

Bitwise Operations

REVISION OF C++ LANGUAGE

OPERATORS

Operators in C

	Operator	Type
Unary operator	++, --	Unary operator
Binary operator	+, -, *, /, %	Arithmetic operator
	<, <=, >, >=, ==, !=	Relational operator
	&&, , !	Logical operator
	&, , <<, >>, ~, ^	Bitwise operator
	=, +=, -=, *=, /=, %=	Assignment operator
Ternary operator	?:	Ternary or conditional operator

BITWISE OPERATORS

Operator	Operation	Description
&	bitwise and	$b1 \& b2$ is 1 if both $b1$ and $b2$ are 1; it is 0 otherwise
	bitwise or	$b1 b2$ is 1 if either $b1$ or $b2$ or both are 1; it is 0 otherwise
<<	Bit shift left	$x \ll y$ is the value obtained by shifting the bits in x y positions to the left
>>	Bit shift right	$x \gg y$ is the value obtained by shifting the bits in x y positions to the right
~	bitwise negation	$\sim b$ is 0 if b is 1; $\sim b$ is 1 if b is 0
^	bitwise exclusive or	$b1 \wedge b2$ is 1 if exactly one of $b1$ or $b2$ is 1; it is 0 otherwise

```
int i = 6; // 0110
cout << (i | 5) << endl; // 0110 OR 0101 = 0111 = 7
cout << (i & 5) << endl; // 0110 AND 0101 = 0100 = 4
cout << (i ^ 5) << endl; // 0110 XOR 0101 = 0011 = 3
cout << (i << 1) << endl; // 0110 LS 1 = 1100 = 12
cout << (i >> 1) << endl; // 0110 RS 1 = 0011 = 3
cout << (~i) << endl; // NEG 0110 = -7
```

EXAMPLES

```
#include <iostream>
using namespace std;
int main()
{
    int num1 = 6;
    int num2 = 5;
    int result = num1 & num2;
    int result2 = num1 | num2;
    int result3 = num1 ^ num2;
    int result4 = num1 << 1;
    int result5 = num1 >> 1;
    int result6 = ~ num1;
    cout << "the result for AND is " << result << endl;
    cout << "the result for OR is " << result2 << endl;
    cout << "the result for XOR is " << result3 << endl;
    cout << "the result for shift left is " << result4 << endl;
    cout << "the result for shift right is " << result5 << endl;
    cout << "the result for not is " << result6 << endl;
    system("pause");
    return 0;
}
```

```
the result for AND is 4
the result for OR is 7
the result for XOR is 3
the result for shift left is 12
the result for shift right is 3
the result for not is -7
Press any key to continue . . .
```

EXAMPLES

Q2: Write a program to check two numbers that are equal or not using bitwise operations

EXAMPLES

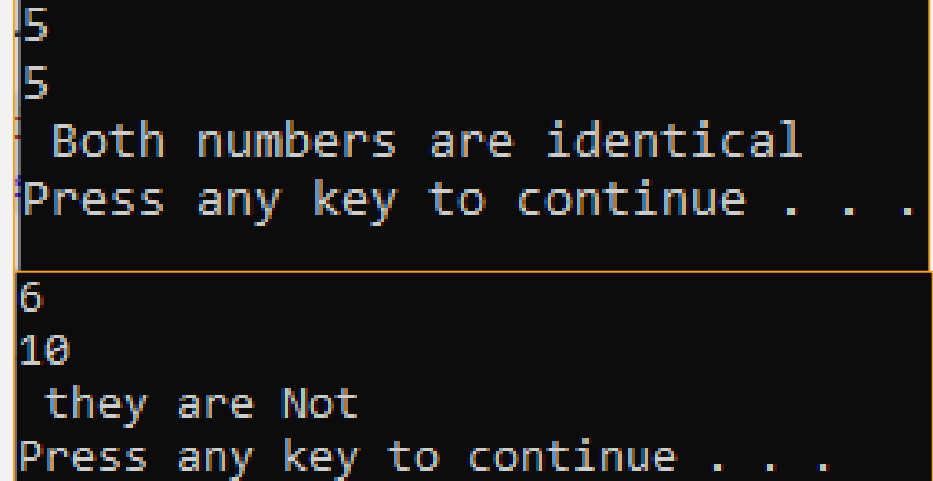
Q2: Write a program to check two numbers that are equal or not using bitwise operations

```
#include <iostream>
using namespace std;

void main()
{

int a;
int b;
cin>> a >> b;

if ((a ^ b)==0)
cout << " Both numbers are identical " << endl;
else
cout << " they are Not " << endl;
system("pause");
}
```



```
5
5
Both numbers are identical
Press any key to continue . . .

6
10
they are Not
Press any key to continue . . .
```

EXAMPLES

Q3: Write a program to change from lowercase to uppercase and vise versa

```
A 1000001 65  
a 1100001 97  
  
B 1000010 66  
b 1100010 98  
  
C 1000011 67  
c 1100011 99
```

EXAMPLES

Q3: Write a program to change from lowercase to uppercase and vice versa

```
#include <iostream>
using namespace std;
char lowerToUpper(char c)
{
    return (c & '_'); // → Underscore, can be written its equivalent value 95 or 0x5f
}
char upperToLower(char c)
{
    return (c | ' '); // → Space can be written its equivalent value 32 or 0x20
}
int main() {
    char c;
    cout << "Enter Character ( in lower case ) : \n";
    cin >> c;
    cout << "Output : " << lowerToUpper(c);
    cout << "\n\nEnter Character ( in Upper case ) : \n";
    cin >> c;
    cout << "Output : " << upperToLower(c) << endl;
    system("pause");
}
```

A	1000001	65
a	1100001	97
B	1000010	66
b	1100010	98
C	1000011	67
c	1100011	99

The binary form of ‘_’ (underscore) is 1011111 and ASCII code is 95d.

The binary form of space (‘ ’) is 0100000 and ASCII code is 32d, so space is equivalent to (1 << 5).

EXAMPLES

Q4: Write a program to check whether the number is even or odd using bitwise

```
#include<iostream>
using namespace std;

int main()
{
    int num;

    cout<<"ENTER THE NUMBER TO BE CHECKED:\n";

    cin>>num;

    if((num & 1)== 0 )           // Using Bitwise AND (&) operator
    {
        cout<<"NUMBER IS EVEN" << endl;}
    else {
        cout<<"NUMBER IS ODD" << endl; }

    system("pause");
    return 0;}
```

A	B	C	D
0	0	0	0
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	0	1	1
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1

THANK YOU

QUIZZES

Q1: Tracing the following program written in C++ and write its output.

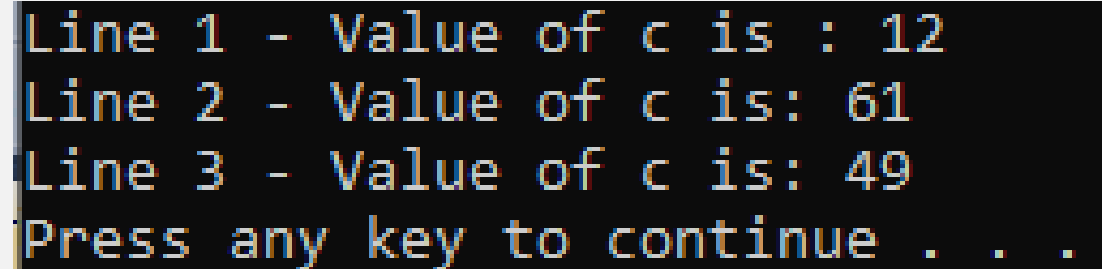
```
#include <iostream>
using namespace std;

int main() {
    unsigned int a = 60;
    unsigned int b = 13;
    int c = 0;

    c = a & b;
    cout << "Line 1 - Value of c is :" << c << endl ;

    c = a | b;
    cout << "Line 2 - Value of c is:" << c << endl;

    c = a ^ b;
    cout << "Line 3 - Value of c is:" << c << endl;
    system ("pause");
    return 0;
}
```



```
Line 1 - Value of c is : 12
Line 2 - Value of c is: 61
Line 3 - Value of c is: 49
Press any key to continue . . .
```

QUIZZES

Q2: Tracing the following program written in C++ and write its output.

```
#include <iostream>
using namespace std;
```

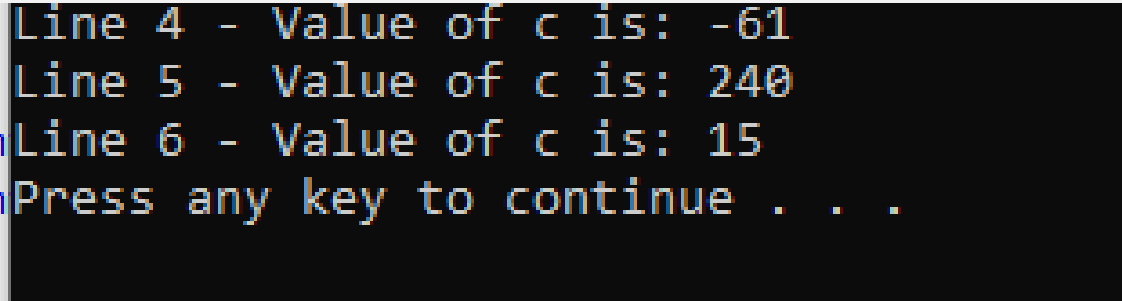
```
int main() {
    unsigned int a = 60;
    unsigned int b = 13;
    int c = 0;

    c = ~a;
    cout << "Line 4 - Value of c is: " << c << endl;

    c = a << 2;
    cout << "Line 5 - Value of c is: " << c << endl;

    c = a >> 2;
    cout << "Line 6 - Value of c is: " << c << endl;

    return 0;
}
```

A screenshot of a terminal window showing the output of the C++ program. The text is displayed in a monospaced font with a color scheme where keywords like 'Line' are blue, 'Value of c is:' is red, and the values are green. The output consists of four lines: 'Line 4 - Value of c is: -61', 'Line 5 - Value of c is: 240', 'Line 6 - Value of c is: 15', and 'Press any key to continue . . .'.

```
Line 4 - Value of c is: -61
Line 5 - Value of c is: 240
Line 6 - Value of c is: 15
Press any key to continue . . .
```

QUIZZES

Q3: Tracing the following program written in C++ and write its output.

```
#include <iostream>

using namespace std;

int main() {
    int x = 30;
    int a = 0;
    for (int i=0; i<=3; i++){
        cout<< "i= "<< i<< endl;
        cout<< " a= " << (a=x>>i)<< endl;
    }
    system("pause");
    return 0;
}
```

```
i= 0
a= 30
i= 1
a= 15
i= 2
a= 7
i= 3
a= 3
Press any key to continue . . .
```

QUIZZES

Q4: Tracing the following program written in C++ and write its output.

```
#include <iostream>
```

```
using namespace std;
```

```
int main() {  
    int x = 15;  
    for (int i=0; i<=3; i++){  
        cout<< "i= "<< i<< endl;  
        cout<< " x= " << (x<<i)<< endl;  
    }  
    system("pause");  
    return 0;  
}
```

```
i= 0  
x= 15  
i= 1  
x= 30  
i= 2  
x= 60  
i= 3  
x= 120  
Press any key to continue . . .
```

THANK YOU