

# 3<sup>rd</sup> year lab assignment 2023

## Dept. of Mathematics, Govt. Titumir College, Dhaka

- Print the root of the equation  $ax^2 + bx + c = 0$  ( $a \neq 0$ ) where  $a, b, c$  are any real numbers.
  - Compute the value of  $e^5$  and  $e^{1.5}$  with the help of sum of 5 terms of series  $e^x$ .
  - Find prime numbers from 1 to 400. The output should have 4 numbers in each line.
  - Calculate the value of Pi from 500 term of the series  $\frac{\pi}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots + \frac{1}{N^2}$
  - write a Fortran program to estimate the value of  $\pi$  up to 6 decimal place by adding the first 50 terms  $\pi = 4 - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \dots$
  - write a Fortran program to find first 30 terms of Fibonacci sequence. The output should have 5 numbers in a line.
- A function  $f(x)$  is defined by  $f(x) = \begin{cases} 1-x^2 & \text{if } x < 0 \\ 1+2x & \text{if } 0 \leq x \leq 1 \\ 3 + \frac{1}{x} & \text{if } x \geq 1 \end{cases}$ . Compute  $f(x)$ ,  $x \in [-10, 10]$  at an interval of 0.5
  - Find the minimum value of  $f(x, y) = x^2 + y^2 - 2x - 6y + 14$  in the window  $[0, 2] \times [2, 4]$  with increment 0.01 for  $x$  and  $y$
- Using
  - Newton-Raphson method
  - Fixed Point Iteration method
 to find the root of the equation  $x^3 - 3x - 5 = 0$  correct upto five decimal places. Show your result in a tabular form with proper headings. Input  $x_0 = 2.0$
- Use
  - Gauss - Seidal method
  - LU Factorization method
  - SOR iterative method
  - Gauss – Jordan Method
  - Jacobi Iterative Method
  - Gauss elimination Method
 to solve the following system of linear equations correct upto four decimal places.
 
$$\begin{aligned} 83x + 11y - 4z &= 95 \\ 7x + 52y - 13z &= 104 \\ 3x + 8y + 29z &= 71 \end{aligned}$$
- Compute  $\int_0^1 \sqrt{1-x^2} dx$  by
  - Simpson's 1/3 rule

(ii) Simpson's 3/8 rule

(iii) Trapezoidal rule

and compare your result to exact value.

6. (a) Every year Tk. 12000 is deposited in a saving account in 1567 which yield 5% interest compounded annually. Write a program which prints account number and amount in the account after 10 years.
- (b) Print all the odd positive integers  $\leq n$ , omitting those are divisible by 3 and 5. The output should have five numbers in each line.
- (c) Read a positive integer  $N \geq 10$ , Print all even positive integer from 1 to N with three numbers to a line, omitting those divisible by 5. Determine whether N is prime or not. If N is not prime, then print all the divisors.
7. For Romberg integration to approximate the value of the integral  $\int_0^{\frac{\pi}{2}} x^2 \sin x \, dx$  correct upto five decimal places. Compare your result with the exact value 0.0887553. Show your result in a tabular form.
8. Using the data (300,2.4771), (304,2.4829), (305,2.4843), (307,2.4871). find the result for f (301)  
For
- (i) Lagrange interpolation formula
- (ii) Newton's divided difference interpolation formula
- (iii) Newton's backward difference formula
9. Find the dominant eigen value and the corresponding eigenvector of the following matrix:  
$$\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix} \text{ with } X^{(0)} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$$
10. Solve the following IVP using subroutine subprograms for
- (i) R-K 2<sup>nd</sup> order method
- (ii) R-K 4<sup>th</sup> order method
- (iii) Euler's method
- (iv) Modified Euler's method
- (v) Adams Bashforth
- to approximate the solution of the IVP:  $y' = y - t^2 + 1$ ,  $0 \leq t \leq 2$ ,  $y(0) = 0.5$  with  $h=0.1$ . Hence compare your result with the actual solution  $y(t) = (t+1)^2 - 0.5 e^t$