ECE-5554 Computer Vision: Problem Set 0

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LaTeX

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Matlab Code

Answer Sheet

Short answer problems

1. Skipped.

2. (a) Creates a row vector containing random permutations of numbers between 1 and 1000.

   (b) Line 1: Creates a matrix:

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

   Line 2 assigns the second row of x to the variable b.

$$b = [4, 5, 6]$$

   (c) Creates a matrix:

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

Line 2 assigns the all the values the variable b in column vector form.

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

(d) Line 1 creates the column vector f [1×5] with the normally distributed random values.

Line 2 sets another variable and fills it with the elements of f which are above 0.

(e) Line 1 sets a row vector [1×10] with zeros and adds 0.5 to each element of it.

$$x = [0, 0, 0, 0, 0, 0, 0, 0, 0, 0] + 0.5$$

$$x = [0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5]$$

Line 2 creates another row vector with the same size of vector x [1×10], and multiplies each element of new row vector with 0.5.

$$y = [1, 1, 1, 1, 1, 1, 1, 1, 1, 1] \times 0.5$$

$$y = [0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5]$$

Line 3 sums vector x and y and assigns the result to z.

$$z = x + y$$

$$z = [1, 1, 1, 1, 1, 1, 1, 1, 1, 1]$$

(f) Line 1 creates a row vector [1×100] which contains the sequence starting from 1 to 100 (inclusive).

$$a = [1, 2, 3, 4 \ldots 98, 99, 100]$$

Line 2 flips the vector and sets vector b with these values.

$$a = [100, 99, 98, 97 \ldots 3, 2, 1]$$

3. The code is in PS0_1-3.m file.

(a)
```
function result = diceTrials(n)
    if(n>0)
        result = uint8(rand([1,n])*5)+1;
    else
        result = 'You may wanna not to do that operation, the number
        error(result)
end
```

(b)

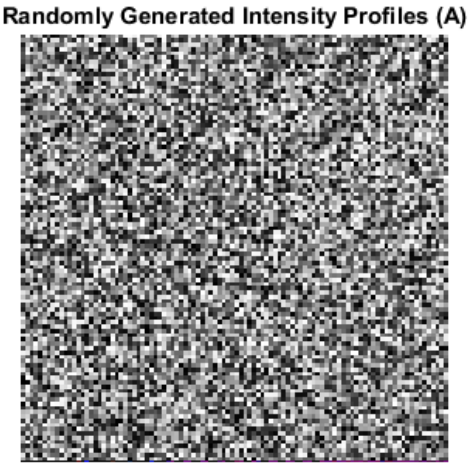
(c)

(d)
```
%% clear workspace, and command window, close all figures already op
clear all, close all, clc;
%% PS0-1.3a
diceResults = diceTrials(99);
%% PS0-1.3b
% y = [1, 2, 3, 4, 5, 6]'
y = (1:6)';
% z = [1, 3, 5; 2, 4, 6]
z = reshape(y,[2,3]);
```

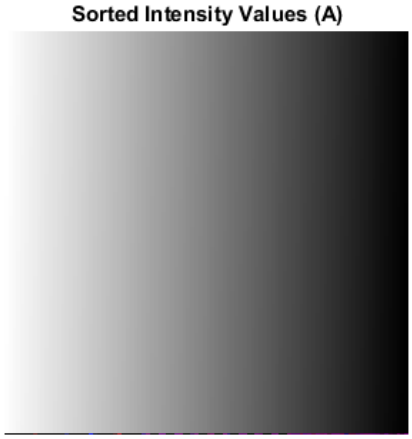
```
%% PS0-1.3c
% find the max value of matrice y and of which indice
[x, I] = max(y);
% convert indice to subscripts (row and column number)
[r, c] = ind2sub(size(z),I);
%% PS0-1.3d
% create vector v = [1, 8, 8, 2, 1, 3, 9, 8]
v = [1,8,8,2,1,3,9,8];
% alter the value of vector x
% the problem can be solved by two different approach
% 1 - x = numel(v(v==1))
% 2 - x = sum(v==1)
x = numel(v(v==1));
```

4. The code is in PS0Q1.m file.

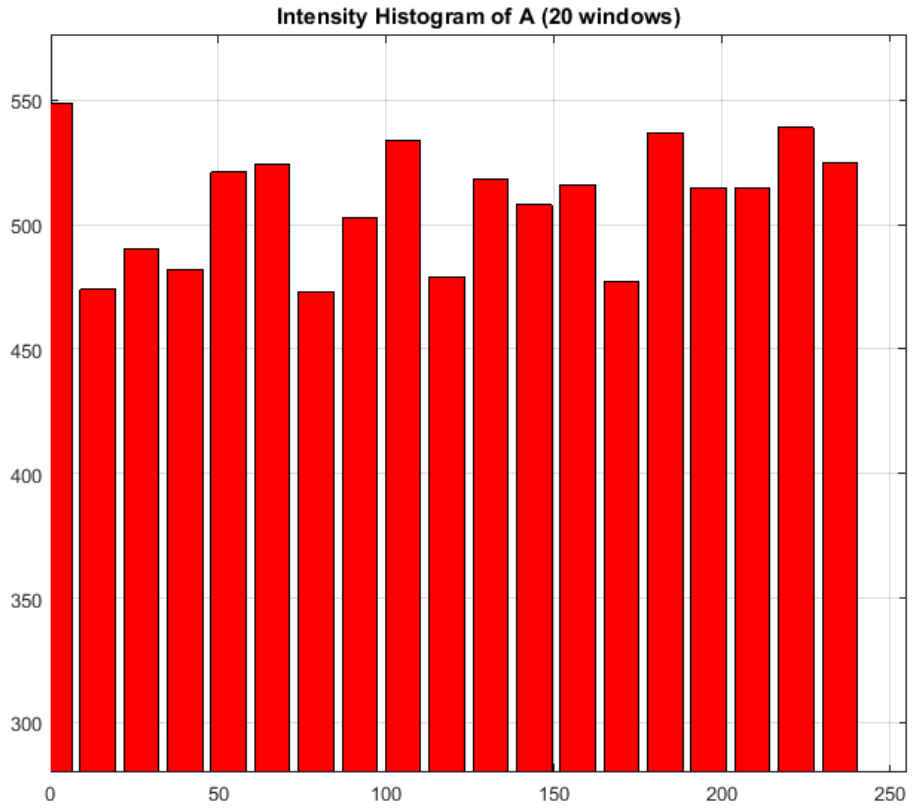
   The source matrix created and used as input file is depicted below.



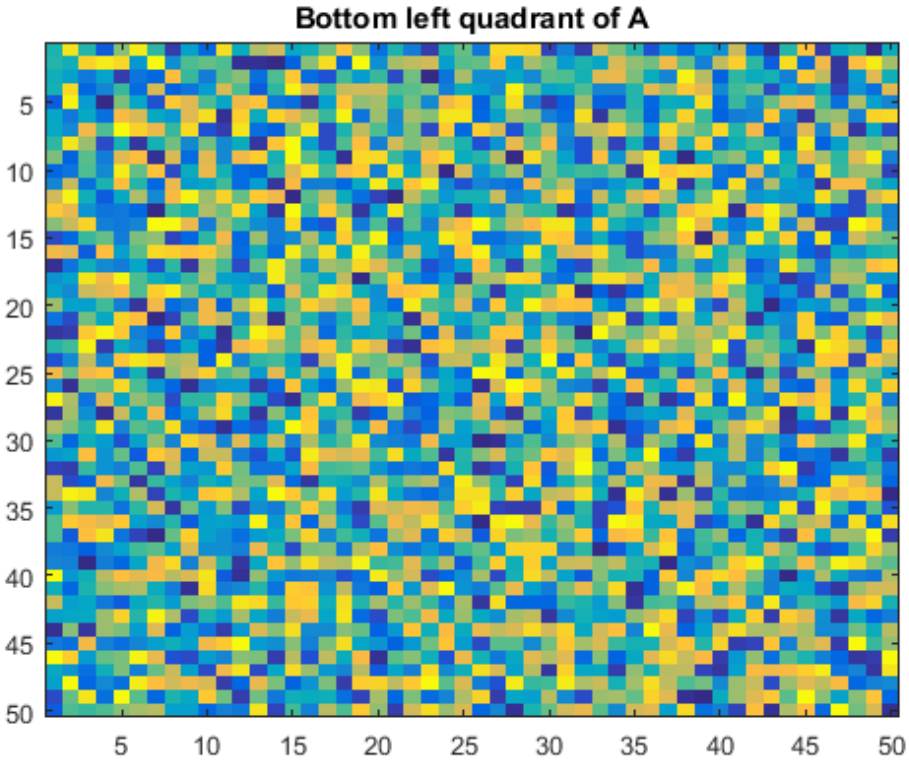
(a) Randomly generated intensity and the result of sort process.



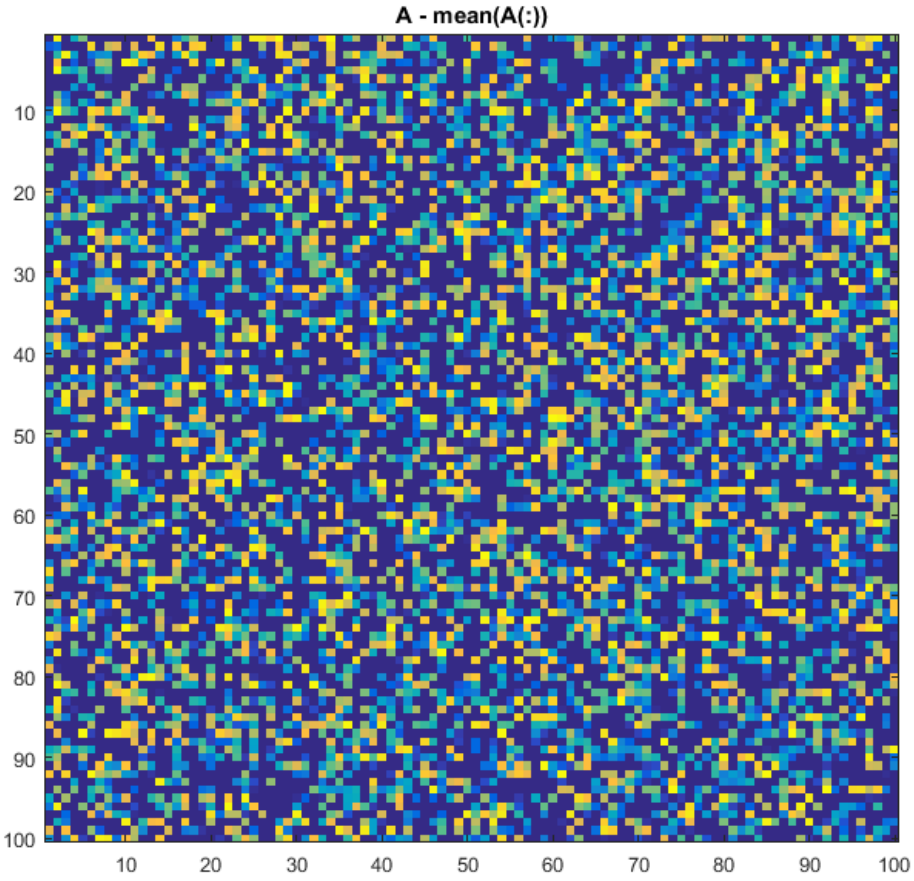
(b) Intensity histogram of A is given below.



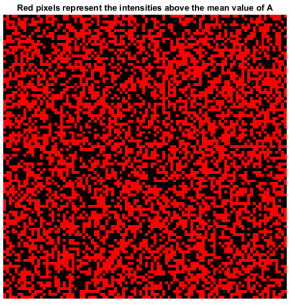
(c) The bottom left quadrant of A is depicted below. Please also find the attached outputXPS0Q1.mat in the zipped folder.



(d) Please find the attached outputYPS0Q1.mat file.



(e) Please find the attached outputYPS0Q1.mat file.




```
1 %% clear workspace , and command window, close all figures already op
```

```
clear all, close all, clc;
figure(1);
A = uint8(randi(255,[100,100]));
figure(1);
imshow(A);
title('Randomly Generated Intensity Profiles (A)')
save('inputAPS0Q1.mat', 'A');
load('inputAPS0Q1.mat', 'A');
%% PS-0 4a
A_sorted = sort(reshape(A,[numel(A), 1]), 'descend');
A_sorted = reshape(A_sorted, size(A));
figure(2);
imshow(A_sorted);
title('Sorted Intensity Values (A)')
%% PS-0 4b
bins = 20;
maxA = max(A(:));
minA = min(A(:));
range = (maxA-minA)/bins;
hist = zeros(1,bins);
y = zeros(1,bins);
for i=1:20
    hist(i) = numel(A(A>=(minA+(i-1)*range) & A<(minA+(i)*range)));
    y(i) = minA+(i-1)*range;
end
figure(3);
bar(y,hist, 0.8, 'r');
```

```
29 axis([0 255 min(hist) max(hist)*1.05])
30 grid on;
31 title('Intensity Histogram of A (20 windows)');
32 %% PS-0 4c
33 % X = A_sorted(size(A,1)/2:size(A,1), 0:size(A,2)/2);
34 X = A(size(A,1)/2+1:size(A,1), 1:size(A,2)/2);
35 save('outputXPS0Q1.mat','X');
36 figure(4);
37 imagesc(X);
38 title('Bottom left quadrant of A');
39 %% PS-0 4d
40 Y = A - mean(A(:));
41 save('outputYPS0Q1.mat','Y');
42 figure(5);
43 imagesc(Y);
44 title('A - mean(A(:))');
45 %% PS-0 4e
46 Z = uint8(zeros(size(A_sorted,1),size(A_sorted,2),3));
47 ind = find(A>mean(A(:)));
48 [u, v] = ind2sub(size(A),ind);
49 for i=1:numel(ind)
50     Z(u(i),v(i),:) = [255,0,0];
51 end
52 figure(6);
53 imshow(Z);
54 title('Red pixels represent the intensities above the mean value of A
```

Short Programming Question

1. 

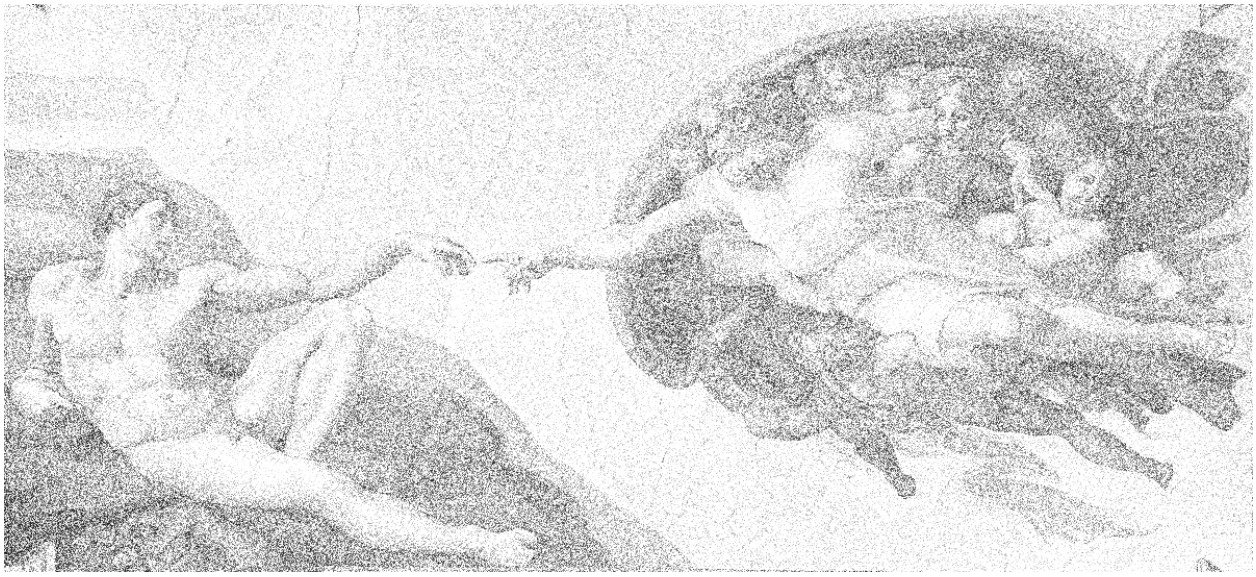
2. 

3.

(a)

(b)

(c)



```
%% clear workspace , and command window, close all figures already open.
clear all, close all, clc;
figure(1);
A = uint8(randi(255,[100,100]));
figure(1);
imshow(A);
title('Randomly Generated Intensity Profiles (A)')
```

```
8  save('inputAPS0Q1.mat', 'A');
9  load('inputAPS0Q1.mat', 'A');
10 %% PS-0 4a
11 A_sorted = sort(reshape(A,[numel(A), 1]), 'descend');
12 A_sorted = reshape(A_sorted, size(A));
13 figure(2);
14 imshow(A_sorted);
15 title('Sorted Intensity Values (A)')
16 %% PS-0 4b
17 bins = 20;
18 maxA = max(A(:));
19 minA = min(A(:));
20 range = (maxA-minA)/bins;
21 hist = zeros(1,bins);
22 y = zeros(1,bins);
23 for i=1:20
24     hist(i) = numel(A(A>=(minA+(i-1)*range) & A<(minA+(i)*range)));
25     y(i) = minA+(i-1)*range;
26 end
27 figure(3);
28 bar(y,hist, 0.8, 'r');
29 axis([0 255 min(hist) max(hist)*1.05])
30 grid on;
31 title('Intensity Histogram of A (20 windows)');
32 %% PS-0 4c
33 % X = A_sorted(size(A,1)/2:size(A,1), 0:size(A,2)/2);
34 X = A(size(A,1)/2+1:size(A,1), 1:size(A,2)/2);
```

```
35 save('outputXPS0Q1.mat','X');
36 figure(4);
37 imagesc(X);
38 title('Bottom left quadrant of A');
39 %% PS-0 4d
40 Y = A - mean(A(:));
41 save('outputYPS0Q1.mat','Y');
42 figure(5);
43 imagesc(Y);
44 title('A - mean(A(:))');
45 %% PS-0 4e
46 Z = uint8(zeros(size(A_sorted,1),size(A_sorted,2),3));
47 ind = find(A>mean(A(:)));
48 [u, v] = ind2sub(size(A),ind);
49 for i=1:numel(ind)
50     Z(u(i),v(i),:) = [255,0,0];
51 end
52 figure(6);
53 imshow(Z);
54 title('Red pixels represent the intensities above the mean value of A');
```