



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

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Instructions:

A) Save your lab.doc as LAB_no_RollNo.doc. At the end of lab you need to submit your all programs along with the output.
-- LAB_No_Roll_No_2hr.doc for lab task executed during the lab
-- LAB_No_Roll_No_complete.doc for Full solution of the Lab assignment (It should contain all lab assignment/problems)
B) Use/paste the snapshot of the steps followed along with result/s.
C) Mention your observation/comment after results in the doc.
D) Along with the doc/pdf file you need to upload your c program files with following nomenclature.
-- LAB_No_Prob_No.c

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Objective(s):

- To be familiar with different Operators and Expressions in C.

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PART A : Conceptual Questions

1. Write a C program to prompt the user to input 2 integer values and perform the different bitwise operators : Bitwise AND, Bitwise OR, Bitwise XOR, Bitwise complement (+2's Complement), Right shift operator and Left shift operator.

Problem Analysis:

The problem is to create a C program that prompts the user to input two integer values and then performs various bitwise operators on these values. The program should perform the following operations:

1. Bitwise AND
2. Bitwise OR
3. Bitwise XOR
4. Bitwise complement (2's Complement)
5. Right shift operator
6. Left shift operator

To achieve this, the program needs to take two integer inputs from the user, perform the specified bitwise operations, and display the results.



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

Code

```
#include <stdio.h>

int main(){
    int num1, num2;

    // Prompt the user to enter two numbers
    printf("Enter two numbers :\n");
    scanf("%d %d",&num1,&num2);

    // Perform Bitwise AND operation on num1 and num2 and display the result
    printf("\n\nPerforming Bitwise AND function on num1(%d) and num2(%d) \n%d",num1,num2,num1&num2);

    // Perform Bitwise OR operation on num1 and num2 and display the result
    printf("\n\nPerforming Bitwise Or function on num1(%d) and num2(%d) \n%d",num1,num2,num1|num2);

    // Perform Bitwise XOR operation on num1 and num2 and display the result
    printf("\n\nPerforming Bitwise XOR function on num1(%d) and num2(%d) \n%d",num1,num2,num1^num2);

    // Perform Bitwise complement operation on num1 and num2 and display the result
    printf("\n\nPerforming Bitwise complement function on num1(%d) - %d and num2(%d) - %d",num1,~num1,num2,~num2);

    // Perform Shift right operation on num1 and num2 and display the result
    printf("\n\nPerforming Shift right function on num1(%d) - %d and num2(%d) - %d ", num1,(num1>>1),num2,(num2>>1));

    // Perform Shift Left operation on num1 and num2 and display the result
    printf("\n\nPerforming Shift Left function on num1(%d) - %d and num2(%d) - %d\n\n", num1,(num1<<1),num2,(num2<<1));

    return 0;
}
```

Output

```
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ gcc lab4_231210036_Q1.c
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ ./a.out
Enter two numbers :
1
2

Performing Bitwise AND function on num1(1) and num2(2)
0

Performing Bitwise Or function on num1(1) and num2(2)
3

Performing Bitwise XOR function on num1(1) and num2(2)
3

Performing Bitwise complement function on num1(1) - -2 and num2(2) - -3

Performing Shift right function on num1(1) - 0 and num2(2) - 1

Performing Shift Left function on num1(1) - 2 and num2(2) - 4
```

Discussion and Conclusion:

This C program is designed to demonstrate the usage of various bitwise operators in programming. It prompts the user to input two integer values and then performs the specified bitwise operations on these values. Here's a brief discussion of each operation:

1. **Bitwise AND:** This operation performs a bitwise AND between the two input values. It sets each bit in the result to 1 if the corresponding bits in both operands are 1; otherwise, it sets the bit to 0.
2. **Bitwise OR:** This operation performs a bitwise OR between the two input values. It sets each bit in the result to 1 if either of the corresponding bits in the operands is 1.
3. **Bitwise XOR:** This operation performs a bitwise XOR (exclusive OR) between the two input values. It sets each bit in the result to 1 if the corresponding bits in the operands are different (one is 0 and the other is 1).
4. **Bitwise complement (2's Complement):** This operation calculates the 2's complement



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

of the first input value. It inverts all the bits in the binary representation of the input value and adds 1 to the result.

5. **Right shift operator:** This operation performs a right shift of the first input value by the number of positions specified by the second input value. It shifts the bits to the right and fills the vacant positions with zeros.
6. **Left shift operator:** This operation performs a left shift of the first input value by the number of positions specified by the second input value. It shifts the bits to the left and fills the vacant positions with zeros.



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

2. Write a program to read a character in upper case and then print it in lower case.

Problem Analysis:

The problem is to create a program that takes as input a character in uppercase and then prints the corresponding lowercase character.

Code

```
#include <stdio.h>

int main(){
    char letter;

    // Prompt the user to enter a character
    printf("Enter a Character: ");
    letter = getchar();

    // Convert the character to lowercase and display it
    // ASCII value of 'A' is 65, and 'a' is 97. To convert to lowercase, add 32.
    printf("Lower Case : %c \n\n", letter + 32);

    return 0;
}
```

Output

```
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ gcc lab4_231210036_Q2.c
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ ./a.out
Enter a Character: A
Lower Case : a
```

Discussion and Conclusion

The problem is solved easily with the knowledge of ASCII values of the characters. "A" has ASCII value 65 and "a" has ASCII value 97. So, there is a difference of 32 in the ASCII values of the characters and hence each character can be made lowercase by simply adding 32 to eachone's char value.



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

3. Take input as days, convert and display an equivalent number of months and days.
Assumption one month has 30 day.

Problem Analysis:

The problem is to create a program that takes a user input representing a number of days and converts it into an equivalent number of months and days, assuming that one month has 30 days.

Code

```
#include <stdio.h>

int main(){
    int month, days;

    // Prompt the user to enter the number of days
    printf("Enter number of days: ");
    scanf("%d", &days);

    // Calculate the number of months and remaining days
    month = days / 30; // Assuming a month has 30 days
    days = days % 30; // Calculate the remaining days

    // Display the number of months and remaining days
    printf("Number of Month(s) is %d and number of Days is %d\n\n", month, days);

    return 0;
}
```

Output

```
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ gcc lab4_231210036_Q3.c
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ ./a.out
Enter number of days: 545
Number of Month(s) is 18 and number of Days is 5
```

Discussion and Conclusion:

This program is designed to convert days into months and days based on the assumption that a month has 30 days. So Month can be calculated by integer dividing the number of days by 30 and the number of days now is the modulus of days by 30.



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

4. Print the value of y for given x=2 & z=4 and analyze the output.

- a) $y = x < z ? z : x$
- b) $y = x++ + ++x$;
- c) $y = ++x + ++x$;
- d) $y = ++x + ++x + ++x$;
- e) $y = x > z$;
- f) $y = x | z$;
- g) $y = x >> 2 + z << 1$;

```
#include <stdio.h>

int main(){
    int x=2,z=4,y;

    y=x<z ? z:x;
    printf("\n%d\n",y);
    //x is less than z so expression 1 (z) is printed ->4

    x=2;
    z=4;
    y= x++ + ++x;
    printf("%d\n",y);
    // x(2) is added then incremented to 3 and then x is first incremented to 4 and then added => 2+4=6

    x=2;
    z=4;
    y = ++x + ++x;
    printf("%d\n",y);
    //++ takes precedence over + operator and hence x is incremented twice to 4 so 4+4=8 is printed

    x=2;
    z=4;
    y = ++x + ++x + ++x;
    printf("%d\n",y);
    // ++ takes precedence over + and its associativity is right to left so the statement can be written as ++x + ( ++x + ++x) = ++x +(4+4)=5+4+4=13

    x=2;
    z=4;
    y = x>z;
    printf("%d\n",y);
    //x is not greater than 4, hence x>z is false so 0

    x=2;
    z=4;
    y = x|z;
    printf("%d\n",y);
    //2=010 and 4=100 so bitwise or results in 110 = 6

    x=2;
    z=4;
    y=x>>2+z<<1;
    printf("%d\n",y);
    //+ operator precedes >> and hence x>>2+z<<1 is computed as x>>6<<1 then 0<<1=0

    return 0;
}
```

Activation of network connection failed



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LAB 4: Operators and Expressions in C

Output:

```
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ vi lab4_231210036_Q4.c
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ gcc lab4_231210036_Q4.c
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ ./a.out
4
6
8
13
0
6
0
```



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

5. Write a program to take input of Rollno, Name, Phone no and Marks obtained by a student in lab course CSB101 in 5 Labs each have its 10 full marks and display the name, rollno with percentage score secured. Your solution should contain following information as discussed in Lab 2 :

Problem Analysis:

The problem is to create a program that takes input for a student's roll number, name, phone number, and marks obtained in five lab courses (each out of 10 marks) and then displays the student's name, roll number, and percentage score secured.

Algorithm:

1. Start
2. Input student's roll number, name, and phone number.
3. Input 5 variables mark1 to mark5.
4. Calculate percentage as $(\text{mark1} + \text{mark2} + \text{mark3} + \text{mark4} + \text{mark5} / 50) * 100$ (since there are five labs, each out of 10 marks).
5. Display the student's name, roll number, and percentage score.
6. Stop

Flowchart:



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

```
#include <stdio.h>

int main() {
    // Declare variables to store student information
    int roll, sub1, sub2, sub3, sub4, sub5;
    long int phone;
    char name[20];

    // Prompt the user to enter their name
    printf("Enter your name:\n");

    // Read the name from the user, %[^\n]s is used to read a whole line including spaces
    scanf("%[^\n]s", name);

    // Prompt the user to enter their Roll No
    printf("Enter your Roll No:\n");

    // Read the Roll No from the user
    scanf("%d", &roll);

    // Prompt the user to enter their Phone No
    printf("Enter your Phone No\n");

    // Read the Phone No from the user
    scanf("%ld", &phone);

    // Prompt the user to enter their marks in five subjects
    printf("Enter your Marks in Subject 1\n");
    scanf("%d", &sub1);

    printf("Enter your Marks in Subject 2\n");
    scanf("%d", &sub2);

    printf("Enter your Marks in Subject 3\n");
    scanf("%d", &sub3);

    printf("Enter your Marks in Subject 4\n");
    scanf("%d", &sub4);

    printf("Enter your Marks in Subject 5\n");
    scanf("%d", &sub5);

    // Calculate the percentage by averaging the marks in subjects
    float percentage = (sub1 + sub2 + sub3 + sub4 + sub5) * 10.0 / 5.0;

    // Display the student's information, including name, Roll No, Phone No, and percentage
    printf("\n\nName: %s , Roll No.: %d , Phone No.: %ld , Percentage: %.2f%\n\n", name, roll, phone, percentage);

    return 0;
}
```

Code:

Output (Compilation, Debugging and Testing):

```
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ ./a.out
Enter your name:
Daksh Verma
Enter your Roll No:
231210036
Enter your Phone No
7042823625
Enter your Marks in Subject 1
6
Enter your Marks in Subject 2
8
Enter your Marks in Subject 3
7
Enter your Marks in Subject 4
5
Enter your Marks in Subject 5
9

Name: Daksh Verma , Roll No.: 231210036 , Phone No.: 7042823625 , Percentage: 70.00%
```

Discussion and Conclusion:

This program efficiently takes input for a student's roll number, name, phone number, and lab marks, calculates the percentage score, and displays the student's information along with their percentage. It's a practical example of data input, calculation, and output in C programming and can be used for various similar scenarios in educational institutions.

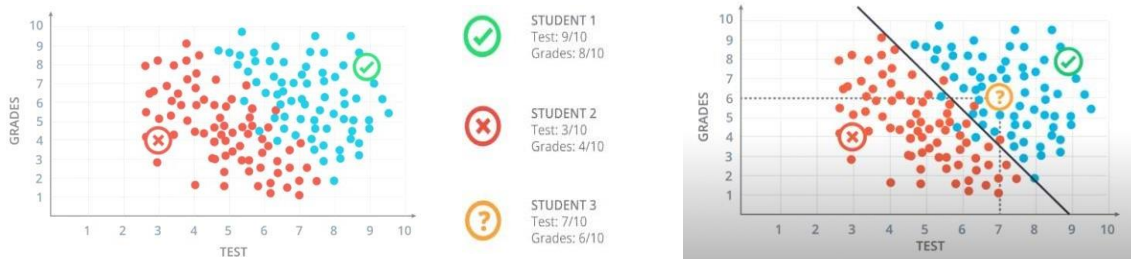


CSB101: Problem Solving and Computer Programming

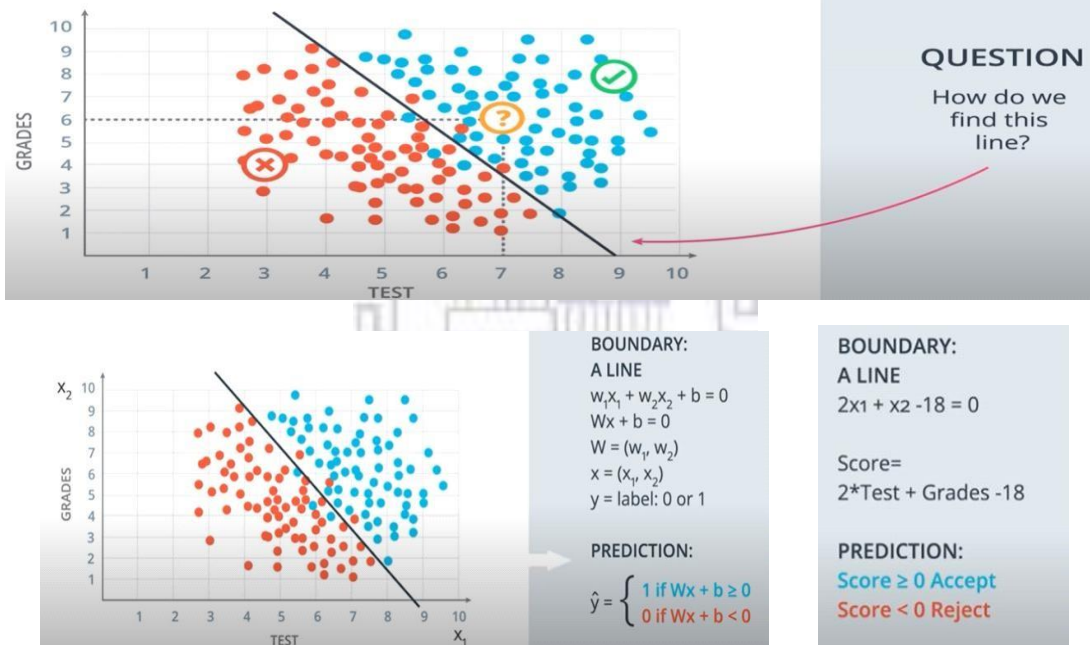
LAB 4: Operators and Expressions in C

PART B : Exploratory Problem : Admission in NIT at UG level:

6. Let us say that student can get admission in NIT based on the JEE- Main marks and class 12 grades.



Does the student get accepted?



Write a c program to find the chances of student acceptance in NIT at UG level.

How many variables are there considered while giving students admission to NITs and IITs respectively. Let us assume that the equation for the score\decision line is $(2w_1 + w_2 - 18=0)$. Also shown in the above figure. What is the score of a student Mohit, who got 7/10 in the JEE test and grades as 6/10?



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

- Based on the above figure equations, Predict will Mohit be accepted or reject for admission in NIT.

Accepted

Code

```
#include <stdio.h>

int main() {
    // Declare variables to store JEE Main score and grade
    int jee, grade;

    // Prompt the user to enter their JEE Main score
    printf("Enter JEE Main score (test):\n");
    scanf("%d", &jee);

    // Prompt the user to enter their grade
    printf("\nEnter your Grade:\n");
    scanf("%d", &grade);

    // Calculate the admission eligibility based on the given condition
    if (2 * jee + grade - 18 >= 0) {
        // If the condition is met, printing a congratulatory message
        printf("\nCongratulations, You have secured admission into NIT Delhi\n\n");
    }
    else {
        // If the condition is not met, printing a message indicating that admission was not secured
        printf("\nUnfortunately, you haven't secured admission into NIT Delhi\n\n");
    }

    return 0;
}
```

Output

```
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ gcc lab4_231210036_Q6.c
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ ./a.out
Enter JEE Main score (test):
7

Enter your Grade:
6

Congratulations, You have secured admission into NIT Delhi
```



CSB101: Problem Solving and Computer Programming

LAB 4: Operators and Expressions in C

- Suppose w1 was 1.5 instead of 2. Would the student who got 7 on the JEE test and 6 on the grades be accepted or rejected?

Rejected

Code:

```
#include <stdio.h>

int main() {
    // Declare variables to store JEE Main score and grade
    int jee, grade;

    // Prompt the user to enter their JEE Main score
    printf("Enter JEE Main score (test):\n");
    scanf("%d", &jee);

    // Prompt the user to enter their grade
    printf("\nEnter your Grade:\n");
    scanf("%d", &grade);

    // Calculate the admission eligibility based on the given condition
    if (1.5 * jee + grade - 18 >= 0) {
        // If the condition is met, printing a congratulatory message
        printf("\nCongratulations, You have secured admission into NIT Delhi\n\n");
    }
    else {
        // If the condition is not met, printing a message indicating that admission was not secured
        printf("\nUnfortunately, you haven't secured admission into NIT Delhi\n\n");
    }

    return 0;
}
```

Output:

```
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ gcc lab4_231210036_Q6.c
dakshverma@nitdelhi-HP-Compaq-Elite-8300-SFF:~/Desktop/Lab/Lab 4$ ./a.out
Enter JEE Main score (test):
7

Enter your Grade:
6

Unfortunately, you haven't secured admission into NIT Delhi
```

Observation /Comments:

The provided prompts encompass diverse programming tasks and concepts, addressing admission processes, character manipulation, data processing, bitwise operations, and date calculations. They offer practical scenarios for learning and practicing C programming skills, each with unique challenges and applications.