Assignment 03

Second Year BS (Honors) 2018-2019
Course Title: Math Lab II, Course Code: AMTH 250
Department of Applied Mathematics, University of Dhaka

Name: **Roll No:** **Group:**

Write a FORTRAN program to solve each of the following problems. Always use **files** named according to the assignment no. and problem no. to take input and show output unless **specified otherwise**, e.g., for problem no. **Y** of assignment no. **X**, input and output file names should be 'in_a**X**q**Y**.txt' and 'ot_a**X**q**Y**.txt' respectively.

No.	Problem
1.	Consider the function $f(x) = \frac{1}{16}x^3 - \sin x$. Determine an approximation to the zero of this function that is accurate to within 10^{-6} using the Bisection method. Use the endpoints of the interval $[-1, 2]$ as the starting points and follow each of the stopping criteria given below: (i) $\frac{\mid P_n - P_{n-1} \mid}{\mid P_n \mid} < TOL$ (ii) $\mid f(P_n) \mid < TOL$ where P_n is the n^{th} approximation and TOL is the tolerance. Show your answer in two different tables with headings as follows: Table 1: Iteration No., a, b, P_n, $\frac{\mid P_n - P_{n-1} \mid}{\mid P_n \mid}$. Table 2: Iteration No., a, b, P_n, $\mid f(P_n) \mid$.
2.	Use the Fixed Point Iteration method to determine an approximation to the root of the equation $-2^{-x} + x^3 - \frac{1}{2}x^2 + x = 0$ on $[0, 1]$ that is accurate to within 10^{-3}. Choose each of the following two initial guesses: (i) $p_0 = 0.5$ (ii) $p_0 = 1$ Take $g(x) = 2^{-x} - x^3 + \frac{1}{2}x^2$. Show your answer in two different tables – each with headings as follows: Iteration No., P_{n-1}, P_n, $f(P_n)$.
3.	The equation $\frac{1}{2} + \frac{1}{4}x^2 - x\sin x - \frac{1}{2}\cos 2x = 0$ has three real roots namely 0 and $\pm\frac{1655\,\pi}{2743} \approx \pm 1.89549$. To approximate a root, use the Newton-Raphson method with initial guess $p_0 = 10\,\pi$ where π must be taken as follows: (i) $\pi \approx 3.142$ (ii) $\pi \approx 3.1416$ (iii) $\pi \approx 3.14159$ Iterate until an accuracy of 10^{-5} (if possible) is obtained. Show your answer in three different tables – each containing headings as follows: Iteration No., P_{n-1}, $f'(P_{n-1})$, P_n, $f(P_n)$.

4.	The exact solution of the equation $3^{3x+1} - 7 \times 5^{2x} = 0$ is $\frac{\ln 7 - \ln 3}{3\ln 3 - 2\ln 5}$. Store this solution in a variable named *'EXCT'* in your program. Then use the Regula Falsi method to generate approximations to this exact solution, accurate to within 10^{-4}. Choose the initial two approximations p_0 and p_1 so that the interval $[p_0, p_1]$ has length at least 1 i.e. $p_1 - p_0 \geq 1$. Also find the absolute error and relative error at each step. Show your answer in a table with a suitable title and containing headings as follows: Iteration No., P_{n-2}, P_{n-1}, $f(P_{n-2})$, $f(P_{n-1})$, P_n, Abs. Err., Rel. Err.