

ESS111 : Programming 1 (C Programming)

LAB - 2

Due: 2 December, 2020 @ 11:59 pm

Part A (to be submitted)

Problem 1: Write a program that inputs two integers (x and y) and outputs $f(x, y)$ up to two decimal places as defined below

$$f(x, y) = \begin{cases} \log_e y & x \geq y \\ e^x & \text{otherwise} \end{cases}$$

(Hint: Use `#include <math.h>` and use `-lm` linker option while compiling)

Sample Input 1:

5 5

Output 1:

1.61

Sample Input 2:

5 10

Output 2:

148.41

Problem 2: Consider the polynomial $f(x) = x^4 - x^3 - 24x^2 + 4x + 80$. Write a program to input a number x in floating point format and then print "Root" if the given input x is a root of $f(x)$. If the input x is not a root, then print the sign of $f(x)$ ("Positive" or "Negative").

Sample Input 1:

5

Output 1:

Root

Sample Input 2:

10.1

Output 2:

Positive

Problem 3: Write a program that inputs coefficients a, b, c (use `double` variables) and outputs the roots of the quadratic equation of the form $ax^2 + bx + c = 0$. If a is 0, output "Invalid input", otherwise, in every other case, print both the roots, even if they are equal or imaginary.

Note: If the roots are equal, print the same on two separate lines. If the roots are real, they must be printed in increasing order on separate lines. Outputs should be up to 2 decimal places. For imaginary roots of the form $(\alpha \pm i\beta)$, print α, β followed by $\alpha, -\beta$ on the next line.

Sample Input 1:

1.0 2.0 1.0

Output 1:

-1.00

-1.00

Sample Input 2:

1.0 0.0 1.0

Output 2:

0.00,1.00

0.00,-1.00

Sample Input 3:

0.0 2.0 1.0

Output 3:

Invalid input

Sample Input 4:

1.0 -6.0 10.0

Output 4:

3.00,1.00

3.00,-1.00

Problem 4: Write a program that inputs a number between 0 and 99999 and calculate the sum of its digits.

(Hint: Use the modulus operator '%')

Sample Input 1:

12345

Output 1:

15

Sample Input 2:

356

Output 2:

14

Problem 5: Write a program to input Cartesian co-ordinates (x, y) of a point and convert them into polar co-ordinates (r, θ) . (θ in radians.)

Note: Output up to two decimal places.

Hint: $r = \sqrt{x^2 + y^2}$ and $\theta = \tan^{-1}(\frac{y}{x})$

Sample Input 1:

2.4 3.4

Output 1:

4.16 0.96

Sample Input 2:

3.4 5.6

Output 2:
6.55 1.03

Part B (need not be submitted)

A. What will be the output of the following programs:

- (a)

```
#include <stdio.h>
int main()
{
    int i = 2, j = 3, k, l ;
    float a, b ;
    k = i / j * j ;
    l = j / i * i ;
    a = i / j * j ;
    b = j / i * i ;
    printf ( "%d %d %f %f\n", k, l, a, b ) ;
    return 0 ;
}
```
- (b)

```
#include <stdio.h>
int main()
{
    int a, b, c, d ;
    a = 2 % 5 ;
    b = -2 % 5 ;
    c = 2 % -5 ;
    d = -2 % -5 ;
    printf ( "a = %d b = %d c = %d d = %d\n", a, b, c, d ) ;
    return 0 ;
}
```
- (c)

```
#include <stdio.h>
int main()
```

```

{
    float a = 5, b = 2 ;
    int c, d ;
    c = a % b ;
    d = a / 2 ;
    printf ( "%d\n", d ) ;
    return 0 ;
}

```

(d) `#include <stdio.h>`

```

int main()
{
    printf ( "nn \n\n nn\n" );
    printf ( "nn /n/n nn/n" );
    return 0 ;
}

```

(e) `#include <stdio.h>`

```

int main( )
{
    int a, b ;
    printf ( "Enter values of a and b" ) ;
    scanf ( " %d %d ", &a, &b ) ;
    printf ( "a = %d b = %d", a, b ) ;
    return 0 ;
}

```

B. Attempt the following questions:

- (a) Write a program to receive values of latitude (L1, L2) and longitude (G1, G2), in degrees, of two places on the earth and output the distance (D) between them in nautical miles. The formula for distance in nautical miles is:

$$D = 3963 \cos^{-1} (\sin L1 \sin L2 + \cos L1 \cos L2 * \cos (G2 - G1))$$

- (b) Wind chill factor is the felt air temperature on exposed skin due to wind. The wind chill temperature is always lower than the air temperature, and is calculated as per the following formula:

$$wcf = 35.74 + 0.6215t + (0.4275t - 35.75) * v^{0.16}$$

where t is the temperature and v is the wind velocity. Write a program to receive values of t and v and calculate wind chill factor (wcf).

- (c) If value of an angle is input through the keyboard, write a program to print all its Trigonometric ratios.