University of Dhaka

Department of Applied Mathematics

Second Year B.S. (Honors), Academic Session: 2023-2024

Course Title: Math Lab II (FORTRAN), Course Code: AMTH 250

Assignment No.: 2

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

[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 'in XqY.txt' and 'outXqY.txt' respectively]

1. Show that $f(x) = 3x + \sin x - e^x = 0$ has a root in $[1,3]$ and then use the Bisection method to determine an approximation to the root that is accurate to at least within 10^{-8}. Show your findings in a tabular form containing table headings as follows:

"Iteration Number", "a ", "b ","x ","$f(x)$ ", "Relative Error"

2. Use a Fixed-Point iteration method to determine a solution accurate to within 10^{-6} for $x^4 - x - 10 = 0$ on $[0,2]$ employing the following initial guesses:

(i). $p_0 = 0.5$

(ii). $p_0 = 1.0$

(iii). $p_0 = 1.5$

Besides, consider the following three different $g(x)$ functions to solve the above-mentioned problem

(a). $g(x) = \dfrac{\sqrt{x+10}}{x}$

(b). $g(x) = (x+10)^{1/4}$

(c). $g(x) = \dfrac{10}{x^3 - 1}$

Hence, show and justify your obtained results in three different tables each having headings in the following manner.

"Iteration Number", "P_{n-1} ", "P_n ", "$f(P_n)$ ", "Absolute Error".

3. Find the real root of the equation $5x^2 + \cos[3x] - 2e^x - e^{-x} = 0$, correct to five decimal places, by Newton-Raphson method considering the following initial guesses:

(i). $x_0 = -5$

(ii). $x_0 = -2$

(iii). $x_0 = 1$

(iv). $x_0 = 4$

Hence, portray your findings in four separate tables each containing headings as follows:

"Iteration Number", "P_{n-1}", "$f'(P_{n-1})$", "P_n", "$f(P_n)$", "Relative Error"

4. Use the Secant method to find the approximate root of the equation $4x^3 - 1 - e^{x^2/2} = 0$ in $[0,4]$ correct up to six decimal places. Show your results in a tabular form using suitable table headings. Consider the formula $x_{n+1} = x_n - f(x_n)\dfrac{(x_{n-1} - x_n)}{f(x_{n-1}) - f(x_n)}$ while applying the Secant method.

5. Use the method of False Position to find the solution of the equation $e^x + 2^{-x} + 2\cos x - 6 = 0$ accurate to within 10^{-5} for $1 \le x \le 2$. Display your findings in a tabular form using suitable table headings.

THE END