MATH 353: Engineering Mathematics III – Section 012

Spring 2013 (F.–J. Sayas) Lab # 9 April 19

Open Matlab and *move to the Desktop or to a folder where you can find your work* at the end of the session. Type these lines

```
>> diary myworkApril19
>> format long
>> format compact
```

1. Matrix review:

   (a) Introduce the following matrix in Matlab.

$$A = \begin{bmatrix} 2 & -1 & 0 & 0 & 0 \\ -1 & 2 & -1 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 \\ 0 & 0 & -1 & 2 & -1 \\ 0 & 0 & 0 & -1 & 2 \end{bmatrix}$$

   (b) Select its third row

   (c) Select its fourth column.

2. If you want to solve a linear system

$$\begin{bmatrix} 2 & -1 & 0 & 0 & 0 \\ -1 & 2 & -1 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 \\ 0 & 0 & -1 & 2 & -1 \\ 0 & 0 & 0 & -1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \end{bmatrix} = \begin{bmatrix} -1 \\ 2 \\ 3 \\ 2 \\ 4 \end{bmatrix}$$

   you get `A` as before, copy the right hand side as a column vector

```
>> b=[-1;2;3;2;4]
>> b=[-1 2 3 2 4]'     % both options give the same result
```

   and then we just go ahead and let Matlab solve with the backslash command.

```
>> A\b
ans =
   3.333333333333334
   7.666666666666670
  10.000000000000002
   9.333333333333332
   6.666666666666665
```

3. Let us repeat the previous exercise with a $N \times N$ system

$$\begin{bmatrix} 2 & -1 & 0 & 0 & 0 \\ -1 & 2 & -1 & 0 & 0 \\ 0 & -1 & 2 & -1 & 0 \\ 0 & 0 & \ddots & \ddots & \ddots \\ 0 & 0 & 0 & -1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_N \end{bmatrix} = \frac{1}{(N+1)^2} \begin{bmatrix} f(t_1) \\ f(t_2) \\ f(t_3) \\ \vdots \\ f(t_N) \end{bmatrix}$$

where

$$f(t) = t^2 - 2t + 1, \qquad t_i = \frac{i}{N+1} \quad i = (0), 1, \ldots, N, (N+1).$$

Write a script that does all the following:

(a) Create the matrix. (Learn how to use the function `diag` in Matlab to do that.)

(b) Define the right-hand side.

(c) Solve the system.

(d) If `x` is the solution, create the vector `x=[0;x;0]` and plot it in the y axis with t_i (for $i = 0, \ldots, N+1$ in the x axis.