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Cosc 360

Code written for Quiz 2

Question 1:

```
clear;
close;

F = 200E6;
t = 1/F;
T = t:t:10E-6;
y = zeros(size(T));

function retval = sinn_An(n,x)
        An = 2/pi/n;
        retval = An*sin(n.*x);
endfunction

function retval = fourier_square(n,x)
        retval = 0.5;
        for i=[0:n]
                retval = retval+sinn_An(2*i+1,x);
        endfor
endfunction

x = 2*pi*1.4E6*T;
y = fourier_square(100,x);

Y = fft(y);
Y = Y(1:end/2);
Y = abs(Y);
f = linspace(0, F/2, length(Y));

subplot(2, 1, 1);
plot(T, y)
subplot(2, 1, 2);
plot(f, Y)
```

Question 3:

```
clear;
close;
```

```
N = 1000;
t = 1/N;
T = t:t:1;
d = zeros(size(T));
d(1) = 1;

y = fft(d);
a = abs(y);
b = arg(y);
f = linspace(0, N/2, length(y));

subplot(2, 1, 1);
plot(f, a)
subplot(2, 1, 2);
plot(f, b)

d(1) = 0;
d(100) = 1;
y = fft(d);
a = abs(y);
b = arg(y);
f = linspace(0, N/2, length(y));


subplot(3, 1, 1);
plot(f, a)
subplot(3, 1, 2);
plot(f, b)

subplot(3, 1, 3);
plot(unwrap(f,b))
```

Question 4:

```
clear;
close;

fs = 10E6;
dt = 1/fs;
```

```
f = 100E3;
tmax = 6e-3;
A = 1.0;
t = dt:dt:tmax;

x = sin(2*pi*f*t);
x(find(x>=0.75)) = 0.75;
x(find(x<=-0.75)) = -0.75;
d = abs(fft(x));

freqs = linspace(0, fs/2, length(d));

semilogy(freqs, d)
```

Question 5:

```
clear;
close;
home;

% Question 1
X = load("Nasdaq_closing_prices_2024_2025.m");
plot(X(:,1), X(:,2), '-', 'color', 'black');
xlabel('Days');
ylabel('Price (USD)');

% Question 2
N = length(X);
fs = 1;
fmax = fs/2;
f = linspace(0, fmax, N/2);

y = abs(fft(X(:,2)));
y = y(1:end/2);

semilogy(f, y, '-', 'color', 'black')

% Question 3
fs = 1;
dt = 1/fs;
```

```
T = 365.0;
t = [dt:dt:T];
x = X(:,2);

kern = ones(7, 1)/7;
Y = conv(x, kern);

subplot(2, 1, 1);
plot(X(:,1), X(:,2), '-', 'color', 'black');
xlabel('Days');
ylabel('Price (USD)');
subplot(2, 1, 2);
plot(Y);
xlabel('Days');
ylabel('Price (USD)');
```

Question 6:

```
clear;
close;

fs = 10.0E6;
fcl = 745E3;
fch = 735E3;
dt = 1/fs;
fcarrier = 740E3;
faudio = 2.5E3;
T = 1e-3;
t = dt:dt:T;
x = randn(size(t))*10;

function ret = sinc(i, fC)
  ret = sin(2*pi*fC*i)/(i*pi);
endfunction

function ret = black(i, M)
  ret = 0.42 - 0.5*cos(2*pi*i/M)+0.08*cos(4*pi*i/M);
endfunction

function ret = windowed_sinc(fC,M)
```

```
  ret = zeros(M, 1);
  for i=1:M
    if (i==M/2)
      ret(i) = 2*pi*fC;
    else
      ret(i) = sinc(i-M/2, fC)*black(i,M);
    endif
  endfor
  ret = ret/sum(ret);
endfunction

function ret = spec_inver(fC, M)
  ret = -windowed_sinc(fC, M);
  ret(M/2) = 1+ret(M/2);
endfunction

y = sin(2*pi*fcarrier*t)+x;
kernel = windowed_sinc(fcl, 100);
kern = spec_inver(fch, 100);
Y = conv(conv(kernel, kern), y);

w = sin(2*pi*faudio*t);
z = y.*w;
Z = conv(conv(kernel, kern), z);

d = abs(fft(Z));
d = d(1:end/2);
freq = linspace(0, fs/2, length(d));
semilogy(freq, d)
```