Assignment 5_2021-batch

1. Write a program which takes two integers from the user and returns all prime numbers between the two integers. The result should not depend on the order in which the integers are entered by the user.

2. The exponential of a number (x) is given by: $e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \frac{x^5}{5!} + \frac{x^6}{6!} + ...$

In general, the nth term is $\frac{x^n}{n!}$.

Since the evaluation of n! is time intensive for large n, another way out is to note the existence of a recursive relation

$$T_n = \frac{x}{n} T_{n-1}$$

where, T_n is the nth term of the series. We may calculate exp(x) efficiently by using the above relation.

Write a program which uses the above relation to evaluate exp(π) to the accuracy of 10^{-4}. Your program should print number of terms of the series (which have been evaluated), the computed value, the actual value and their absolute difference of the two. See note below Q6 to understand what is meant by accuracy of 10^{-4}.

3. Use the above method (relation between successive terms) to estimate sin(π/2) to the accuracy of 10^{-4}. Your program should print number of terms of the series (which have been evaluated), the computed value, the actual value and their absolute difference of the two.

Note: You can use the series expansion: $\sin(x) = \frac{x}{1!} - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + ... + (-1)^n \frac{x^{(2n+1)}}{(2n+1)!} + ...$

4. Write a code to generate the following pattern. You can define x=''A'' and y='' '' and use them to generate the pattern

```
         AA
        AAAA
       AAAAAA
      AAAAAAAA
     AAAAAAAAAA
    AAAAAAAAAAAA
   AAAAAAAAAAAAAA
  AAAAAAAAAAAAAAAA
 AAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAA
```

5. Suppose the length of three sticks are given by three numbers. Define a function which takes the three lengths (as arguments) and determines whether these sticks can form a triangle. The function should return True or False depending on whether the triangle is formed or not. Your program should take three numbers from the user and should print

whether a triangle is possible or not. For a triangle to be formed out of 3 lengths, the sum of length of 2 sides must be greater than the length of the other side.

6. The following series yields the value of $tan^{-1}(x) = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \cdots$..:

Define a function f(x; n) which calculates the above series up to nth term for a given x. Write a program which finds the number of terms required to compute the value of π (using the above series) correct up to an absolute difference of 10^{-3}. The program should print the number of terms required (value of n), the exact value of π, the computed value of π and their absolute difference.
Note that the absolute difference = abs(exact value – computed value). Correct up to an absolute difference of 10^{-3} (or accuracy of 10^{-3}) means that the series should be computed until absolute difference = abs(exact value – computed value) < 10^{-3}

7. Define a function which takes a number (x) as argument and returns the 9/10 power of the same number ($x^{0.9}$). If x is greater than 1, then f(x) < x and f(f(x)) < f(x). Let us suppose, that we start with x = 10 and in each iteration, we assign x = f(x). How many iterations do we need to perform to have x < 2 starting from x = 10?