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DSAA Assignment 4

Problem 1

a)

Function create_mat_dct() outputs the the 8-point 2D-DCT basis function F.

create_mat_dct() gives:

0.3536 0.3536 0.3536 0.3536 0.3536 0.3536 0.3536 0.3536
0.4904 0.4157 0.2778 0.0975 -0.0975 -0.2778 -0.4157 -0.4904
0.4619 0.1913 -0.1913 -0.4619 -0.4619 -0.1913 0.19130.4619
0.4157 -0.0975 -0.4904 -0.2778 0.2778 0.4904 0.0975 -
0.4157
0.3536 -0.3536 -0.3536 0.3536 0.3536 -0.3536 -0.3536
0.3536
0.2778 -0.4904 0.0975 0.4157 -0.4157 -0.0975 0.4904 - 0.2778
0.1913 -0.4619 0.4619 - 0.1913 -0.1913 0.4619 -0.46190.1913
0.0975 -0.2778 0.4157 - 0.4904 0.4904 -0.4157 0.2778
- 0.0975

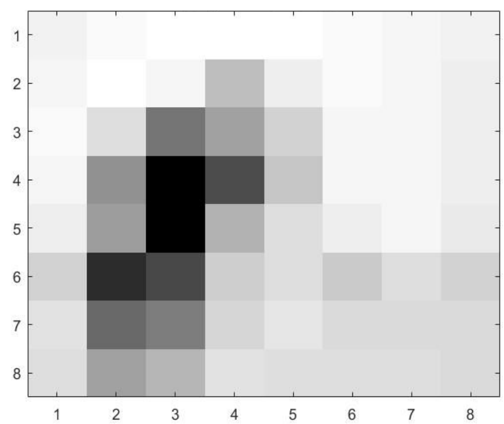
b)

Function myDCT(Im,F):

returns DCT Transformed Image.

Output = F*Im*F' where F is 8-point 2D-DCT basis function F.

For eg. 8 x 8 image transform using myDCT function.

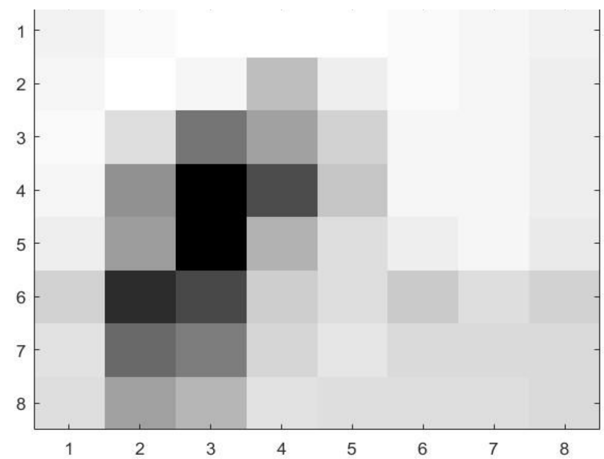


c) Function myIDCT(Im,F):

returns Inverse of DCT Transform.

Output = F'*Im*F where F is 8-point 2D-DCT basis function F.

For eg. 8 x 8 image Inverse transform using myIDCT function.

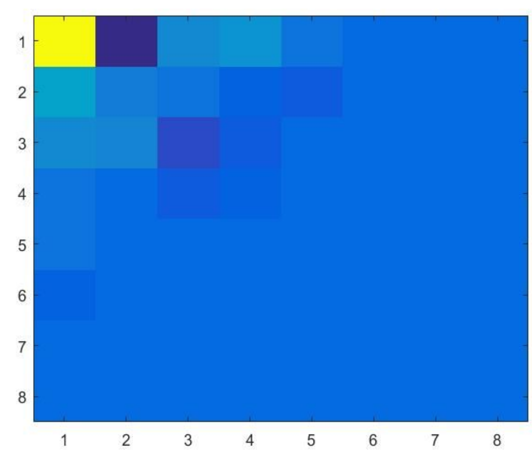


d)

Function **myDCT_quantization(imDCT,qm,c):**

returns quantized DCT image.

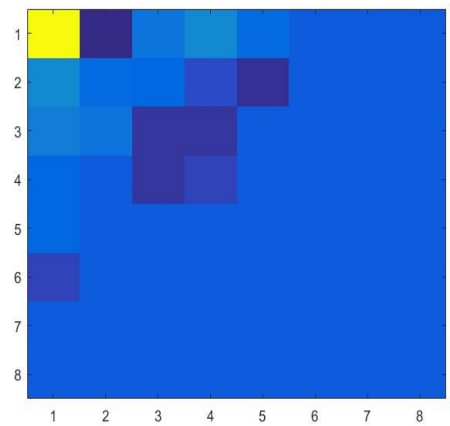
For eg.



e) Function **myDCT_dequantization(imDCT,qm,c):**

returns de-quantized DCT image.

For eg.



f)

Function RMSE(im1, im2), which computes RMSE error between two images of arbitrary size

Calculated using formula:

sqrt(mean((double(im1(:)) - double(im2(:))).^2,'all'));

where im1=image1 and im2=image2

g)

Function My_entropy(im), computes the entropy of a given image using the imhist() function.

- First calculate PDF
- Set any entries in the PDF that are 0 to 1 so log calculation works
- Calculate entropy using formula: -**sum(h.*log2(h));**

Entropy of given image “LAKE.TIF” = 7 .4845

2.

Q_mat =

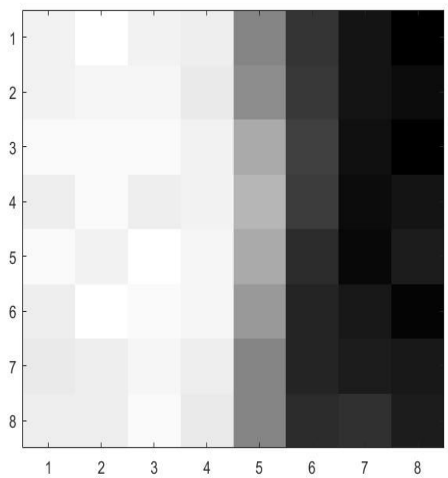
16	11	10	16	24	40	51	61
12	12	14	19	26	58	60	55
14	13	16	24	40	57	69	56
14	17	22	29	51	87	80	62
18	22	37	56	68	109	103	77
24	35	55	64	81	104	113	92
49	64	78	87	103	121	120	101
72	92	95	98	112	100	103	99

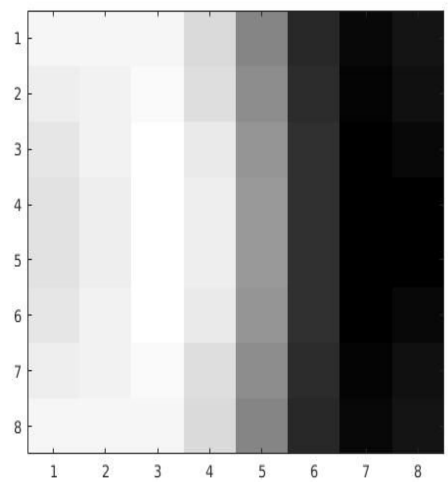
C = 2 here C=compression factor;

For Left corners are at the coordinates:

- [420, 45]:

Original Image: **Compressed Image:**

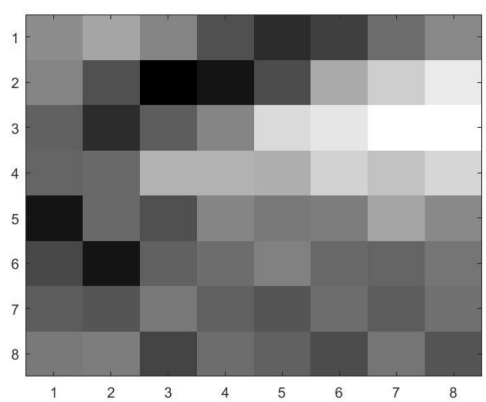




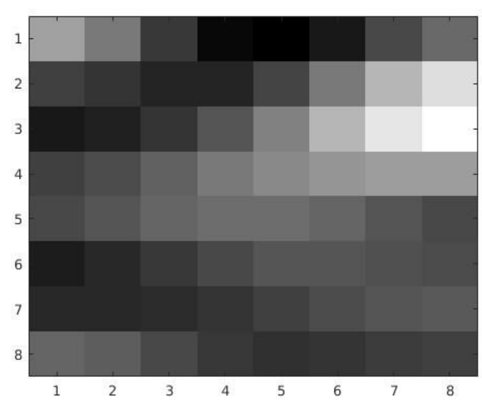
A lot variation is present between the values of the pixels,as a results the image is reconstructed almost perfectly after compression.

- For [427, 298]

Original:



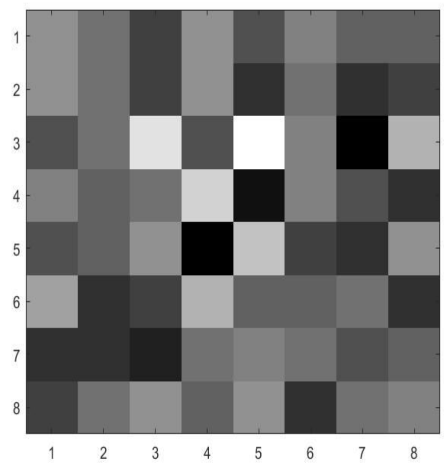
Reconstructed



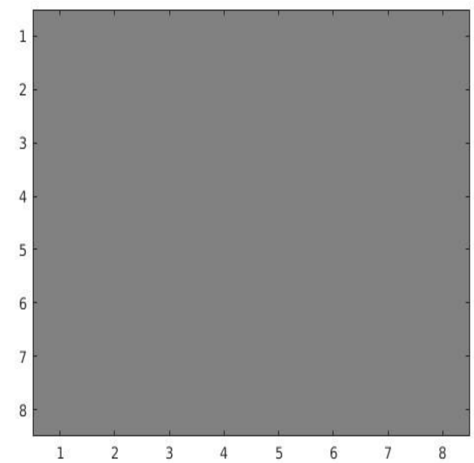
In this image there is less variation between values of pixels.As a result,after quantization less number of non-zero values are present. So image reconstruction is not satisfactory.

- For [30, 230]

Original



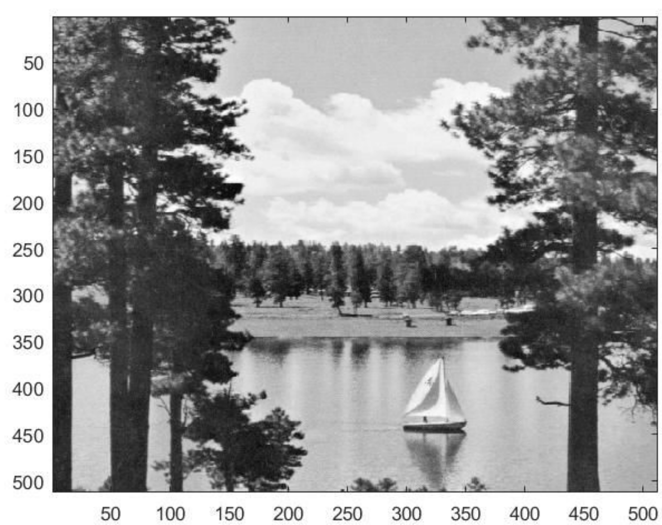
Reconstructed



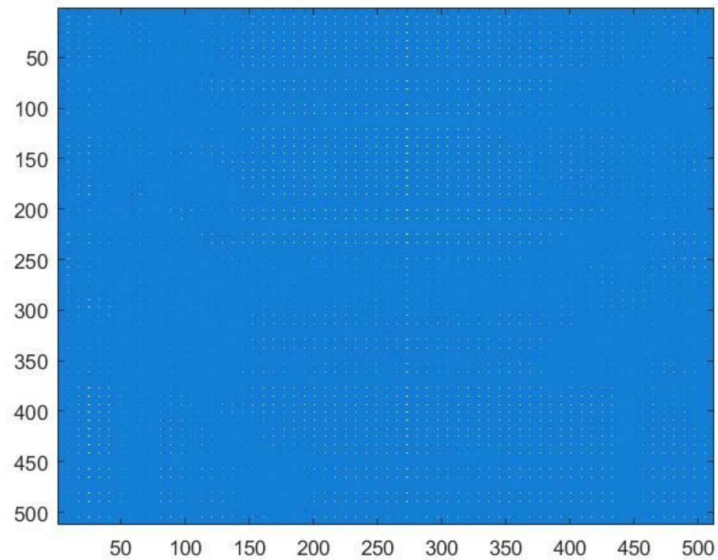
As variation of Image3 is very small,therefore after taking dct , quantization leads to a significant loss of information. As a result the image is not properly reconstructed.

3.

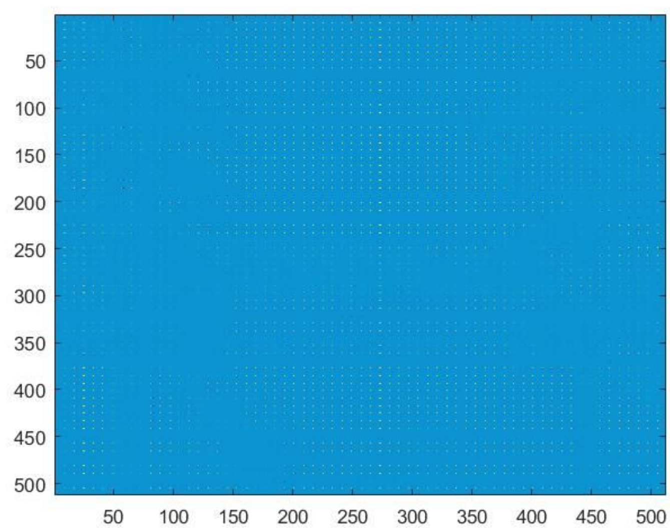
Original image



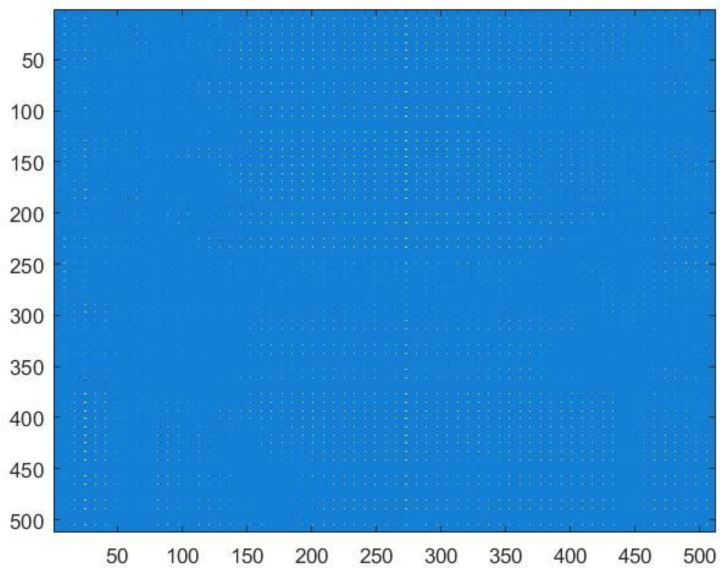
DCT_Transform



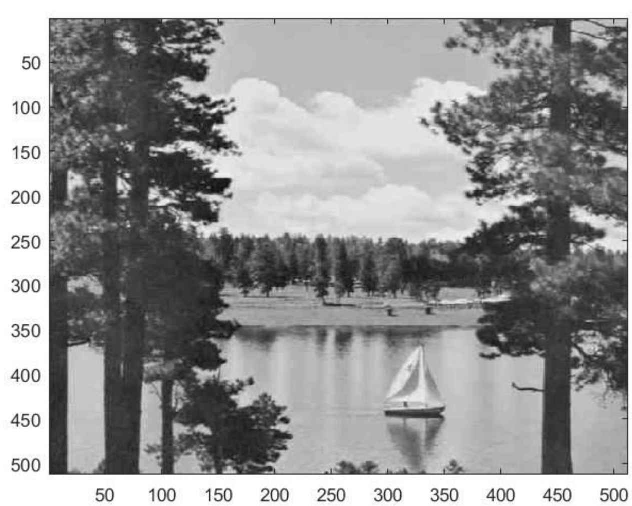
Quantized_image



De-quantized_image



Reconstructed_image



For compression factor=2:

We observe that the image is almost perfectly reconstructed after compression.

4.

For c=2:

Original Reconstructed

Entropy: 0.0010

RMSE: 7.4132

For c=4:

Original Reconstucted

Entropy:0.0034
RMSE:9.4709

For c=8:
Original Reconstructed

Entropy: 0.0077
RMSE:12.7261

For c=10
Original Reconstructed

Entropy:0.0103
RMSE:14.0217

6. c=15
Original Reconstructed

Entropy:0.0165
RMSE:17.3306

We see that as we increase the value of c the amount of pixelation in the image increases.
As a result, c = 2 or 3 must be sufficient to reconstruct the image.

In c = 10
Error value is very high ~14 and entropy is also high ~0.01
At c = 10, we observe a huge amount of pixelation.