Complete within two working days

Date: 18/01/2021

Assignment 02

Second Year BS (Honours) 2020-2021
Course Title: Math Lab II, Course Code: AMTH 250
Department of Applied Mathematics, University of Dhaka

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[Write a FORTRAN program to solve each of the following problems. Use files for input/output unless specified otherwise. Name the files and the code according to the assignment and problem no., e.g., for problem no. Y of assignment X, input & output file names must be 'inXqY.txt' and 'outXqY.txt' respectively.]

Day-1

1. The roots of the quadratic equation $ax^2 + bx + c = 0$ are given by $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, where a, b and c are real numbers. Write a program that takes the value of a, b and c from the keyboard as input and calculates the roots. You must declare the roots as COMPLEX variable. In the output file, first show a message stating whether the roots are real or complex and then print them. [10]

Checked 16.01.22

2. The *Stern's Diatomic Sequence* is a sequence starting with $a_0 = 0$ and $a_1 = 1$ and for $n \geq 2$, the n^{th} term a_n is given by [10]

$$a_n = \begin{cases} a_{n/2} & \text{if } n \text{ is even,} \\ a_{(n-1)/2} + a_{(n+1)/2} & \text{if } n \text{ is odd.} \end{cases}$$

Write a program to take n as input from the keyboard and print the sequence up to a_n as follows:

Value of n	n^{th} term
0	0
1	1
2	1
3	2
4	1
:	:
n	a_n

Day-2

3. For any two positive integers a and b, the *greatest common divisor (GCD)* satisfies the following recurrence relationship: [8]

$$\gcd(a, b) = \begin{cases} b & \text{if } a \bmod b = 0 \\ \gcd(b, (a \bmod b)) & \text{if } a \bmod b \neq 0 \end{cases}$$

Write a program using RECURSIVE FUNCTION that takes a and b as input from the keyboard and gives their GCD as output on the terminal.

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4. For any positive integer n, the *Euler* phi-function, denoted by $\phi(n)$, is defined as the number of integers k in the range $1 \leq k \leq n$ such that $\gcd(n, k) = 1$. Use this definition and the recursive function of problem-3 to write a program that takes a value of n from the keyboard and prints the value of $\phi(n)$ on the terminal. [12]

5. Write a program to find all the prime divisors of a positive integer n. You must use a SUBROUTINE to check the primality of the divisors. [15]