National University of Computer & Emerging Sciences (NUCES) Islamabad,

Department of Computer Science

Programming Fundamentals– FALL 2023

LAB 05

Bitwise operator and conditional control

Bitwise Operators

Bitwise AND

A	B	A&B
0	0	0
0	1	0
0	1	0
1	1	1

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

int main()
{
int a=5; //101
int b=3; //011
cout<<"The bitwise AND of "<<a<<" and "<<b<<" is: "<<(a&b)<<endl;
return 0;
}
```

```
The bitwise AND of 5 and 3 is: 1
```

Bitwise OR

A	B	A|B
0	0	0
0	1	1
0	1	0
1	1	1

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

int main()
{
int a=5; //101
int b=3; //011
cout<<"The bitwise OR of "<<a<<" and "<<b<<" is: "<<(a|b)<<endl;
return 0;
}
```

```
The bitwise OR of 5 and 3 is: 7
```

Bitwise XOR

A	B	A^B
0	0	0
0	1	1
0	1	1
1	1	0

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

int main()
{
int a=5; //101
int b=3; //011
cout<<"The bitwise XOR of "<<a<<" and "<<b<<" is: "<<(a^b)<<endl;
return 0;
}
```

```
The bitwise XOR of 5 and 3 is: 6
```

Bitwise Complement

A	~A
0	1
1	0

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

int main()
{
int a=5; //101
cout<<"The bitwise Complement of "<<a<<" is: "<<(~a)<<endl;
return 0;
}
```

```
The bitwise Complement of 5 is: -6
```

Bitwise LeftShift

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

int main()
{
int a=1; //0001
cout<<" "<<a<<" after left shift 2 is: "<<(a<<2)<<endl;
return 0;
}
```

```
1 after left shift 2 is: 4
```

Bitwise RightShift

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

int main()
{
int a=9; //1001
cout<<" "<<a<<" after right shift 3 is: "<<(a>>3)<<endl;
return 0;
}
```

```
9 after right shift 3 is: 1
```

Submission Instructions:

1. Create a single cpp file containing all the functions of the problems and main function.
2. Save the **cpp** file with the roll no and task number
   e.g. i230001_Q1.cpp
3. Now create a new folder with *ROLLNO_LAB01_SEC* **e.g. i23XXXX_LAB05_A**
4. You need to display your roll no and name before the output of each question.
5. Now you have to submit this zipped file on Google Classroom.
6. If you don't follow the above-mentioned submission instructions, you will be marked **zero.**
7. Plagiarism in the Lab Task will result in **zero** marks in the whole category.

Lab Tasks

Problem 01

Write a program that inputs a number n from user and calculates 3n using bitwise operators.

```
Enter a number: 4
3 * 4 = 12
```

Problem 02

Write a program that takes a number from user and calculates the remainder of that number with 8 using bitwise operators.

```
Enter a number: 10
10 % 8 = 2
```

Problem 03

Write a program that swaps two numbers without using an extra variable.

```
Enter two numbers:
Number 1: 7
Number 2: 11
Before swapping: num1 = 7, num2 = 11
After swapping: num1 = 11, num2 = 7
```

Problem 04

Write a program use bitwise operators to find the maximum and minimum of two integers

```
Enter two integers: 14
10
Maximum: 14
Minimum: 10
```

Problem 05

Write a program that clears all bits in a specified range (from bit position m to bit position n) to 0 in an integer.

```
Enter an integer: 15
Enter the starting bit position (m): 1
Enter the ending bit position (n): 2
Result after clearing bits in range: 9
```

Problem 06

Implement a function that swaps adjacent bits in an integer (e.g., 10101010 becomes 01010101).

For example

```
Enter an integer: 10
After swapping adjacent bits: 5
```

```
Enter an integer: 19
After swapping adjacent bits: 35
```