

Assignment 5: Basic Matlab Operations

Date Due: October 11, 2013

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Problem 1

Use Matlab to solve this problem. Use the Command Window and define two matrices, A and B, in Matlab. Use (;) to separate the rows in the matrix and use square parenthesis to define the numerical values inside the matrix.

$$A = \begin{bmatrix} 7 & 8 & 1 \\ 4 & 6 & 1 \\ 9 & 8 & 6 \end{bmatrix}$$

$$\text{and } B = \begin{bmatrix} 13 & 12 & 5 \end{bmatrix}$$

Perform the following matrix operations. In one line comment on the results obtained after each operation.

- $C = B \times A$
- $D = A(1,:)$
- $E = 2 * B'$
- $F = A \times B$
- $G = A(3,:) + B$
- $H = A(:,1)$ compare with part (b). Comment.
- $I = \text{diag}(A) + B'$
- $J = \text{ones}(3,3) + A$
- $x = \text{inv}(A) * B'$

Problem 2

Use Matlab to solve this problem.

- Create a new Matlab script and define two vectors as follows:

$$x = 0 : 0.1 : 20$$

$$y = x.^{1.85} .* \exp(-x)$$

In your script make a simple plot using the “plot” function in Matlab. Label the x-axis as ‘Time (seconds)’ and the y axis as ‘Amplitude (dim)’. Add a grid to the plot using the ‘grid’ attribute of the plot.

- Modify the script created in part (a) and using the interactive ‘Tools-Edit Plot’ adjust the color of the line to be red and the line width to be 4.0.

c) Modify the script created in part (a) creating another variable z.

$z = \text{gradient}(y)$ % the Matlab function gradient takes the first derivative of the values in (y)

Using the “subplot” command create a new figure with two plots. Plot the values of x vs. y in the upper part of the window and x vs. z in the lower part of the same window. Change the line colors to distinguish the two views.

d) Verify that the “gradient” function is working. Verify a few numbers by hand if necessary.

Problem 3

Use Matlab to solve this problem. A companion file provided in the assignment contains the population of the top 25 cities in the US.

Rank	City	State	Population in 2012	Population in 2010
1	New York	New York	8336697	8175133
2	Los Angeles	California	3857799	3792621
3	Chicago	Illinois	2714856	2695598
4	Houston	Texas	2160821	2100263
5	Philadelphia	Pennsylvania	1547607	1526006
6	Phoenix	Arizona	1488750	1445632
7	San Antonio	Texas	1382951	1327407
8	San Diego	California	1338348	1307402
9	Dallas	Texas	1241162	1197816
10	San Jose	California	982765	945942
11	Austin	Texas	842592	790390

- Crete a Matlab script and read the data using the Import Wizard in Matlab.
- Create variables for each column of data provided. For example, Column 1 is the “Rank” variables, and so on.
- Create a new variable in the scrip to estimate the change in population between the years 2012 and 2010.
- Find the percent change (%) of the population between the two years.
- Find the name of the city with the highest population change using the Matlab “max” function (e.g., max(x) finds the highest value of vector x)
- Find the names of the top 25 cities located in the state of California. Show the code to do this search. I suggest you use the “find” function in Matlab as demonstrated in class.

Problem 4

Data collected by a Global Positioning System (GPS) recording unit inside a car is presented in the accompanying file (GPS Data). Create a Matlab script that performs the following steps:

- Import the data into Matlab using the “load” command.
- Plot the speed of the car (in y-axis) vs. time (x- axis). Observe the plot and comment on the number of stops the vehicle makes.
- Estimate the acceleration of the car as a function of time (use the Matlab “gradient” function - see Problem 2). In your script find the largest deceleration the vehicle makes and the time where that acceleration is recorded. Comment on the driving behavior of the person driving the vehicle.
- Find the average speed of the car for the complete profile. Use the Matlab function MEAN(x) to get the average speed.
- Find the number of seconds the car spends at a red traffic light.