

Massachusetts Institute of Technology
Department of Mechanical Engineering

2.003J/1.053J Dynamics & Control I

Fall 2007

Homework 1

Issued: Sep. 7. 2007

Due: Sep. 14. 2007

Problem 1.1 : Matrix generation

i) Create the following matrixes

$$A = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix} \quad \& \quad B = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 3 & 1 \\ 2 & 1 & 1 \end{bmatrix}$$

ii) Create C : a 3×3 identity matrix. Use the most convenient method.

Problem 1.2 : Basic matrix operations

Use the matrixes you made in Problem 1.1.

i) Compare the results of $A * B$ and $A .* B$. Explain what MATLAB did.

ii) Does $A * B = B * A$? Explain.

iii) Does $A .* B = B .* A$? Explain.

iv) Create matrix $D = B^{-1}$. What is $B * D$?

v) Compare A / B and $A \setminus B$. Can you explain what is going on?

vi) Create a new 3×3 matrix E with all diagonal elements equal to 5 and other elements equal to 0.

Problem 1.3 : Understanding data types

Use the matrixes you made in Problem 1.1.

i) What are the data types of the elements of matrixes A , B , and C ?

ii) How many bits of memory are required to store the information in matrix A ?

- iii) Convert A and B to 8 bit signed integer matrixes and define them as matrix F and G respectively (check out function `int8()` in the help menu).
- iv) Calculate $F + G$ and $F * G$. Explain results.

Problem 1.4 : Submatrix extraction and plotting

You are given the trajectory of a ball in a MATLAB file: *ball.mat*. (Please, download it from MIT Server site.) The first column contains 100 time points and the second column contains the corresponding 100 positions of the ball. The third and the fourth column contain a second trial of the same experiment.

- i) Extract the time data from column 1 and assign that to a new matrix “t”.
- ii) Extract the position data from column 2 and assign that to a new matrix “x”.
- iii) Plot “x” vs. “t”.
- iv) Extract only the first 50 time points from column 3 and make a new matrix “t2”.
- v) Extract only the first 50 positions from column 4 and make a new matrix “x2”.
- vi) Plot “x2” vs. “t2”.
- vii) Superimpose both trajectories. Plot them in different color.