

LAB # 4 Solution
(Relevant Lecture: #8-#10)

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 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);
}
```

Solution:

```
#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); → 1.666667
    printf("%d\n", a%b+a); → 10
    printf("%f\n", a%c+b); → compilation error (should be
removed before running the program)
    printf("%d\n", b%a*b); → 64
    b=a++; → /*a=10, b=9*/
    printf("%d\n", b); → 9
    printf("%d\n", a); → 10
    printf("%d\n", --a); → 9
    printf("%d\n", a); → 9
}
```

```
Microsoft Visual Studio Debug Console
1.666667
10
64
9
10
9
9
C:\Users\lxing\source\repos\Lab4-test\Debug\Lab4-test.exe (process 70004) exited with code 0.
Press any key to close this window . . .
```

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);

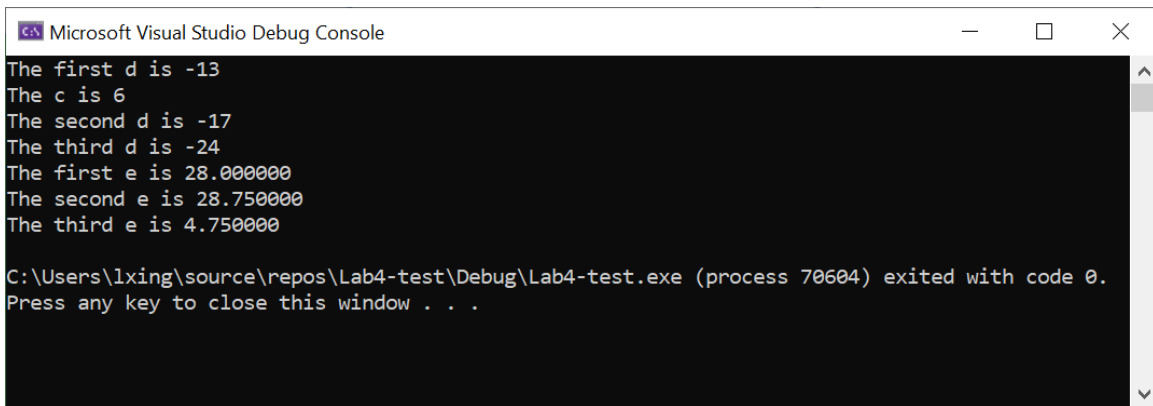
    e=(float) (a/b)+b*c;
    printf("The first e is %f\n", e);

    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);
}
```

Solution:

The first d is -13
The c is 6
The second d is -17
The third d is -24
The first e is 28.000000
The second e is 28.750000
The third e is 4.750000



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()`.

3.7 4.0 3.3 3.7

Solution (an example):

```
#include <stdio.h>
void main(void)
{
    float grade1=0;
    float grade2=0;
    float grade3=0;
    float grade4=0;
    float GPA=0;

    /*This line is used to remind user to input grades*/
    printf("Please input Tom 's 4 grades:\n");
    scanf_s("%f %f %f %f", &grade1, &grade2, &grade3, &grade4);
    GPA=(grade1+grade2+grade3+grade4)/4;
    printf("Tom 's GPA is: %f. ", GPA);
}
```

Testing Runs:

```
Microsoft Visual Studio Debug Console
Please input Tom's 4 grades:
3.7 4.0 3.3 3.7
Tom's GPA is: 3.675000.
C:\Users\lxing\source\repos\Lab4-test\Debug\Lab4-test.exe (process 61840) exited with code 0.
Press any key to close this window . . .
```

```
Microsoft Visual Studio Debug Console
Please input Tom's 4 grades:
3.0
3.3
3.3
2.7
Tom's GPA is: 3.075000.
C:\Users\lxing\source\repos\4tt\Debug\4tt.exe (process 8320) exited with code 0.
Press any key to close this window . . .
```

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

- 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");
}
```

Solution:

i) 3 7
 a AND b is 1
 a OR b is 1
 NOT a is 0
 NOT b is 0
 a!=b

```
Microsoft Visual Studio Debug Console
a AND b is: 1
a OR b is: 1
NOT a is: 0
NOT b is: 0
a!=b
C:\Users\lxing\source\repos\Lab4-test\Debug\Lab4-test.exe (process 69348) exited with code 0.
Press any key to close this window . . .
```

ii) 0 7
 a AND b is 0
 a OR b is 1
 NOT a is 1
 NOT b is 0
 a!=b

```
Microsoft Visual Studio Debug Console
Please input two integers a and b from the keyboard:
0 7
a AND b is: 0
a OR b is: 1
NOT a is: 1
NOT b is: 0
a!=b
C:\Users\lxing\source\repos\Lab4-test\Debug\Lab4-test.exe (process 59544) exited with code 0.
Press any key to close this window . . .
```

iii) 0 0
 a AND b is 0
 a OR b is 0
 NOT a is 1
 NOT b is 1
 a==b

```
Microsoft Visual Studio Debug Console
Please input two integers a and b from the keyboard:
0 0
a AND b is: 0
a OR b is: 0
NOT a is: 1
NOT b is: 1
a==b
C:\Users\lxing\source\repos\Lab4-test\Debug\Lab4-test.exe (process 70124) exited with code 0.
Press any key to close this window . . .
```

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 $\text{income} * \text{tax rate}$. The tax rate is determined based on the following assumptions:
 - a. If $\text{income} < 1000$, no tax (or tax rate is 0)
 - b. If $1000 \leq \text{income} < 2000$, tax rate = 25%
 - c. If $\text{income} \geq 2000$, tax rate = 30%
 - 3) finally display the tax for the income.

Example solution using the two-way selection:

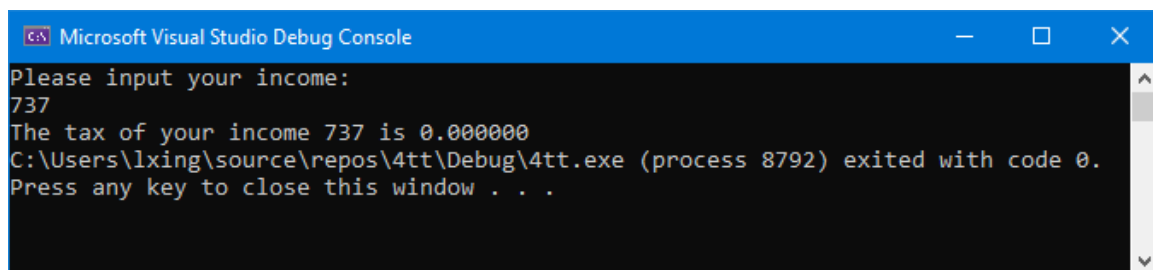
```
#include <stdio.h>
void main(void)
{
    int income=0;
    float tax=0;

    printf("Please input your income:\n");
    scanf_s("%d", &income);

    if (income < 1000)
        tax = 0;
    if ((income >=1000) && (income <2000))
        tax = income * 0.25;
    if (income >=2000)
        tax=income*0.3;

    printf("The tax of your income %d is %f", income, tax);
}
```

Testing Runs using 737, 1600, 2000, 2070:



```
Microsoft Visual Studio Debug Console
Please input your income:
737
The tax of your income 737 is 0.000000
C:\Users\lxing\source\repos\4tt\Debug\4tt.exe (process 8792) exited with code 0.
Press any key to close this window . . .
```

```
Microsoft Visual Studio Debug Console
Please input your income:
1600
The tax of your income 1600 is 400.000000
C:\Users\lxing\source\repos\4tt\Debug\4tt.exe (process 6140) exited with code 0.
Press any key to close this window . . .
```

```
Microsoft Visual Studio Debug Console
Please input your income:
2000
The tax of your income 2000 is 600.000000
C:\Users\lxing\source\repos\4tt\Debug\4tt.exe (process 16400) exited with code 0.
Press any key to close this window . . .
```

```
Microsoft Visual Studio Debug Console
Please input your income:
2070
The tax of your income 2070 is 621.000000
C:\Users\lxing\source\repos\4tt\Debug\4tt.exe (process 9360) exited with code 0.
Press any key to close this window . . .
```