Guide to Exercise 8: Bitwise Operations

> For Q1, 2, & 3, refer to Pg 149 – 150 of the module notes. Take note of the characteristics of the Bitwise OR, Bitwise AND and Bitwise XOR operators.

1. The bits in the result of an expression using the _____ operator are set to 1 if at least one of the corresponding bits in either operand is set to 1. Otherwise, the bits are set to zero.

2. The bits in the result of an expression using the _____ operator are set to 1 if the corresponding bits in each operand are set to 1. Otherwise, the bits are set to zero.

3. The bits in the result of an expression using the _____ operator are set to 1 if exactly one of the corresponding bits in either operand is set to 1. Otherwise, the bits are set to zero.

> Refer to Pg **153** of the module notes.

4. The bitwise AND operator, & is often used to _____ the value of a selected bit in data. For example, if ((data & 0b0000 0100) == 0) { /*do something*/ }.

> Refer to Pg 155 of the module notes.

5. The ____ and ____ operators are used to shift the bits of a value to the left or to the right, respectively.

6. Determine and verify the results of the following hexadecimal values:

   > Convert the hexadecimal numbers to binary. Then, do a bit-by-bit AND / OR operations. For example:
   >
   > ```
   >       0  0  1  1
   >    &  0  1  0  1
   >    ───────────────
   >       0  0  0  1
   > ```

   a. 3 & 5 =

   b. E & E =

   c. F & 7 =

   d. 3 | 5 =

   e. E | E =

7. Determine and verify the results of the following operations:

   a. 0x1234 << 3 =

   > Convert the hexadecimal numbers to binary. Then, do a shift left or shift right operations: For example:
   >
   > 0x12 << 3
   > =0b0001 0010 << 3
   > =0b1001 0000
   > = 0x90

   b. 0x1234 >> 2 =

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8. Write a program that will perform Shift Left or Shift Right operation depending on the choice entered by the user. If the choice is 1, shift left is performed or 2, which will shift right. The user will then enter the value and the number of time to be shifted. The result will be displayed on the screen.

A sample run is as follows:

Choice:
1. **Shift Left**
2. **Shift Right**

Enter choice: 1
Enter value: 8
Enter times: 2

The value 8 shifted 2 times is 32

You can refer to chapter 4 (Ex 4) to see how you can write a menu driven program.

Assume that the names of variables you used are choice, num, times and ans. Your program will be something like this:

```
switch(choice)
{
        case 1:
                ans = num << times;
                break;
......
}
```

Skeleton of the code:

```
1    #include <iostream>
2
3    using namespace std;
4
5    int main()
6    {
7        int num, choice, times, ans; /* Choose appropriate variable names*/
8        cout <<"_____";/* User needs to know what are the choices*/
9        cout <<"_____";
10       cout <<"_____";
11       cout <<"_____";/*Prompt for choice*/
12       cin >> _____
13       cout <<"_____";/*Prompt for the value*/
14       cin >> _____;
15       cout << "_____";/*Prompt for the number of places for shifting*/
16       cin >> _____;
17       switch(____) /*Shifting to left or right depends on this variable*/
18       {
19           case ___: _____; /* Use the shift operator to get the answer*/
20           break;
21           case ___: _____; /* Use the shift operator to get the answer*/
22           break;
23       }
24       if (_____)/*Output the value only when the user has keyed in correctly the choices*/
25           cout << "\nThe value " << num << " shifted " << times << " times is " << ans << endl;
26       return 0;
27    }
28
```