FE531 Sep. 3. 2018
Numerical Methods in Finance Jung-Soon Hyun

HW 1: Solving a system of linear equation

(Due: Sep. 10, 2018)

1. For each $\alpha = 0.5$ and $\alpha = 5$, find the solution $x = (x_1, x_2, \cdots, x_n)$ for the system of n linear equations below:

$$\begin{pmatrix} 1+\alpha & -\alpha/2 & 0 & \cdots & & 0 \\ -\alpha/2 & 1+\alpha & -\alpha/2 & & & 0 \\ 0 & -\alpha/2 & 1+\alpha & & & 0 \\ & & & & -\alpha/2 & \\ & & & -\alpha/2 & 1+\alpha & \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ \\ \\ x_n \end{pmatrix} = \frac{\alpha}{2} \begin{pmatrix} d_1 \\ 0 \\ \\ \vdots \\ d_n \end{pmatrix}$$

where $d_1 = 0$ and $d_n = 1$, and $n = 10$.

You may use the algorithm given in lecture note. Do you think the algorithm is convergent? Justify your answer. Increase α by 0.1 and find the solution. How does the solution change? Even the data (d −vector, the right hand side) of the equation increases by 5 times, you may not observe the solution varies as much as α does. Guess why such thing happens and describe your opinion. In order to use your program for any tridiagonal system, you'd better code it as a function.

As you are instructed in class, you don't have to hand in the program file but a hard copy for the answer.