Matlab Lab 1

Melvyn Sim [*]

5 July 2005

(1) Enter matrices:

$$A = [2\ 6; 3\ 9]; B = [1\ 2; 3\ 4]; C = [-5\ 5; 5\ 3];$$

Create a big matrix, that has A, B, C on the diagonal. Delete the last row and last column. Extract the first 4×4 matrix from G. Replace $G(5,5)$ with 4. What do you get for $G(13)$? What happens if you type $G(12,1)$?

(2) Discuss various approaches for calculating

$$y_k = 1 - y_{k-1} \times y_{k-2},$$

for $k = 2, \ldots, N$ with $y_0 = 0.1$ and $y_1 = 0.5$. How does the performance of your code vary with N?

(3) Let

$$S = X_1 + \ldots + X_{m_1}$$

where $X_i,\ i = 1, \ldots, m_1$ are independently distributed uniform distributions in $[0,1]$. Generate 1000000 samples of S and plot the histogram. Let

$$T = Y_1 + \ldots Y_{m_2}$$

where Y_i, $i = 1, \ldots, m_2$ are independent two points distributions with

$$\mathrm{P}(Y_i = y) = \begin{cases} 0.01 & \text{if } y = 0 \\ 0.99 & \text{if } y = 1. \end{cases}$$

Generate N samples of $S + T$ and plot the histogram. Explore difference approaches and discuss their competitive advantages with respect to memory usage and speed.

[*]NUS Business school. Email: dscsimm@nus.edu.sg

(4) Generate the following tridiagonal matrix, $A \in \Re^{n\times n}$

$$A = \begin{pmatrix} 2 & -1 & 0 & \dots & 0 \\ -1 & 2 & -1 & 0 & \dots \\ 0 & -1 & 2 & -1 & \dots \\ \vdots & & & \ddots & \vdots \\ \dots & & 0 & -1 & 2 \end{pmatrix}.$$

Determine the solution of

$$Ax = b,$$

where $b = [1, \dots, 1]'$;. What is the maximum size you can solve. (Warning, you may halt the PC if n is too large). Explore matlab sparse matrix commands. Do a help on spalloc. Can you increase the size? Why? Try to map a function to the solution x and justify the function numerically. Could you prove it theoretically?