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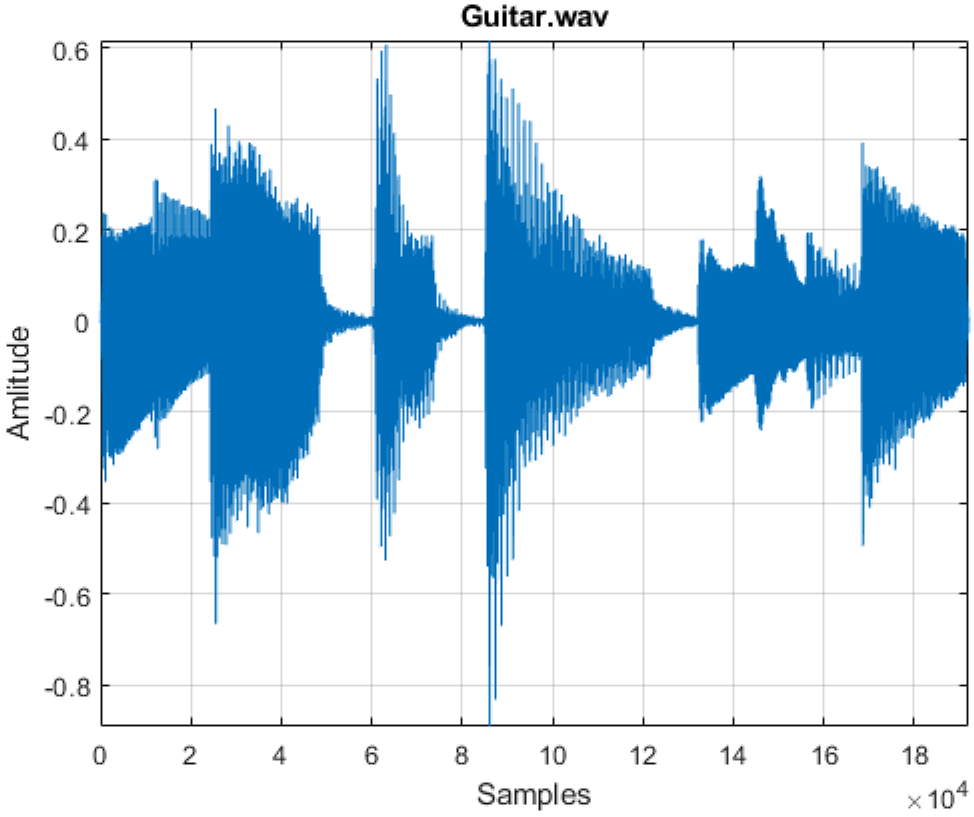
How to import audio data

```
audio_file = 'Guitar.wav';        % Save path to tha audio file to a
 string
[signal, fs] = audioread(audio_file); % Read audio file to vector and
 its' sampling frequency to fs
```

Analysing audio signal in time domain

```
audioinfo(audio_file)   % Prints information about a audio file

figure(1)               % New figure
plot(signal)            % Plot the mono audio signal to figure(1)

grid on                 % Draws gridlines to the figure(1)
xlabel('Samples')       % Label the x-axis of the plot
ylabel('Amlitude')      % Label the y-axis of the plot
title(audio_file)       % Give a tittle to the plot
axis([0 length(signal) min(signal) max(signal)]) % Zooms to the plot
```

```
ans = 

  struct with fields:

            Filename: 'E:\Ali\Aalto University\Semester 4\Computer
 Lab in Digital Signal Processing\Assignment 1\Guitar.wav'
   CompressionMethod: 'Uncompressed'
         NumChannels: 1
          SampleRate: 48000
        TotalSamples: 192000
            Duration: 4
               Title: []
             Comment: []
              Artist: []
       BitsPerSample: 16
```



Playing audio signal

```
gain = 1;                  % Try different values to gain and see how it
 affect the played audio
soundsc(gain*signal, fs) % Scales signal to 1 and plays it with
 correct sampling frequency
%sound(gain*signal, fs)   % Plays signal with original amplitude and
 sampling frequency
```

Task a) (replace 0 with a correct answer)

What is the sampling frequency of 'signal'?

```
sampling_frequency = 48000 % This is essentially the same as variable
 'fs'

% How long the 'signal' is in second?
length_in_seconds = 4

% What are the maximum and minimum values of the 'signal' and
 corresponding
% indexes that those values occur?

signal_max = 0.6174
signal_min = -0.8911
```

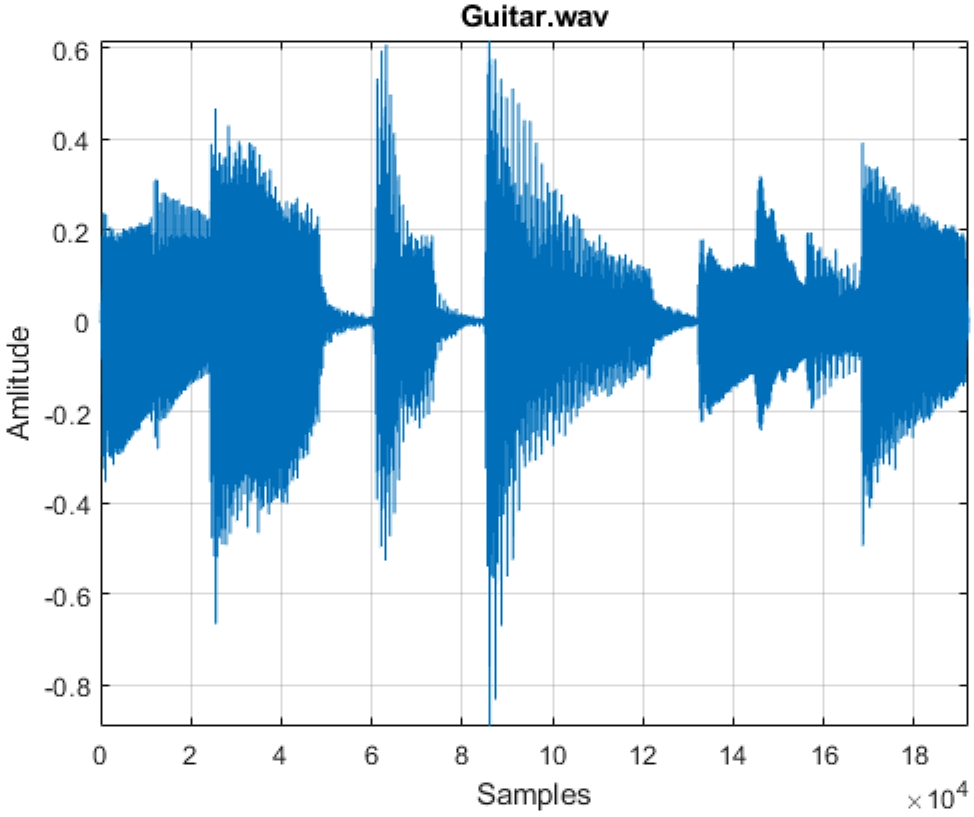
```
signal_max_idx = 85970
signal_min_idx = 86080
```

```
sampling_frequency =

       48000


length_in_seconds =

     4


signal_max =

    0.6174


signal_min =

   -0.8911


signal_max_idx =

       85970


signal_min_idx =

       86080
```

Task b)

Generate a signal named 'signal_a' that is same as 'signal' but it is reversed and scaled to 1

```
signal_a = flipud(signal);
gain = 1;                % Try different values to gain and see how it
 affect the played audio
soundsc(gain*signal_a, fs)

%figure(2)               % New figure
%plot(signal_a)            % Plot the mono audio signal to figure(2)

%grid on                 % Draws gridlines to the figure(2)
%xlabel('Samples')       % Label the x-axis of the plot
%ylabel('Amlitude')      % Label the y-axis of the plot
%title(audio_file)       % Give a tittle to the plot
%axis([0 length(signal_a) min(signal_a) max(signal_a)]) % Zooms to the
 plot
```



Task c)

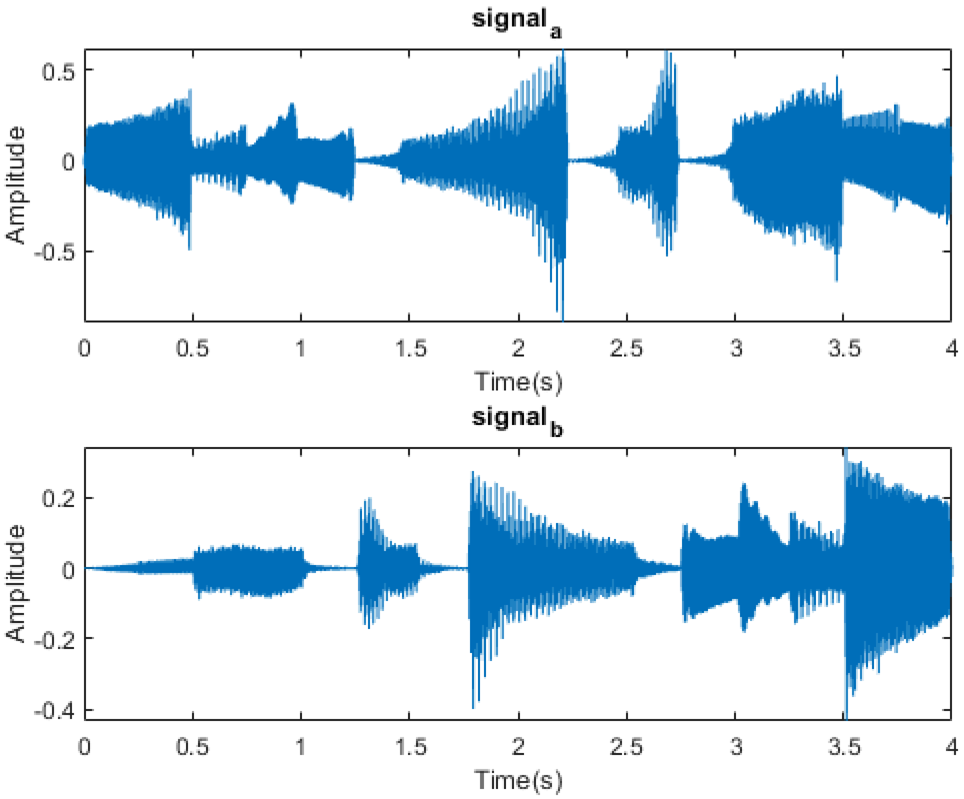
Generate a vector that is equally long as 'signal' that grows linearly from 0 to 1 and element-wise multiply 'signal' with it to generate 'signal_b'. Scale 'signal_b' also to 1.

```
vector_b = linspace(0,1,192000);
for i = 1:length(signal)
    signal_b(i) = signal(i)*vector_b(i);
end
gain = 1;                    % Try different values to gain and see how it
 affect the played audio
soundsc(gain*signal_b, fs)


%figure(2)                   % New figure
%plot(signal_b)                % Plot the mono audio signal to figure(2)

%grid on                     % Draws gridlines to the figure(2)
%xlabel('Samples')           % Label the x-axis of the plot
%ylabel('Amlitude')          % Label the y-axis of the plot
%title(audio_file)           % Give a tittle to the plot
%axis([0 length(signal_b) min(signal_b) max(signal_b)]) % Zooms to the
 plot
```

d)

Plot 'signal_a' and 'signal_b' to same figure but in different graphs using subplot() so that 'signal_a' is on top of 'signal_b' and y-axises are amplitude and x-axises are time in seconds. Name the plots and all axises. Also set the axises so that there is no unnecessary space in the plots.

```
time = (1:length(signal))/fs;
figure(3)
subplot(2,1,1)
plot(time, signal_a), xlabel('Time(s)'), ylabel('Amplitude'), axis([0
 4 min(signal_a) max(signal_a)])
title('signal_a')
subplot(2,1,2)
plot(time, signal_b), xlabel('Time(s)'), ylabel('Amplitude'), axis([0
 4 min(signal_b) max(signal_b)])
title('signal_b')
```



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