Assignment 5: Basic Matlab Operations

Solution Instructor: Trani

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.

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

For example, A would be defined in Matlab as: > A=[3 5 2; 4 6 1; 9 8 7]

and $B = \begin{bmatrix} 23 & 12 & 5 \end{bmatrix}$

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

a) $C = B \times A$

Standard matrix multiplication (1x3) x (3 x 3) = (1 x 3)

b) $D = A(1,2:3)$

Extracts elements of matrix A (the first row and the elements of 2nd and 3rd columns)

c) $E = B'$

Transposes row vector B

d) $F = A \times B$

Bad operation

e) $G = A(1,:) + B$

Extracts all elements of first row in matrix A and adds to B. Produces a 3x1.

f) $H = A(:,1)$

Extracts all element of the first column of matrix A

g) $I = diag(A) + B'$

Takes the diagonal elements of 3x3 matrix A and adds to B transposed (result is a 3 x1)

h) $J = ones(3,3) + A$

Creates a 3x3 matrix with all ones and adds to matrix A

i) $x = inv(A) * B'$

Solves the system of linear equations Ax = B

Problem 2

Use Matlab to solve this problem.

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

$$x = 1:1:25$$

$$y = x.\text{^}2.*\exp(-x)$$

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.

b) 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.

```
x= 1:1:25;
y=x.^2.*exp(-x);

figure
plot(x,y,'o-r')
xlabel('Time (seconds)','fontsize',20)
ylabel('Amplitude (dim)','fontsize',20)
grid
```

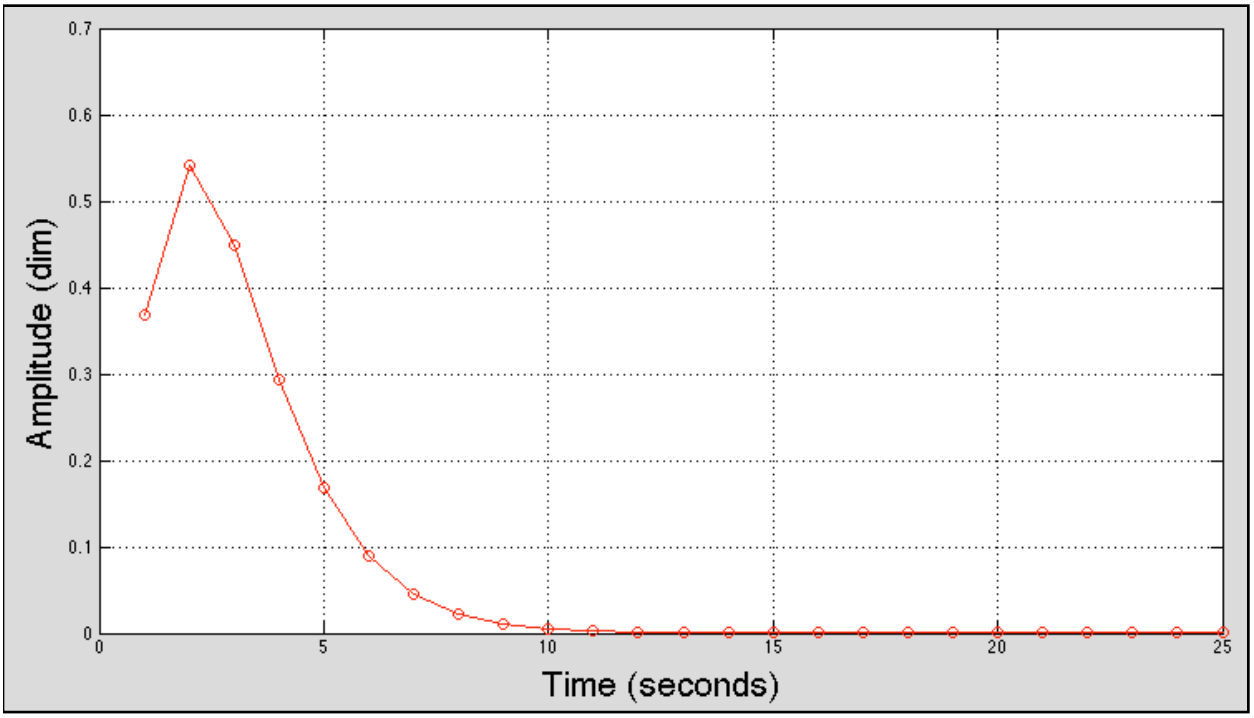

Figure 1. Plot with large step size.

c) Modify the script created in part (a) by making the interval across the x -variable smaller. For example, try:

$x = 1:0.01:25$

Plot and comment on the solution.

```
x= 1:.01:25;
y=x.^2.*exp(-x);

plot(x,y,'or')
xlabel('Time (seconds)','fontsize',20)
ylabel('Amplitude (dim)','fontsize',20)
grid
```

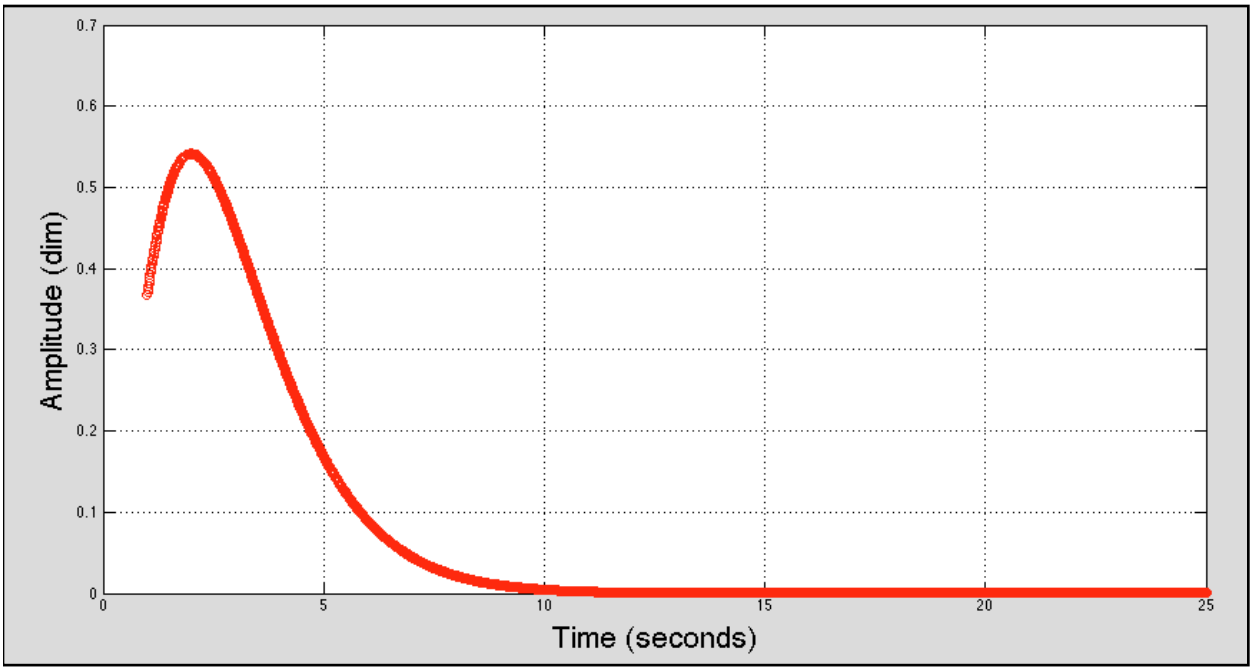

Figure 2. Plot with small step size.

Problem 3

Use Matlab to solve this problem. Define two vectors as follows:

airportNames={'Atlanta';'Charlotte';'Greenboro'};

passengers = [81e6 16e6 7.4e6];

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

a) B = airportNames(1)

Selects first element in vector with airport names (Atlanta). B is a cell array.

b) C = airportNames(1:2)

Selects first two elements in vector with airport names (Atlanta and Charlotte). C is a cell array.

c) D= airportNames{1}

Selects first element of airportNames as a string variable (char type in Matlab)

d) Comment on any differences observed between variables B and D.

One is a string variable and one is a cell array. You can convert the contents of a cell array to a string by using the "char" command. For example:

stringName = char(B) converts the cell array B into a string character. Certain operations or functions in Matlab work best in strings than in cell arrays.

e) E = airportNames{1}(1)

Selects the first character of the contents inside the first element of cell array airportNames.

f) F = airportNames{1}(1:4)

Selects the first four characters of the contents inside the first element of cell array airportNames.

g) G = horzcat(airportNames(1),airportNames(2))

Horizontally concatenates the contents of airportNames (1) and (2). Builds the two words 'Atlanta' 'Charlotte' into a single name.

Execute the following two commands sequentially.

h) H = find(passengers > 15e6)

Finds the indices (i.e.,, positions) of cells in array passengers whose numerical value is greater than 15 million.

i) I = airportNames(H)

Selects the contents of variable airportNames whose indices match H (elements 1 and 2). Produces names Atlanta and Charlotte.

Comment on the two operations executed sequentially.