

EE101 C programming and SW engineering 1

Lab Practice 4 – Operations and Branching

Use your preferred compiler to investigate the programming exercises below. This laboratory concerns the use of relational and logical operators together with branching flow control statements **if/else** and **switch**.

Logical Operators

Here is a table of the common logical operators you have learned about in your lectures.

Value of exp1	Value of exp2	exp1&&exp2 (AND)	exp1 exp2 (OR)	!exp1 (NOT)
0	0	0	0	1
0	non-zero	0	1	1
non-zero	0	0	1	0
non-zero	non-zero	1	1	0

Exercise 1

Give equivalent expressions for the following logical expressions without negation

!(a>b)	!(a<=b&& c<=d)	!(a+1==b+1)	!(a<1 b<2&&c<3)

Example

!(a<5 || a>10) is equivalent to a>=5 && a<=10

Hint: Apply operator precedence rules given during lectures.

Exercise 2

For the following declarations complete the table by correctly parenthesizing the expression and then finding the value:

int a=1, b=2,c=3;

double x=1.0;

Expression	Parenthesize () Expression	Value
a>b && c<b		
a<!b !!a		
a+b<!c+c		
a-x b*c && b/a		

Write a C program to print the values on the screen to see if your answers are correct.

Exercise 3

What gets printed by the following program?

```
char c='A';
int i=5, j=10;
printf("%d\t%d\t%d\n", !c, !!c, !!!c);
printf("%d\t%d\t%d\n", -!i, !-i, !-i-!j);
printf("%d\t%d\t%d\n", !(6*j+i-c), !i-5, !j-10);
```

Note: The ASCII code for 'A' is 65. Be careful about following the precedence rules!

Exercise 4

In each case below, construct a logic expression to express the following conditions and then write a program to test your expression:

- Determine if an int variable number is equal to or greater than 1 but smaller than 9.
- Determine if a char variable ch is not the value q or k.
- Determine if an int variable number is between 1 and 9 but is not 5.
- Determine if an int variable number is not between 1 and 9

Example:

number is 5 or 10

Solution

number ==5 || *number* ==10

The if, if-else and switch Statements

Exercise 5

What gets printed by the following programs? Do it on paper first and then using the computer.

Program 1

```
int i=7, j=2;
if(i==1)
    if(j==2)
        printf("%d\n", i=i+j);
        printf("%d\n", i=i-j);
        printf("%d\n", i);
```

Program 2

What gets printed when n=101 or n=10

```
#define LIMIT 100
main(){
    int n;
    printf ("Enter an integer: ");
    scanf ("%d", &n);
    switch (n){
        case LIMIT-1 :    printf ("slightly less"); break;
        case LIMIT   :    printf ("exact"); break;
        case LIMIT+1 :    printf ("slightly high"); break;
        default      :    printf ("too far"); break;
    }
}
```

Exercise 6

The mathematical operation $\min(x,y)$ can be represented by the conditional expression:

$z = (x < y) ? x : y;$

Or

```
if(x<y)
    z=x;
else
    z=y;
```

Write your own expression (in either format) to define the mathematical operation $\min(x,y,z)$.

Exercise 7

Write a program to take the depth (in kilometers) inside the earth as input data. The program should use this information to compute and display the temperature at this depth in degrees Celsius and degrees Fahrenheit. The relevant formulae are:

Celsius temperature at depth in km formula:

$$\text{Celsius} = 10 \times \text{depth} + 20$$

Celsius to Fahrenheit conversion formula:

$$\text{Fahrenheit} = 1.8 \times \text{Celsius} + 32$$

Exercise 8

Write a program that computes the square root of a given real number. The program should let its user know that negative numbers are not accepted. Its execution should look like the following:

Give a non negative number: 2

Its square root is 1.4142214

Give a non negative number: -1

This is a negative number; please provide a non negative one!

Hint: Include the `math.h` header file and use the function `sqrt()` to calculate the square root.