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

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

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, ch ) ;
}
```

(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.