MACM 316 – Computing Assignment 3

Due Date: October 3rd, at 11pm.

ou must upload both your code (to Computing Code 2) and your report (to Computing Report 2) in Crowdmark. The assignment is due at 11:00pm. If you submit late, you will be given 0 on the assignment. Your computing report must be exactly 1 page. There will be a penalty given if your report is longer than one page. Your code needs to be printed out from Matlab as a .pdf file in order to upload it to Crowdmark.

- Please read the **Guidelines for Assignments** first.
- Please use the Canvas discussion board and please keep in mind that Canvas discussions are open forums.
- Acknowledge any collaborations and assistance from colleagues/TAs/instructor.

A. Computing Assignment – Computational time for Gaussian elimination

Required submission: 1 page PDF document and scripts/codes uploaded to Canvas.

Remark: to complete this assignment, you should download the file *Matrices.m*. You may also find it useful to look at the in-class demo *TicToc.m* (posted on lecture notes page).

In class we saw that the computation time can be calculated using Matlab's *tic* and *toc* commands (see the demo *TicToc.m*). The purpose of this assignment is to investigate the actual computation time for Gaussian elimination for a number of different types of matrices and compare this to theoretical results discussed in lectures.

These matrices are as follows:

1. An $N \times N$ random matrix
2. An $N \times N$ random, diagonally-dominant matrix
3. An $N \times N$ random, upper triangular matrix
4. An $N \times N$ tridiagonal matrix
5. An $N \times N$ tridiagonal matrix stored as a sparse array

Code for generating these matrices is given in the file *Matrices.m*.

Detailed instructions are as follows:

- Choose an appropriate number of trials and set of values for N.
- For each matrix, compute the the average time taken $T_{\text{avg}}(N)$ and plot the data points $(\log(N), \log(T_{\text{avg}}(N)))$.
- You should find that the data follows roughly a straight line. Perform a linear fit of the data and find the slope of the line.
- For matrices 1., 2. and 3., discuss how this value relates to theoretical results on 'flop counts' discussed in the lectures.

Your conclusions should be explained in a one-page report.