Lab 1 – Fall 2021

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ENSF 337: Programming Fundamentals for Software and Computer

Lab Section: B04

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Date Submitted: September 23, 2021

Exercise 2 – Variable and Basic Arithmetic

Program to Perform Various Calculations:

```c
#include <stdio.h>
int main()
{
    double num1 = -34.5;
    double num2 = 98.7;

    double sum;          // sum of num1 and num2
    double sumSquared;       // the square of num2 plus num2

    // calculating sum
    sum = num1 + num2;
    // squaring sum
    sumSquared = sum * sum;
    printf( "The sum squared is: %f \n", sumSquared);
    // doubling sumsquared
    sumSquared = sumSquared * 2;
    printf( "The sum squared is now: %f \n",  sumSquared);
    return 0;
}
```

Output:

```
The sum squared is: 4121.640000
The sum squared is now: 8243.280000
```

Exercise C – Operator Precedence

```
double z = 0;

double x = 2.5;

double y = -1.5;

int m = 18;

int n = 4;
```

What are the values of z in the following expressions? Show your work.

a) `z = x + n * y - (x+n) * y;`

```
= 2.5 + 4 * (-1.5) - (2.5+4) * (-1.5)
= 2.5 + 4 * (-1.5) - (6.5) * (-1.5)
= 2.5 - 6.0 - (6.5) * (-1.5)
= 2.5 - 6.0 + 9.75
= 6.25
```

b) `z = m / n + m % n;`

```
= 18 / 4 + 18 % 4
= 4 + 18 % 4
= 4 + 2
= 6
```

c) `z = n / m + n % m;`

```
= 4 / 18 + 4 % 18
= 0 + 4 % 18
= 0 + 4
= 4
```

d) `z = 5 * x - n / 5;`

```
= 5 * 2.5 - 4 / 5
= 12.5 - 4 / 5
= 12.5 - 0
= 12.5
```

e) `z = 1-(1-(1-(1-(1-n))));`

```
= 1 - (1 - (1 - (1 - (1 - 4))))
= 1 - (1 - (1 - (1 - (- 3))))
= 1 - (1 - (1 - (4)))
= 1 - (1 - (-3))
= 1 - 4
= - 3
```

f) `z = sqrt(sqrt((double)n);`

```
= sqrt (sqrt((double)4)))
= sqrt (sqrt(4.0))
= sqrt (2.0)
= 1.4142135623730951
```

Exercise D - Mathematical Expressions

Program to Compute Sine of an Angle and Taylor Series Approximation:

```c
#include <stdio.h>
#include <math.h>

int main()
{
    double angle;
    double sinoutput;
    double taylorseries;

    printf("Enter the angle (in radians): ");
    scanf("%lf", &angle);

    sinoutput = sin(angle);
    printf("Sine of theta -> %f is %f radians \n", angle, sinoutput);

    taylorseries = angle - (pow(angle, 3))/(6) + (pow(angle,5))/(120) -
(pow(angle,7))/(5040);
    printf("Taylor Series approximation of sin(%f) up to the seventh order is
%f \n", angle, taylorseries);
    return 0;
}
```

Outputs:

```
Enter the angle (in radians): 0
Sine of theta -> 0.000000 is 0.000000 radians
Taylor Series approximation of sin(0.000000) up to the seventh order is 0.000000
```

```
Enter the angle (in radians): 0.5
Sine of theta -> 0.500000 is 0.479426 radians
Taylor Series approximation of sin(0.500000) up to the seventh order is 0.479426
```

```
Enter the angle (in radians): 2.5
Sine of theta -> 2.500000 is 0.598472 radians
Taylor Series approximation of sin(2.500000) up to the seventh order is 0.588534
```

```
Enter the angle (in radians): 1.0
Sine of theta -> 1.000000 is 0.841471 radians
Taylor Series approximation of sin(1.000000) up to the seventh order is 0.841468
```

Exercise E – Problem Solving

Program to Find the Roots of the Quadratic Equation:

```c
#include <stdio.h>
#include <math.h>

int main() {

    double a,b,c,determinant,root1,root2,rp,ip;
    printf("Enter a nonzero value for coefficient a: ");
    scanf("%lf",&a);
    printf("Enter a nonzero value for coefficient b: ");
    scanf("%lf",&b);
    printf("Enter a nonzero value for coefficient c: ");
    scanf("%lf",&c);

    determinant = pow(b,2)-(4*a*c);

     if (determinant>0) {
         root1 = (-b + sqrt(determinant))/(2*a);
         root2 = (-b - sqrt(determinant))/(2*a);
         printf("The roots are: root 1 = %lf and root 2 = %lf",root1,root2);
     }
     else if (determinant==0) {
         root1 = root2=-b/(2*a);
         printf("The root is root 1 = root 2 = %lf",root1);
     }
     else {
         rp = -b/(2*a);
         ip = sqrt(fabs(determinant))/(2*a);
         printf("The roots are: root 1 = %lf+i(%lf) and root 2 = %lf-
i(%lf)",rp,ip,rp,ip);
     }

    return 0;
}
```

Outputs:

```
Enter a nonzero value for coefficient a: 2
Enter a nonzero value for coefficient b: 4
Enter a nonzero value for coefficient c: -6
The roots are: root 1 = 1.000000 and root 2 = -3.000000
```

```
Enter a nonzero value for coefficient a: -4
Enter a nonzero value for coefficient b: 12
Enter a nonzero value for coefficient c: -9
The root is root 1 = root 2 = 1.500000
```

```
Enter a nonzero value for coefficient a: 1
Enter a nonzero value for coefficient b: 0
Enter a nonzero value for coefficient c: 9
The roots are: root 1 = -0.000000+i(3.000000) and root 2 = -0.000000-i(3.000000)
```

a	b	c	Quadratic Equation	Root 1	Root 2
2	4	-6	$2x^2 + 4x - 6 = 0$	$x_1 = -1.0$	$x_2 = 3.0$
-4	12	9	$-4x^2 + 12x - 9 = 0$	$x_1 = 1.5$	$x_2 = 1.5$
1	0	9	$x^2 + 9 = 0$	$x_1 = 3i$	$x_2 = -3i$

a	b	c	Quadratic Equation	Root 1	Root 2