A3Q5:

N = length(y);

xpts = linspace(0,N,N);

figure(1);

plot(xpts, y);

title('sound of birds and train');

F = fft(y);

figure(2);

h = stem(xpts, abs(F));

set(h, 'Marker', 'none')

title('sound of DFT birds and train');

trainIndex = 2200;

birdIndex = 2500;

% isolate the train sound, zero out bird - low pass

train\_Sound = F;

train\_Sound(trainIndex: N - trainIndex) = 0;

train\_sound = ifft(train\_Sound);

figure(3);

plot(xpts, real(train\_sound));

title('Train only - Plot');

figure(4);

a = stem(xpts, abs(train\_Sound));

set(a, 'Marker', 'none');

title('Train only - stem');

% isolate the bird sound, zero out train, high pass

bird\_Sound = F;

bird\_Sound(1:birdIndex) = 0;

bird\_Sound(N - birdIndex: N) = 0;

bird\_sound = ifft(bird\_Sound);

figure(5);

plot(xpts, real(bird\_sound));

title('Bird only - Plot');

figure(6);

b = stem(xpts, abs(bird\_Sound));

title('Bird only - stem');

set(b, 'Marker', 'none');

A3Q6:

I = imread('operahall.jpg');

I = im2double(I);

I = I(1:32, 481:512);

Y = fft2(I);

figure(1);

bar3(Y);

h = bar3(Y)

set(h, 'facecolor', 'white');

title('2D FFT')

Y(1,1) = 0;

figure(2);

bar3(Y);

h = bar3(Y)

set(h, 'facecolor', 'white');

title('2D FFT - zero out 1')

function [y, drop] = Compress(X, tol)

block\_size = 32;

f = X;

[row, col] = size(f);

result = zeros(row, col);

Num\_drop = 0;

Num\_nonzero = 0;

for i = 1:block\_size:row

for j = 1:block\_size:col

%for each block of 32

f\_32 = f(i:i+block\_size-1, j:j+block\_size-1);

f\_32 = fft2(f\_32);

temp = f\_32(1, 1);

f\_32(1,1) = 0;

maxf = max(max(abs(f\_32)));

%number of nonzero and number of dropped

f\_nonzero = f\_32(f\_32 ~=0);

Num\_nonzero = Num\_nonzero + length(f\_nonzero);

Ele\_dropped = f\_nonzero(abs(f\_nonzero) <= maxf\*tol);

Num\_drop = Num\_drop + length(Ele\_dropped);

%set to be 0

f\_32(abs(f\_32) <= maxf\*tol) = 0;

f\_32(1,1) = temp;

%reconstruct the new/compressed 32\_32 image array by using the inverse 2D Fourier

result(i:i+block\_size-1, j:j+block\_size-1) = real(ifft2(f\_32));

end

end

y = result;

drop = Num\_drop / Num\_nonzero;

end

I = imread('operahall.jpg');

I = im2double(I);

figure(1);

subplot(2,2,1);

P1 = Compress(I, 0.015);

imshow(P1);

title('P1 tol=0.015, drop = 0.5');

subplot(2,2,2);

P2 = Compress(I, 0.063);

imshow(P2);

title('P2 tol=0.063, drop = 0.85');

subplot(2,2,3);

P3 = Compress(I, 0.161);

imshow(P3);

title('P3 tol=0.161, drop = 0.95');

subplot(2,2,4);

P4 = Compress(I, 0.3);

imshow(P4);

title('P4 tol=0.3, drop = 0.98');

figure(2);

subplot(2,2,1);

f1 = ones(size(I)) - abs(P1 - I);

imshow(f1);

title('f1 tol=0.015, drop = 0.5');

subplot(2,2,2);

f2 = ones(size(I)) - abs(P2 - I);

imshow(f2);

title('f2 tol=0.063, drop = 0.85');

subplot(2,2,3);

f3 = ones(size(I)) - abs(P3 - I);

imshow(f3);

title('f3 tol=0.161, drop = 0.95');

subplot(2,2,4);

f4 = ones(size(I)) - abs(P4 - I);

imshow(f3);

title('f4 tol=0.3, drop = 0.98');

















