Department of Electrical and Computer Engineering
University of Massachusetts Dartmouth

ECE160: Foundations of Computer Engineering I (Spring 2023)
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# LAB # 4

**(Relevant Lecture: #8-#10)**

Monday, February 13 (L1) and Wednesday, February 15 (L2)

## OBJECTIVES

- To learn the C expressions
- To learn how to use the two-way selection statements

## SUBMISSION REQUIREMENT

1. Please follow "Submission Guidelines" in the lab section of the course website to submit your program files to the class M: drive **by 5pm, February 15**.
2. Suggested format for naming your solution files: lab#-your last name-p#.cpp
   For example: lab4-xing-p1.cpp for problem 1; lab4-xing-p2.cpp for problem 2; …

## EXERCISES

## Part I: C expressions (Lecture#8, 9)

1. **Write down the output of each printf() in the following program first.** Then check your results by compiling and running this program. Note that you need to identify and remove the statement that may cause a compilation error. **Do think about and understand the answers!!**

```
#include <stdio.h>

void main(void)
{
  int a=9;
  int b=8;
  float c=2.0;
  float d= 3.0;

  printf("%f\n", a/b+c/d);
  printf("%d\n", a%b+a);
  printf("%f\n", a%c+b);
  printf("%d\n", b%a*b);
  b=a++;
  printf("%d\n", b);
  printf("%d\n", a);
  printf("%d\n", --a);
  printf("%d\n", a);
}
```

2. **Write down the output of each printf() in the following program first.** Then check your results by compiling and running this program. **Do think about and understand the answers!!**

```
#include <stdio.h>

void main(void)
{
  int a=3;
  int b=4;
  int c=5;
  int d=0;
  float e=0;

  d=--a*(3+b)/2-c++*b;
  printf("The first d is %d\n", d);
  printf("The c is %d\n", c);

  d=++a*(4+c)/3-b*++c;
  printf("The second d is %d\n", d);

  d= (float) a/(c-3)*5-b*c;
  printf("The third d is %d\n", d);

  e=(float) (a/b)+b*c;
  printf("The first e is %f\n", e);

  e=(float) a/b+b*c;
  printf("The second e is %f\n", e);

  e=(float) a/b+b%++c;
  printf("The third e is %f\n", e);

}
```

3. Write a program to read Tom's grades for four courses from last semester from the keyboard using scanf_s(), compute his average GPA, and write/display the average GPA on the screen using printf().

   *Example Runs to Test your Program:*

   1) Input 3.7 4.0 3.3 3.7 from the keyboard, 3.675 or 3.675000 should be displayed as the average GPA on the screen.

   2) Input 3.0 3.3 3.3 2.7 from the keyboard, 3.075 or 3.075000 should be displayed as the average GPA on the screen.

## Part II: Logical Expressions and Two-Way Selection (Lecture#10)

4. To understand the three logical operators in C by running the following program and try the following inputs to see what happen and understand the output.
   - 3 7
   - 0 7
   - 0 0

```
#include <stdio.h>
 void main (void)
 {
    int a=0;
    int b=0;

    printf("Please input two integers a and b from the keyboard:\n");
    scanf_s("%d %d", &a, &b);
    printf("a AND b is: %d\n", a && b);
    printf("a OR b is: %d\n", a || b);
    printf("NOT a is: %d\n", !a);
    printf("NOT b is: %d\n", !b);
    if (a==b)
       printf("a==b\n");
    else
       printf("a!=b");
 }
```

5. Write a program to do the following things
   1) input an income (integer type) from the keyboard, then
   2) calculate the tax (floating point type) on the income, which is income * tax rate. The tax rate is determined based on the following assumptions:
      a. If income <1000, no tax (or tax rate is 0)
      b. If 1000 <= income <2000, tax rate = 25%
      c. If income >= 2000, tax rate = 30%
   3) finally display the tax for the income.

   *Example Runs to Test your Program:*

   1) Input income 737, the tax 0.000000 is displayed on the screen

   2) Input income 1600, the tax 400.000000 is displayed on the screen

   3) Input income 2000, the tax 600.000000 is displayed on the screen

   4) Input income 2070, the tax 621.000000 is displayed on the screen