11, and we have to set its 2nd bit.

$N = 11, i = 3$

11 in binary format : 1011, 0th bit = 1, 1st bit = 1, 2nd bit = 0, 3rd bit = 1.

```

  1011
| 0100  <--- (OR with this mask)
-----
  1111  <--- This is the result number after setting the "i"th bit.
-----

```

$result = (N | mask) = (N | (1 << i))$

How to get this mask? "1" left shift by "i", i.e.,  $1 << 2 = 100$ . Do the OR operation of the number with this mask will get you the answer.

### Clearing "i"th bit of a number

$N = 11, i = 1$

```

  1011
& 1101  <--- (AND with this mask)
-----
  1001
-----

```

Mask is a number with all "1" bits except the "i"th bit : 1101, We may notice here that it is NOT of "0010", How to get this second mask "0010"? Left shift "1" by "i".

$result = (N \& \sim(1 << i))$

```
1. #include <iostream>
2. using namespace std;
3. int gettingBit(int n, int i)
4. {
5.     return ((n & (1<<i)) ? 1 : 0);
6. }
7.
8. int settingBit(int n, int i)
9. {
10.    return (n | (1<<i));
11. }
12.
13. int clearingBit(int n, int i)
14. {
15.    return (n & ~(1<<i));
16. }
17.
18. int main()
19. {
20.    int n, i;
21.    cin>>n>>i;
22.    cout<<i<<"th bit in number : "<<n<<" is =
    "<<gettingBit(n,i);
23.    cout<<"\nNumber after setting "<<i<<"th bi
    t in number : "<<n<<" is = "<<settingBit(n,i);
24.    cout<<"\nNumber after clearing "<<i<<"th b
    it in number : "<<n<<" is = "<<clearingBit(n,
    i);
25.    return 0;
26. }
```

Success #stdin #stdout 0s 4372KB

 comments (0) stdin

22

4

 stdout

4th bit in number : 22 is = 1

Number after setting 4th bit in number : 22 is =

22

Number after clearing 4th bit in number : 22 is =

6

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