CLRS-720: Computational Vision Science

Assignment: Homework 1

Objective: This assignment is designed to familiarize you with the basics of MATLAB for color science and to help identify any skills that need your attention, including matrix algebra, programming basics, script, and function documentation (comments), etc.

Instructions: You will submit 2 MATLAB m-files to the appropriate Assignment folder in myCourses, and a hard-copy. The first m-file is a **script** called **YourNameScript.m** that answers each of the following questions in order, with comments referring to the question numbers and explaining what the code is doing. The second m-file is a **function** called **YourNameStats.m** that implements statistical summaries as explained in Question 5. The hard-copy is from Q3c.

Example: Here is an example of code from the YourNameScript.m file. Please mimic this example's formatting and commenting style in your document.

```
% ChrisThorstensonScript.m: CVS Homework 1 Assignment
% 9-1-2021

%%Question 1: matrix addressing and properties
%1a create the matrix
mat1 = [41 36 18; 21 72 7; 2 12 95]
%1b element (2,1)
mat1(2,1)
%1c matrix inverse
…
```

Questions:

1. Matrix addressing and properties

    a. Create the following matrix:
    $$mat1 = \begin{bmatrix} 41 & 36 & 18 \\ 21 & 72 & 7 \\ 2 & 12 & 95 \end{bmatrix}$$

    b. What is the value of the element in row 2, column 1?

    c. What is the inverse of the matrix?

    d. What are the sums of each column?

    e. What are the sums of each row? Bonus: Answer this question two different ways.

2. Variable creation and random numbers:

    a. Create a variable named notMuch that is 5x12 in size consisting of all zeros.

b. Create a variable named `Renny` that is 14x3 in size consisting of random integers in the range 9 to15.

c. Create a variable named `Billy` consisting of 300 normally distributed random numbers with a mean of 50 and a standard deviation of 10.

d. Check that Billy has the correct mean, standard deviation, and is normally distributed

e. Create a vector named `Fiver` with 5 elements covering the range 1 to 5.

f. Create a new variable named `manyFivers` that is 5 replicates of `Fiver` in consecutive rows.

3. Linear systems:

a. Solve the linear system (`mat1` is from Question1):

$$mat1 \begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} = \begin{bmatrix} 20 \\ 20 \\ 20 \end{bmatrix}$$

b. Solve the linear system:

$$mat1 \begin{bmatrix} b_{1,1} & b_{1,2} & b_{1,3} \\ b_{2,1} & b_{2,2} & b_{2,3} \\ b_{3,1} & b_{3,2} & b_{3,3} \end{bmatrix} = \begin{bmatrix} 41.1 & 47.5 & 95 \\ 2.1 & 50 & 100 \\ 0.2 & 54.5 & 109 \end{bmatrix}$$

c. Matrix multiply `mat1 * mat1`; Then do this by hand (but use a calculator!) to get the same answer, showing your work. Turn this in as a hand-written copy with your name on it.

4. Loops and logic:
a. Write a loop that displays the series 1,4,9,16,25,…,2500.

b. Write a nested loop that builds the matrix one element at a time: $\begin{bmatrix} 1 & 5 & 9 & 13 \\ 2 & 6 & 10 & 14 \\ 3 & 7 & 11 & 15 \\ 4 & 8 & 12 & 16 \end{bmatrix}$

5. Write a function called `YourNameStats` in an m-file called `YourNameStats.m` that computes and displays basic statistical summaries of the input it receives. The function should accept a 2-D matrix of values, and compute mean, min, and max values for each column of the input matrix.

In the `YourNameScript.m` file, Write the following call to your function:

```
varStats = YourNameStats(reshape(1:45,9,5));
```

This call should result in the displayed output:

```
Statistics for the variable:
Mean: 5    14    23    32    41
Min:  1    10    19    28    37
Max:  9    18    27    36    45
```

The call should also save the numerical values into the variable `varStats`