

# Program 6 Foundations of Computational Math 2 Spring 2019

Due date: 11:59PM on Friday 26 April 2019

## General Task

Your task is to implement, analyze, and empirically test and demonstrate the capabilities of the methods discussed in the class: Regular Falsi, Secant method, Newton's method and nonlinear splitting contraction mapping methods. You should also include the quadratically convergent Steffensen's method (see Textbook, p. 283, Problem 5).

## Required Tests

Determine the roots and the various intervals of convergence for the methods on at least the following problems:

- some Chebyshev polynomials with degree greater than or equal to 3;
- some Legendre polynomials with degree greater than or equal to 3;
- $f(x) = x^k - \alpha$  where  $\alpha > 0$  for several  $\alpha$  and integer  $k \geq 3$ ;
- $f(x) = e^x - \sin x$  (see Homework 7 for some nonlinear splitting results for this function);
- $f(x) = xe^x - 0.06064$  (see Homework 7 for some Newton's method results for this function);
- $f(v) = v(R^{-1} + \mu\gamma) - \mu v^2 + \alpha(e^{v/\beta} - 1) - \frac{E}{R}$ , where

$$\alpha = 10^{-12}, \quad \beta^{-1} = 40 \quad \mu = 10^{-3}$$

$$\gamma = 0.4, \quad \frac{E}{R} = 1.2 \times 10^{-4}, \quad R^{-1} = 3 \times 10^{-4}$$

# Submission of Results

Expected results comprise:

- A document describing your solutions as prescribed in the notes on writing up a programming solution posted on the class website.
- The source code, makefiles, and instructions on how to compile and execute your code including the Math Department machine used, if applicable.
- Code documentation should be included in each routine.
- All text files that do not contain code or makefiles must be PDF files. **Do not send Microsoft word files of any type.**

These results should be submitted by 11:59 PM on the due date. Submission of results is to be done via FSU Dropbox at <https://dropbox.fsu.edu>. Drop the files off for Zhifeng Deng using his MyFSU email [zd16d@my.fsu.edu](mailto:zd16d@my.fsu.edu). (Note: **do not use [zdeng@math.fsu.edu](mailto:zdeng@math.fsu.edu) to drop off the files**) You should login to FSU Dropbox using your MyFSU login. If for some reason you cannot use FSU Dropbox please email the files to Zhifeng at the email address above.