

ESS111 : Programming 1 (C Programming)

LAB - 6

Due: 8 January, 2021 @ 11:59 pm

Part A (to be submitted)

Problem 1: Given an integer input n ($n > 1$), write a function to print all the prime factors of n in non-decreasing order.

Sample Input 1:

24

Output 1:

2 2 2 3

Sample Input 2:

35

Output 2:

5 7

Problem 2: The expansion for $\sin(x)$ is

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \frac{x^{11}}{11!} + \dots$$

Write a function that takes x as input (*use double*) and computes $\sin(x)$ approximated to power of 11. You must write two functions, one to compute the factorial of an integer and another to compute the power of a number (*output in double format*). Use these to compute $\sin(x)$.

Note: functions from `math.h` must not be used.
The result must be approximated to 6 decimal places.

Sample Input 1:

0.52

Output 1:

0.496880

Sample Input 2:

1.8

Output 2:

0.973847

Problem 3: Write a function to compute distance between two points. Use this to write a function to find area of a triangle. Further write a function to check whether a point lies inside a triangle or not. The program should take 3 points (in (x, y) format) as input (*double format*) and output the area of the triangle joining these points. Next, the program should take an integer n as input. For the next n points, the program should output whether each point lies inside (print 'INSIDE') or outside (print 'OUTSIDE') the triangle.

Note: Points on the triangle are also considered to be inside.

The program should not use any library functions except for `sqrt()`.

Sample Input 1:

0 0

1 1

2 0

2

0.5 0.5

0.5 -0.5

Output 1:

1.000000

INSIDE

OUTSIDE

Sample Input 2:

1 0
3 0
2 -2
3
1.5 1.5
1.5 -3.5
1.5 -0.5

Output 2:

2.000000
OUTSIDE
OUTSIDE
INSIDE

Problem 4: Write a function to compute the binomial coefficient (n choose r) given two positive integers n and r as input.

$$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

Note: You need to make sure that the intermediate results arising due to computation do not overflow the 32 bit integer.
The upper limit of signed int is 2147483647.

Sample Input 1:

4 2

Output 1:

6

Sample Input 2:

10 5

Output 2:

252

Sample Input 3:

22 2

Output 3:

231

Part B (need not be submitted)

A. Point out the **errors**, if any, in the following programs:

(a)

```
#include<stdio.h>
int addmult ( int, int )

int main( )
{
    int i = 3, j = 4, k, l ;
    k = addmult ( i, j ) ;
    l = addmult ( i, j ) ;
    printf ( "%d %d\n", k, l ) ;
    return 0 ;
}

int addmult ( int ii, int jj )
{
    int kk, ll ;
    kk = ii + jj ;
    ll = ii * jj ;
    return ( kk, ll ) ;
}
```



(b)

```
#include<stdio.h>

int main( )
{
    int a ;
    a = message( ) ;
    return 0 ;
}
```



```
void message( )
{
```

```

    printf ( "Viruses are written in C\n" ) ;
    return ;
}

```

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

```

int main( )
{
    float a = 15.5 ;
    char ch = 'C' ;
    printit ( a, ch ) ;
    return 0 ;
}

```



```

printit ( a, ch )
{
    printf ( "%f %c\n", a,
}

```



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

```

int main( )
{
    let_us_c( )
    {
        printf ( "C is a Cimple minded language !\n" ) ;
        printf ( "Others are of course no match !\n" ) ;
    }
    return 0 ;
}

```

B. Answer the following questions:

- (a) Any year is entered through the keyboard. Write a function to determine whether the year is a leap year or not.