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```
clear; clc;
```

## Section A

```
[x, fs] = audioread('SunshineSquare.wav');

window = hamming(1024); % window function
noverlap = 512; % overlap between windows
nfft = 2048; % FFT size

[S, F, T] = spectrogram(x, window, noverlap, nfft, fs);

%plot before remove the noises
figure;
imagesc(T, F, 20*log10(abs(S)));
axis xy;
colorbar;
colormap(jet);
xlabel('Time (s)');
ylabel('Frequency (Hz)');
title('Spectrogram of Original Signal');

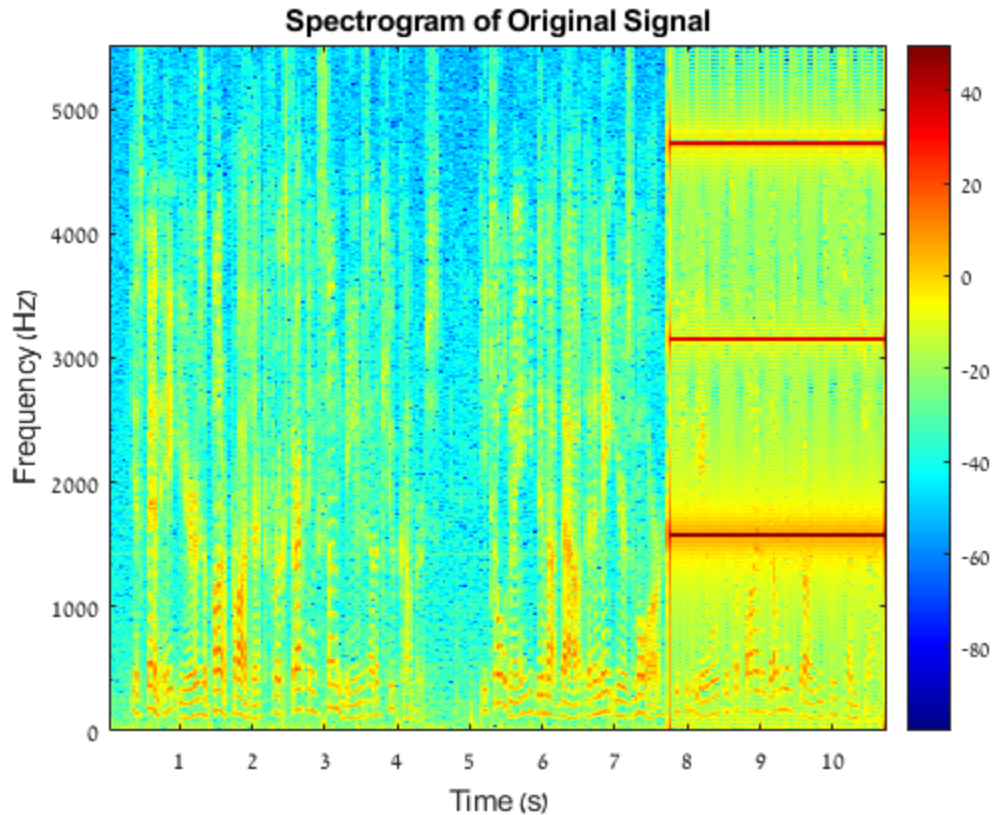
%finding the noises by looking at the spectrogram graph
freqs=[30 , 1575 , 3150 , 4725];

% convert frequencies to discrete-time frequencies (w)
dw = 2*pi/nfft;
to_w = freqs * dw; %multiply each freq to convert to discrete time

disp('Sinusoidal frequencies (Hz):');
disp(freqs);
disp('Sinusoidal frequencies (w):');
disp(to_w);

Sinusoidal frequencies (Hz):
      30      1575      3150      4725

Sinusoidal frequencies (w):
  0.0920   4.8320   9.6641  14.4961
```



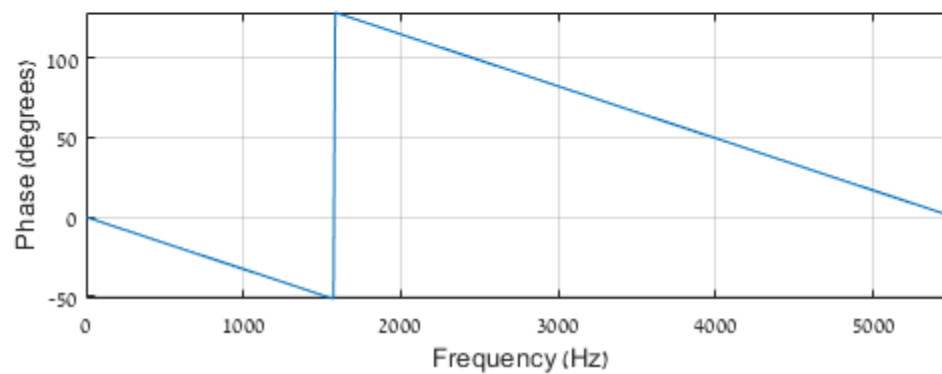
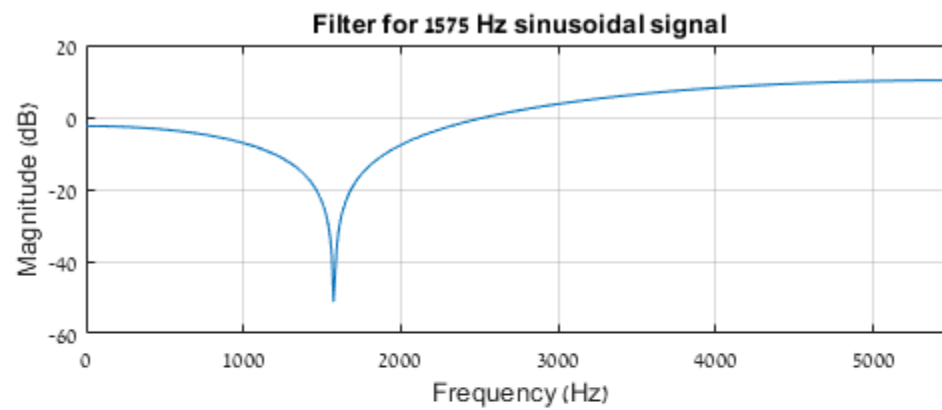
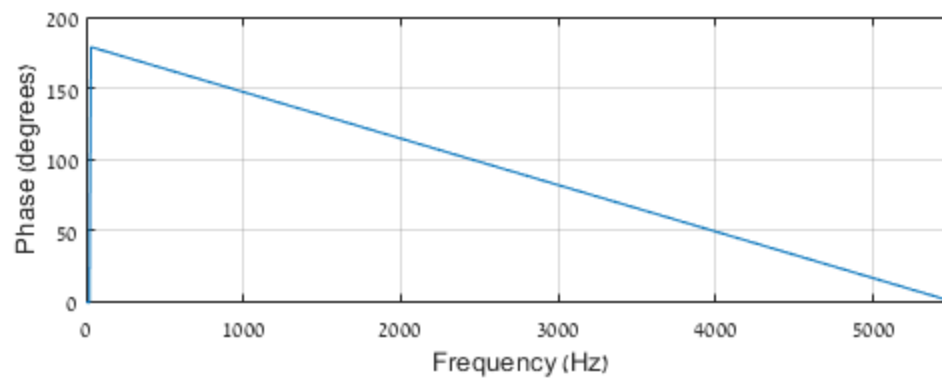
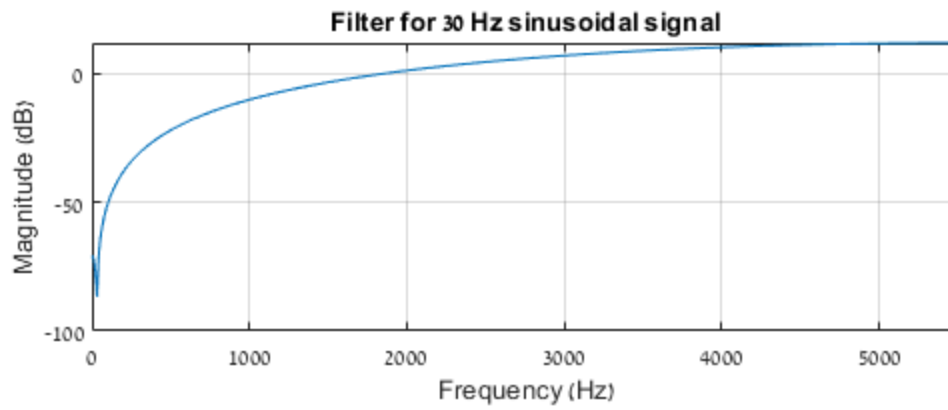
## Section B

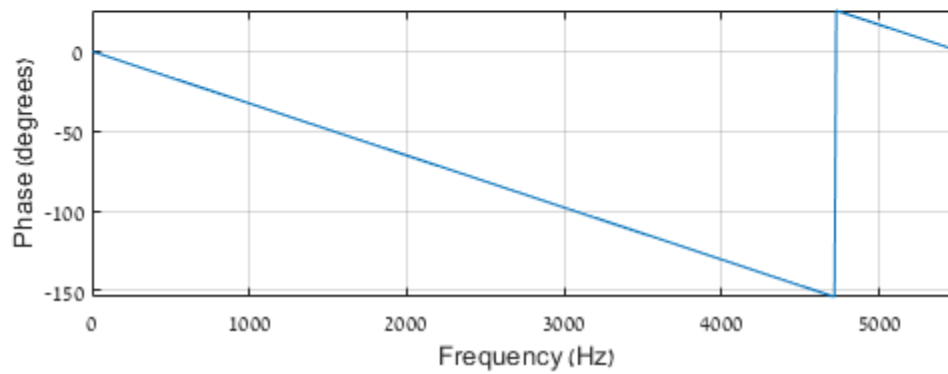
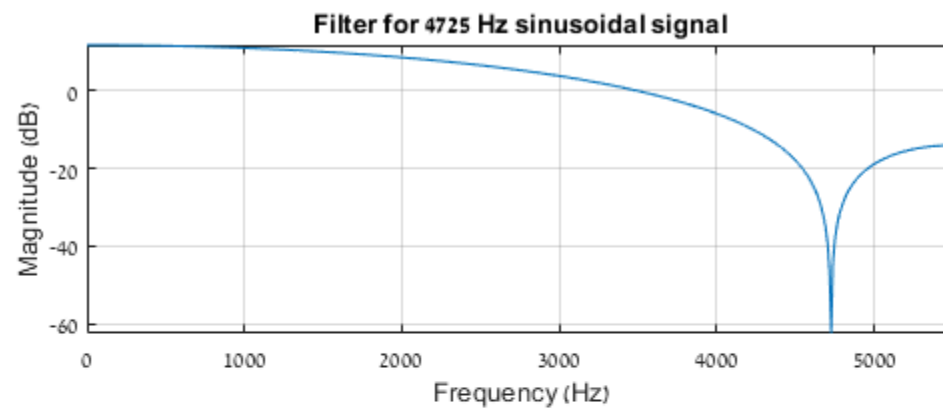
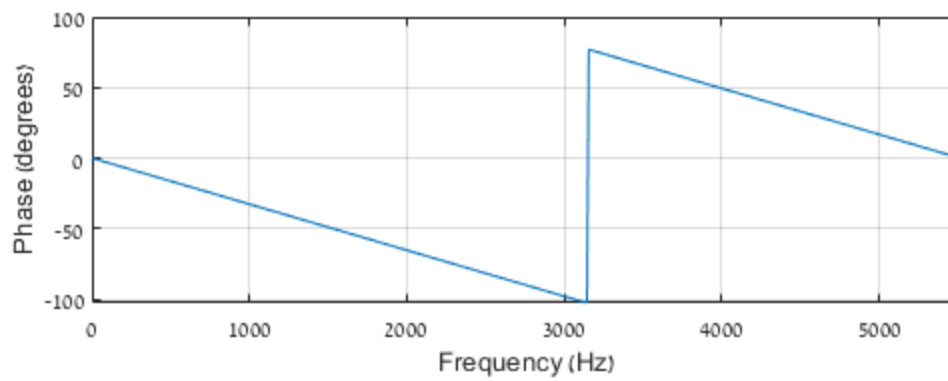
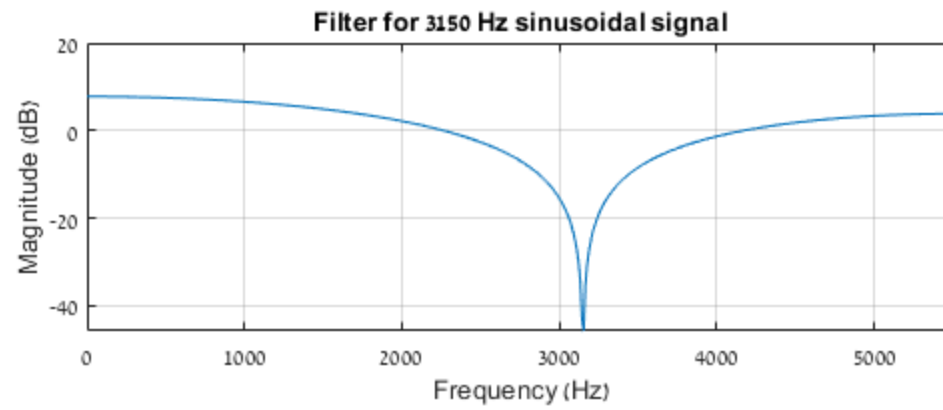
```
%we found the formula by mathematical calc on notebook
As = -2*cos(2*pi*freqs/fs);
for j = 1:length(freqs)
    fprintf("Frequency %d Hz: A = %f\n", freqs(j), As(j));
end
```

```
Frequency 30 Hz: A = -1.999708
Frequency 1575 Hz: A = -1.246980
Frequency 3150 Hz: A = 0.445042
Frequency 4725 Hz: A = 1.801938
```

## Section D

```
total_mag=1;
empty_slot=[];
for i = 1:length(As)
    local_h=[1 As(i) 1];
    figure;
    freqz(local_h, 1, empty_slot ,fs);
    total_mag= conv(total_mag,local_h);
    title(sprintf('Filter for %d Hz sinusoidal signal', freqs(i)));
end
```

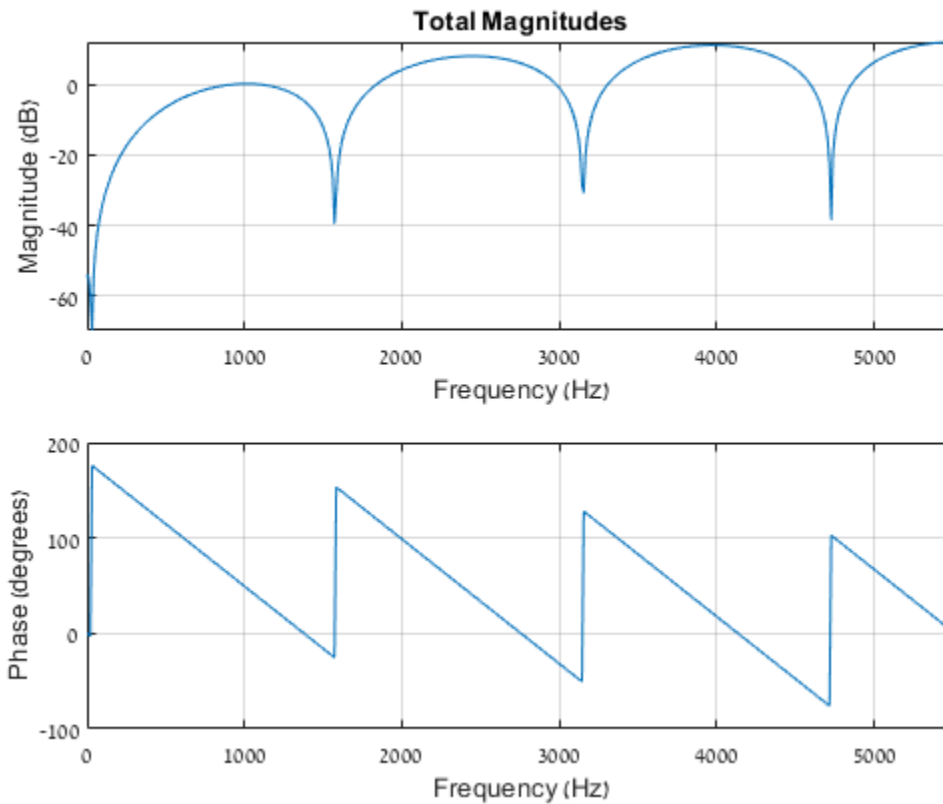




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## Section E

```
figure;  
freqz(total_mag, 1, empty_slot ,fs);  
title(sprintf('Total Magnitudes'));
```



## Section F

```
y=x;  
for i=1:length(As)  
    h1=[1 As(i) 1];  
    y = conv(y,h1);  
end
```

## Section G - plots the spectrograms

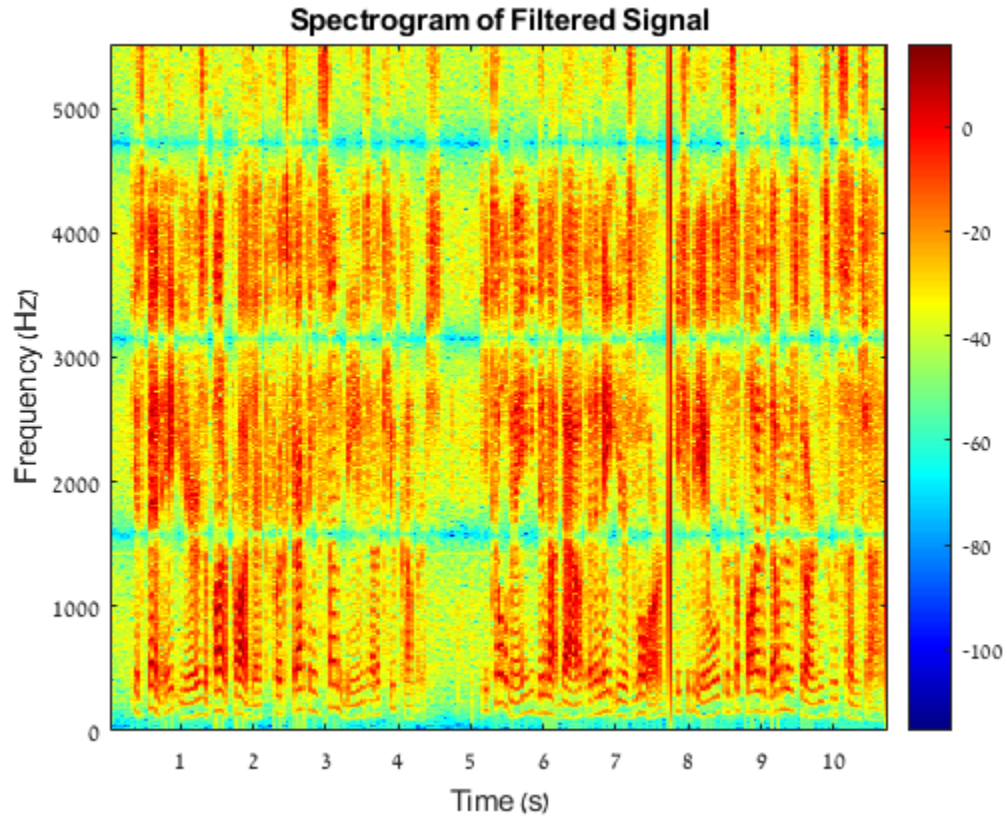
Spectrogram of filtered signal

```
[S_filt, F_filt, T_filt] = spectrogram(y, window, noverlap, nfft, fs);  
figure;  
imagesc(T_filt, F_filt, 20*log10(abs(S_filt)));  
axis xy;  
colorbar;  
colormap(jet);
```

---

```
title('Spectrogram of Filtered Signal');
xlabel('Time (s)');
ylabel('Frequency (Hz)');

%before filtering
%sound(x, fs);
%sound off
%after filtering
sound(y, fs);
```



*Published with MATLAB® R2021b*