Engineering 6 Spring 2016

Homework 6

Due Monday, May 2nd, 11:55 PM

For this assignment,

Complete the required preparation (Reading assignment chapter 10)

Submit a solution for each of the assigned problems. Unless otherwise noted, all problem solutions should be submitted on the same MATLAB file (.m), separated by a %%, into different publishable sections.

You will also submit a published pdf version of your solutions using the MATLAB publishing utility. The published output should be divided into a section for each problem. All solutions must then be submitted via SmartSite.

Problem 1 (30%)

A dog racing event will be held on picnic day. A farmer has five dogs (numbered from 1 to 5) and he can only send two of his best to the race. The data file HW6_Race.mat contains the racing performance of each dog. The farmer has decided to pick two with the shortest average racing time to attend the racing.

Part 1

Load HW6.mat.

Note: The file contains a 2D matrix, ***RacingInfo***, in which each row contains the information of a dog. The first column is the dog's number, each subsequent column is the time that this dog ran in one trial.

Part 2

Find the average racing time for each dog, create a new column to hold all averages, and concatenate it as the last column of ***RacingInfo***. Display the concatenated matrix.

Part 3

Sort the rows of ***RacingInfo*** by the dogs' averages. Display the sorted matrix. Use fprintf() to display which dogs will be selected to the race.

Problem 2 (30%)

Part 1

Write a function ***Pyramid*** that processes a positive, odd integer N and produces an N by (2N-1) array containing a pyramid of numbers. Do not enter the individual numbers manually, you have to use matrix functions. Example:

N = 5

Pyramid(N) =

```
0 0 0 0 1 0 0 0 0
0 0 0 2 1 2 0 0 0
0 0 3 2 1 2 3 0 0
0 4 3 2 1 2 3 4 0
5 4 3 2 1 2 3 4 5
```

Part 2

Write a function ***Vshape*** that processes a positive, odd integer N and produces an N by (2N-1) array containing numbers in the shape of V. Example:

N = 5

Vshape(N) =

```
1 0 0 0 0 0 0 0 1
1 2 0 0 0 0 0 2 1
1 2 3 0 0 0 3 2 1
1 2 3 4 0 4 3 2 1
1 2 3 4 5 4 3 2 1
```

Part 3

Write a function ***Reflect*** that processes a positive, odd integer N and produces an N by N array containing numbers that reflect along the main diagonal. Example:

N = 5

Reflect(N) =

```
6 4 3 2 1
1 6 3 2 1
1 2 6 2 1
1 2 3 6 1
1 2 3 4 6
```

Problem 3 (40%)

The file HW6.mat also contain three other matrices, ***hwScore***, ***midScore*** and ***finalScore***, which stores the homework (out of 10), midterm (out of 30) and final score (out of 50) of 11 students. The first column of each matrix contains the student number (from 101 to 111), the subsequent columns contain the scores.

Part1

Using array operations

a) Check if all the entries are within correct range (should be non-negative and less than the total score) of that category. In case there is a mistake, replace the entry of the corresponding student with the average score of that student in that category. Display the updated matrices.
b) Include the updated midterm scores and final scores to the updated ***hwScore*** as additional columns on the right and make this a new matrix called ***allScores***. Display ***allScores***. The resulting table of matrix should have 1 column for student number, 5 columns for homework, 3 columns for midterm and 1 column for final.
c) Check if the entries/scores for a student in all categories are 0. In such case remove the record of such student from ***allScores***.

Part2

Using array operations

a) Calculate the average homework score and midterm score, round them to nearest integer. Display the results.
b) Calculate the cumulative sum of each student's adjusted score. Then add 10 to it to incorporate the attendance score. Hence, the total is out of 100. Place the total in an additional column on the right of ***allScores*** and make this a new matrix called ***grades***.
c) Finally, assign a letter grade based on the numerical course grade according to the following key and place the answer in an array ***G***. Display ***G***.

A for Grade ≥ 90,
B for 90 > Grade ≥ 80,
C for 80 > Grade ≥ 70,
D for 70 > Grade ≥ 60,
E for 60 > Grade.