Programming assignment II
ME685A – APPLIED NUMERICAL METHODS

9th March 2022

Solve the following second order nonlinear ordinary differential equation arising in heat conduction within a slab using the finite difference method. Use Gauss-Seidel iterations for solving the system of algebraic equations with a relaxation factor of unity. The program should run for up to 1000 equal intervals (1001 grid points). The initial guess should be a constant temperature. Set maximum number of iterations = 5000 and convergence criterion in the greatest change in temperature between iterations to be 10^{-6}. Use harmonic averaging for the treatment of variable conductivity.

The final output on the screen should be temperatures at 11 equally spaced points across the slab.

$$\frac{d}{dx}\left(K(T)\frac{dT}{dx} \right) = 1 - x, \quad 0 < x < 1$$

$$K(T) = 1 - 0.1T$$

$$x = 0 \; T = 1$$

$$x = 1 \; T = 0$$

Upload your answers as a zipped file with your roll number as the file name. File extensions such as *.f, *.C, and *.m are permitted. Our TAs will run the programs and gauge the output that appears on the screen. Initial guesses and all relevant parameters should be built-in. No additional input should be required.