

GE U111 ENGINEERING PROBLEM SOLVING & COMPUTATION, SPRING 2004
HOMEWORK #8

DATE ASSIGNED: March 29, 2004
DATE DUE: April 5, 2004 (at the beginning of class)
READING: Chapter 3 (Etter)

PART A – USER WRITTEN FUNCTIONS

Write five Matlab functions with the inputs and outputs described below. Choose appropriate names for your functions. In each case, be sure to include comments that clearly specify what the function does. Also, include your name and section number in the comments.

1. Function 1
2 inputs: 1-D arrays X and Y
4 outputs: average and median of each input array, rounded to the nearest integer
2. Function 2
3 inputs: scalars a, b, c
2 outputs: scalars that are the roots of the quadratic equation $ax^2 + bx + c = 0$.
3. Function 3
1 input: 1-D array X
1 output: = 1 if there are any duplicates, = 0 if all array elements are distinct
4. Function 4
4 inputs: scalars a, b, c, d
0 outputs. Should calculate the determinant (ad-bc); if it equals 0, then display that the 'system of equations cannot be solved'.
5. Function 5
1 input: 1-D array X
1 output: 1-D array that consists of the elements of X sorted in *descending* order

PART B – RANDOM NUMBERS

1. You can simulate 20 single dice rolls as uniformly distributed numbers:

```
rand('seed',0);  
% Single dice roll => upper bound = 6, lower bound = 1  
% ( (6-1) * rand(1,20) ) + 1  
(5*rand(1,20)) + 1;  
% Now try to get integers 1 through 6  
round((5*rand(1,20)) + 1);  
% Try 10,000 dice rolls and plot the results  
dice1 = round((5*rand(1,20)) + 1); % Don't forget the semicolon!!  
hist(dice1, 25), title('Random dice rolls – 1 die')
```

What's wrong with this code? (Does this histogram look "uniform" to you?) How can you fix this? [HINT: instead of the round function, use ceil. Type **help ceil** to learn what this function does, and then alter the dice1 assignment statement to get a true uniform distribution of integers from 1 to 6.] Type up your solution in Matlab and plot a new histogram; make sure the histogram has a title with your name on it.

2. Use the results from Problem B1 to generate rolling 2 dice simultaneously. Simulate this for 100,000 rolls and show a new histogram of the possible combinations (i.e., the total number of dots). Type up your solution and print your resulting histogram; make sure the histogram has a title with your name on it.
3. Refer to the graphs on page 63 of the Etter text.

```
% The data for data_1 was generated by:  
rand('seed', 246);  
data_1 = rand(1,500)*2+2;  
% The data for data_2 was generated by:  
rand('seed', 95);  
data_2 = randn(1,500)+3;
```

Create an m-file with the above Matlab code. Add code to do the following:
Calculate the standard deviation, mean, median, maximum, and minimums for **each** data set; display each value to the screen.
Generate the plots to display the data. (You may want to try the **subplot** function.)
Generate histograms (10 and 25 bins) for both data sets.
Print all histograms (with titles and your name).

WHAT TO TURN IN

1. Submit the following items in a folder properly labeled and bound. Be sure that both your name and class section appear on the front of the folder. Assignments presented otherwise will be returned with penalty.
 - a. Correspondence page (cover letter, memo, fax sheet)
 - b. List of contents
 - c. Printed copy of your 5 **commented** function m-files for Part A.
 - d. Printed copy of your 3 **commented** m-files for Part B.
 - e. Printouts of 2 histograms from Parts B1-B2.
 - f. Printouts of 2 plots and 4 histograms from Part B3.
 - g. Diskette with all 8 program files.
2. Email copies of your program files to Stephen Frechette at sfrechet@ece.neu.edu by the start of class on the assignment due date. In the subject line, type the following: "Your last name, GE U111-Section X, HW 8".