

## Math 461 Matlab HW 1.

It is recommended to work together in small groups (not more than 3 people) on the Matlab HW. Then you'll hand in a single solution to the HW with the names of all group members on it.

Answer all questions, give detailed explanations.

Consult D. Lay "Study Guide, Appendix : Introduction to Matlab", or a similar introduction to Matlab.

Start random numbers by setting  
`rand('state',sum(100*clock));`

Problem 1. Generate a random  $5 \times 7$  matrix by setting  $A = \text{rand}(5,7)$ . Next put it in reduced echelon form by `rref(A)`.

Remark. The command "pause" gives you a possibility to look at the output and to write explanations.

Are the columns of  $A$  linearly independent? What is the Span of the columns of  $A$ ?

Problem 2. Generate a random vector  $u$  in  $\mathbf{R}^7$  by setting  
`u = rand(7,1)`

Calculate the product  $b = Au$ , where  $A$  is your matrix from Problem 1. Reminder : Matlab command is `b = A*u`. Next use Matlab to solve  $Ax = b$  by setting  $x = A \setminus b$ .

WARNING. If  $Ax = b$  has no solutions,  $x = A \setminus b$  will still give an answer, the "least squares solution" that we will study later in the course. Also if there are infinitely many solutions it will only give one of them without warning you that there are more. You can get the whole solution set by looking at the echelon form of  $A$ .

You know that  $x = u$  is a solution of  $Ax = b$ . Did Matlab give you  $x = u$ ? Did it give you vectors  $x$  and  $u$  which are close? Explain.

Find the reduced echelon form of the augmented matrix

`U = rref([A b])`.

Use  $U$  to find all solutions of  $Ax = b$ .

Problem 3. Generate a random  $15 \times 15$  matrix and a random vector  $b$  in  $\mathbf{R}^{15}$ .

Remark. You can suppress Matlab printout of a result by ending the command with a semicolon. For example `A = rand(15,15);` will generate a random  $15 \times 15$  matrix but not print it out.

Solve  $Ax = b$  by two methods. First use  $x = A \setminus b$ . Then compute  $U = \text{rref}([Ab])$  and get its last column by

`y = U(:,16)`

Did Matlab give you  $x = y$ ? Explain.

In order to check how precise are solutions obtained by two methods use  $R = b - A * x$  and  $S = b - A * y$ .

Did Matlab give you  $R = S$ ? Explain.