MTH 308: Numerical Analysis & Scientific Computing I
Department of Mathematics and Statistics
Indian Institute of Technology - Kanpur February 14, 2019

Lab 6

Steps you should follow :

1. Start a Matlab session by typing

   ```
   $ matlab &
   ```

   at the command prompt.

2. In the Matlab command window, type

   ```
   >> diary lab6_ID
   ```

   where ID stands for your roll number. For example, if your roll number is 12345, then the command will be `diary lab6_12345`; if your roll number is 123456, then the command will be `diary lab6_123456`. This will create a file named `lab6_ID` in the present working directory. PLEASE DO NOT EDIT THIS FILE.

3. Do your lab assignment – create a separate file to write your scripts/functions, if required; once done, at the Matlab's command prompt, type

   ```
   >> diary off
   ```

4. Attach this file (that is, `lab6_ID`) and any other Matlab code file that you may have created for the labwork in an **email with subject Lab6-ID** and send it to

   mth308.iitk@gmail.com

   before the end of the lab session, that is, by 4:30 pm. Note that **late submissions will not get any credit**. In the case that your diary file is too big to be sent as an email attachment, upload it on you Google Drive (the cloud storage space associated with your Google/Gmail account) and share the link with mth308.iitk@gmail.com.

For solution of the equation

$$f(x) = x^2 - 3x + 2 = 0$$

use each of the following equations

$$\begin{aligned} g_1(x) &= (x^2+2)/3 \\ g_2(x) &= \sqrt{3x-2} \\ g_3(x) &= 3-2/x \\ g_4(x) &= (x^2-2)/(2x-3) \end{aligned}$$

to obtain the corresponding one point iteration scheme

$$x_{m+1} = g_j(x_m), \quad n \geq 0, \quad j = 1, 2, 3, 4,$$

where x_0 is chosen randomly between in the interval $[1.5, 2.5]$ (you can use Matlab's `rand` function to do this; type `help rand` for more information). Use $|f(x)| \leq 10^{-14}$ as the stopping criterion for these iterations.

Comment on their respective rates of convergence by looking at

$$\frac{|e_{m+1}|}{|e_m|} \qquad \text{and} \qquad \frac{|e_{m+1}|}{|e_m|^2}$$

for $m = 1, 2, 3, \ldots$, as approximations to

$$\lim_{m\to\infty} \frac{|e_{m+1}|}{|e_m|} \qquad \text{and} \qquad \lim_{m\to\infty} \frac{|e_{m+1}|}{|e_m|^2},$$

where $e_m = x_m - 2$. Note that, as these iterations are being started randomly, you may want to run each of them several times to see the correct (worst case) rate of convergence.