```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% SCRIPT
% HW 1
% 2019.02.05
%
% HyungSeok Yoon, Music and Engineering
%
% this script is running from Q2 ~ 4 for HW1
% ECE 413 - Music and Engineering
% Prof.Hoerning
%
% This script was adapted from hw1 recevied in 2012
%
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Setup
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
close all
clear functions
clear variables
dbstop if error
warning off

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Constants
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
constants.fs=44100;                % Sampling rate in samples per second
constants.durationScale=0.5;       % Duration of notes in a scale
constants.durationChord=3;         % Duration of chords
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Question 2 - scales
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
[soundMajorScaleJust]=create_scale('Major','Just','C',constants);
[soundMajorScaleEqual]=create_scale('Major','Equal','C',constants);
[soundMinorScaleJust]=create_scale('Minor','Just','C',constants);
[soundMinorScaleEqual]=create_scale('Minor','Equal','C',constants);

disp('Playing the Just Tempered Major Scale');
soundsc(soundMajorScaleJust,constants.fs);
disp('Playing the Equal Tempered Major Scale');
soundsc(soundMajorScaleEqual,constants.fs);
disp('Playing the Just Tempered Minor Scale');
soundsc(soundMinorScaleJust,constants.fs);
disp('Playing the Equal Tempered Minor Scale');
soundsc(soundMinorScaleEqual,constants.fs);
fprintf('\n');

% EXTRA CREDIT - Melodic and Harmonic scales
[soundHarmScaleJust]=create_scale('Harmonic','Just','A',constants);
[soundHarmScaleEqual]=create_scale('Harmonic','Equal','A',constants);
[soundMelScaleJust]=create_scale('Melodic','Just','A',constants);
[soundMelScaleEqual]=create_scale('Melodic','Equal','A',constants);

disp('Playing the Just Tempered Harmonic Scale');
soundsc(soundHarmScaleJust,constants.fs);
disp('Playing the Equal Tempered Harmonic Scale');
soundsc(soundHarmScaleEqual,constants.fs);
```

```
disp('Playing the Just Tempered Melodic Scale');
soundsc(soundMelScaleJust,constants.fs);
disp('Playing the Equal Tempered Melodic Scale');
soundsc(soundMelScaleEqual,constants.fs);
fprintf('\n');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Question 3 - chords
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fund = 'A'; % stated for convenience, but can be written manually.

% major and minor chords
[soundMajorChordJust]=create_chord('Major','Just',fund,constants);
[soundMajorChordEqual]=create_chord('Major','Equal',fund,constants);
[soundMinorChordJust]=create_chord('Minor','Just',fund,constants);
[soundMinorChordEqual]=create_chord('Minor','Equal',fund,constants);

disp('Playing the Just Tempered Major Chord');
soundsc(soundMajorChordJust,constants.fs);
disp('Playing the Equal Tempered Major Chord');
soundsc(soundMajorChordEqual,constants.fs);
disp('Playing the Just Tempered Minor Chord');
soundsc(soundMinorChordJust,constants.fs);
disp('Playing the Equal Tempered Minor Chord');
soundsc(soundMinorChordEqual,constants.fs);
fprintf('\n');

% assorted other chords
[soundPowerChordJust]=create_chord('Power','Just',fund,constants);
[soundPowerChordEqual]=create_chord('Power','Equal',fund,constants);
[soundSus2ChordJust]=create_chord('Sus2','Just',fund,constants);
[soundSus2ChordEqual]=create_chord('Sus2','Equal',fund,constants);
[soundSus4ChordJust]=create_chord('Sus4','Just',fund,constants);
[soundSus4ChordEqual]=create_chord('Sus4','Equal',fund,constants);
[soundDom7ChordJust]=create_chord('Dom7','Just',fund,constants);
[soundDom7ChordEqual]=create_chord('Dom7','Equal',fund,constants);
[soundMin7ChordJust]=create_chord('Min7','Just',fund,constants);
[soundMin7ChordEqual]=create_chord('Min7','Equal',fund,constants);


disp('Playing the Just Tempered Power Chord');
soundsc(soundPowerChordJust,constants.fs);
disp('Playing the Equal Tempered Power Chord');
soundsc(soundPowerChordEqual,constants.fs);
disp('Playing the Just Tempered Sus2 Chord');
soundsc(soundSus2ChordJust,constants.fs);
disp('Playing the Equal Tempered Sus2 Chord');
soundsc(soundSus2ChordEqual,constants.fs);
disp('Playing the Just Tempered Sus4 Chord');
soundsc(soundSus2ChordJust,constants.fs);
disp('Playing the Equal Tempered Sus4 Chord');
soundsc(soundSus2ChordEqual,constants.fs);
disp('Playing the Just Tempered Dom7 Chord');
soundsc(soundDom7ChordJust,constants.fs);
disp('Playing the Equal Tempered Dom7 Chord');
soundsc(soundDom7ChordEqual,constants.fs);
disp('Playing the Just Tempered Min7 Chord');
soundsc(soundMin7ChordJust,constants.fs);
disp('Playing the Equal Tempered Min7 Chord');
soundsc(soundMin7ChordEqual,constants.fs);
```

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%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Question 4 - plots
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Recreate Chords for plotting purposes
[soundMajorChordJust_n]=create_chord('Major','Just',fund,constants);
[soundMajorChordEqual_n]=create_chord('Major','Equal',fund,constants);
[soundMinorChordJust_n]=create_chord('Minor','Just',fund,constants);
[soundMinorChordEqual_n]=create_chord('Minor','Equal',fund,constants);

% Fundamental Frequency
f = freqsearch('Just',fund);
T = 1/f; % time for one period
len = ceil(T*constants.fs);
t = 0:1/constants.fs:constants.durationChord;

% Major chords
% Single Wavelength
% Just Temperament
figure(1)
plot(t(1:len),soundMajorChordJust_n(1:len))
title('Figure 1:Single Wavelength of Just Tempered Major Chord')
xlabel('Time Elapsed')
ylabel('Amplitude')
xlim([0,T])

% Equal Temperament
figure(2)
plot(t(1:len),soundMajorChordEqual_n(1:len))
title('Figure 2:Single Wavelength of Equal Tempered Major Chord')
xlabel('Time Elapsed')
ylabel('Amplitude')
xlim([0,T])

% Tens of Wavelengths
% Just Temperament
figure(3)
plot(t(1:20*len),soundMajorChordJust_n(1:20*len))
title('Figure 3:Tens of Wavelength of Just Tempered Major Chord')
xlabel('Time Elapsed')
ylabel('Amplitude')
xlim([0,20*T])

% Equal Temperament
figure(4)
plot(t(1:20*len),soundMajorChordEqual_n(1:20*len))
title('Figure 4:Tens of Wavelength of Equal Tempered Major Chord')
xlabel('Time Elapsed')
ylabel('Amplitude')
xlim([0,20*T])

% Minor chords
% Single Wavelength
% Just Temperament
figure(5)
plot(t(1:len),soundMinorChordJust_n(1:len))
title('Figure 5:Single Wavelength of Just Tempered Minor Chord')
xlabel('Time Elapsed')
ylabel('Amplitude')
xlim([0,T])

% Equal Temperament
```

```
figure(6)
plot(t(1:len),soundMinorChordEqual_n(1:len))
title('Figure 6:Single Wavelength of Equal Tempered Minor Chord')
xlabel('Time Elapsed')
ylabel('Amplitude')
xlim([0,T])

% Tens of Wavelengths
% Just Temperament
figure(7)
plot(t(1:20*len),soundMinorChordJust_n(1:20*len))
title('Figure 7:Tens of Wavelength of Just Tempered Minor Chord')
xlabel('Time Elapsed')
ylabel('Amplitude')
xlim([0,20*T])

% Equal Temperament
figure(8)
plot(t(1:20*len),soundMinorChordEqual_n(1:20*len))
title('Figure 8:Tens of Wavelength of Equal Tempered Minor Chord')
xlabel('Time Elapsed')
ylabel('Amplitude')
xlim([0,20*T])
```

```
Playing the Just Tempered Major Scale
Playing the Equal Tempered Major Scale
Playing the Just Tempered Minor Scale
Playing the Equal Tempered Minor Scale

Playing the Just Tempered Harmonic Scale
Playing the Equal Tempered Harmonic Scale
Playing the Just Tempered Melodic Scale
Playing the Equal Tempered Melodic Scale

Playing the Just Tempered Major Chord
Playing the Equal Tempered Major Chord
Playing the Just Tempered Minor Chord
Playing the Equal Tempered Minor Chord

Playing the Just Tempered Power Chord
Playing the Equal Tempered Power Chord
Playing the Just Tempered Sus2 Chord
Playing the Equal Tempered Sus2 Chord
Playing the Just Tempered Sus4 Chord
Playing the Equal Tempered Sus4 Chord
Playing the Just Tempered Dom7 Chord
Playing the Equal Tempered Dom7 Chord
Playing the Just Tempered Min7 Chord
Playing the Equal Tempered Min7 Chord
```

Figure 1:Single Wavelength of Just Tempered Major Chord

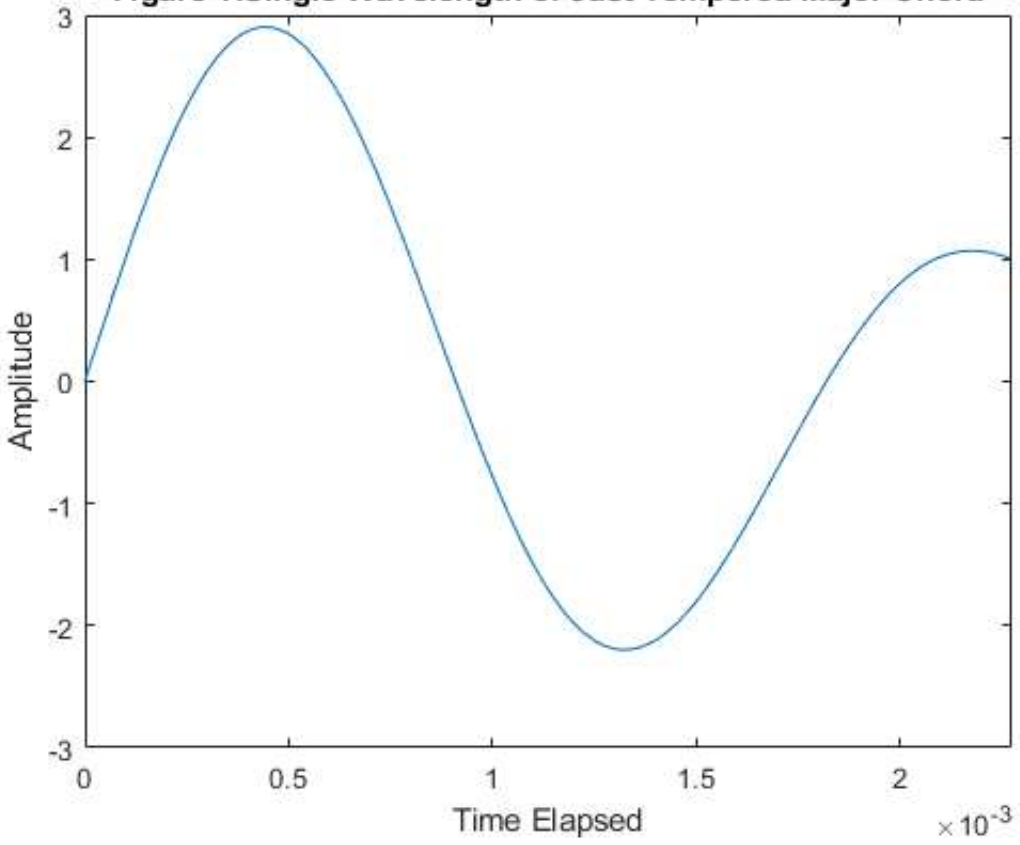
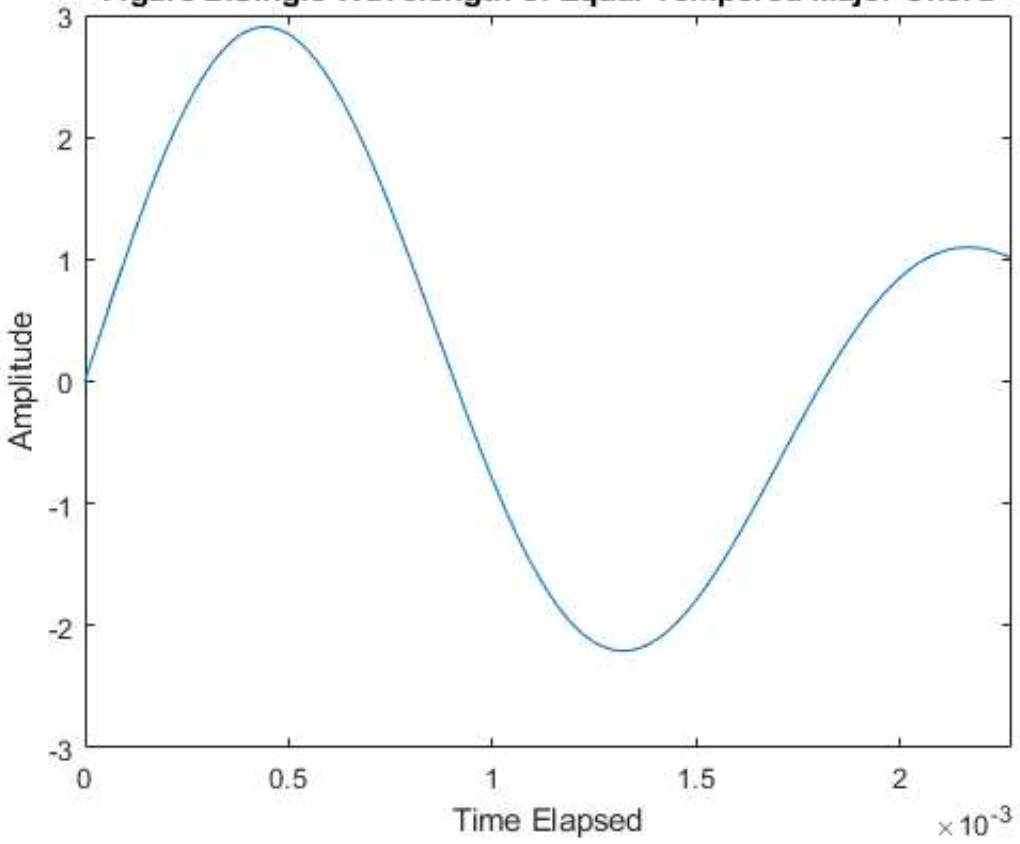


Figure 2:Single Wavelength of Equal Tempered Major Chord



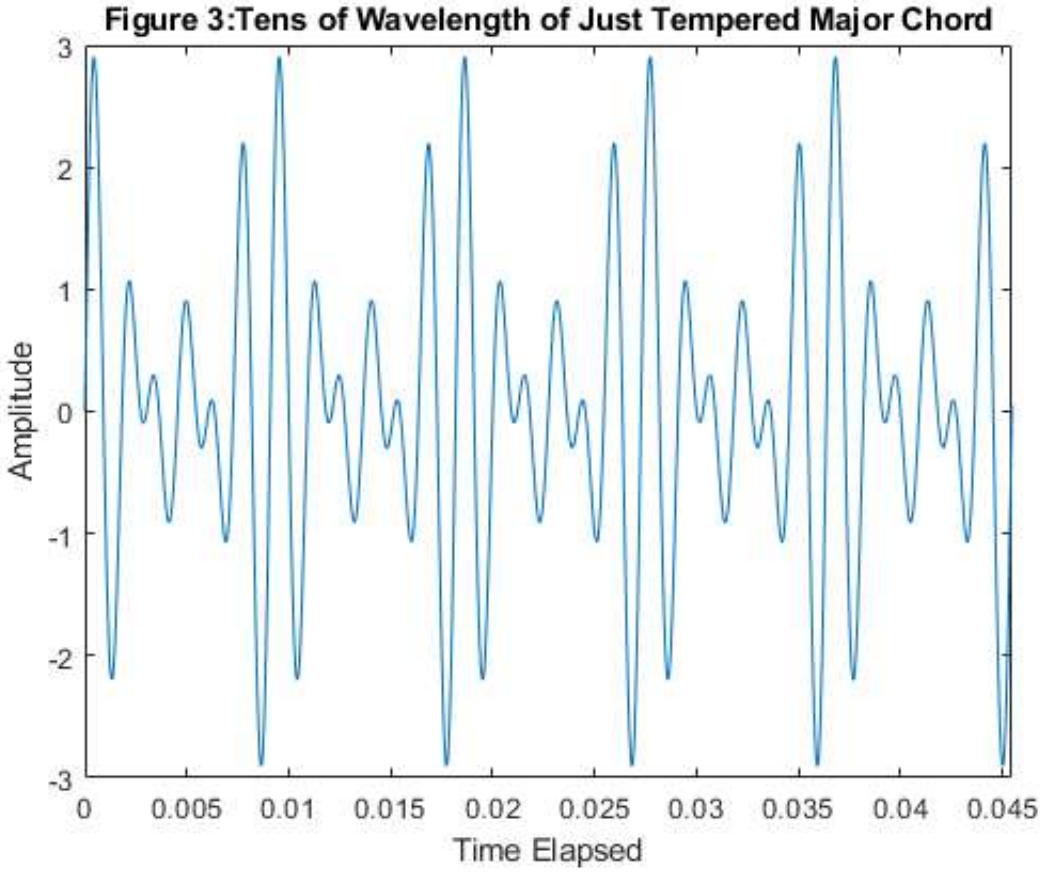


Figure 3:Tens of Wavelength of Just Tempered Major Chord
Amplitude
Time Elapsed
3
2
1
0
-1
-2
-3
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045

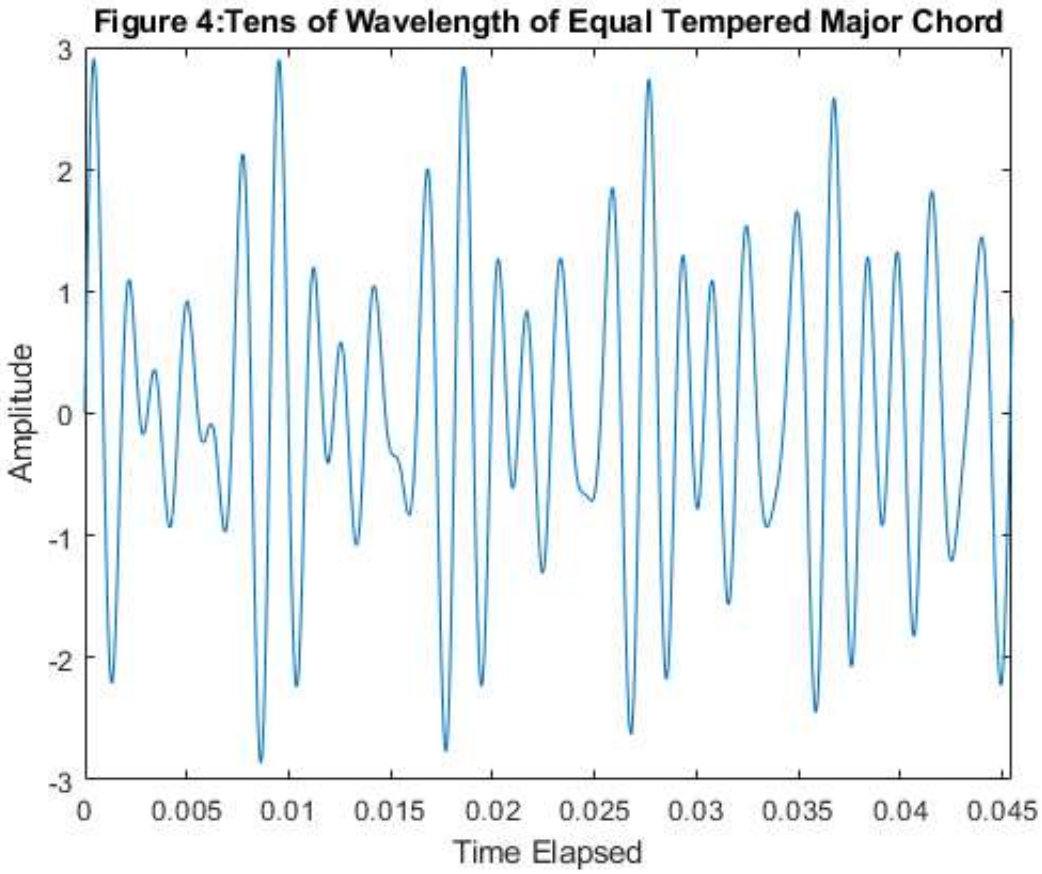


Figure 4:Tens of Wavelength of Equal Tempered Major Chord
Amplitude
Time Elapsed
3
2
1
0
-1
-2
-3
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045

Figure 5:Single Wavelength of Just Tempered Minor Chord

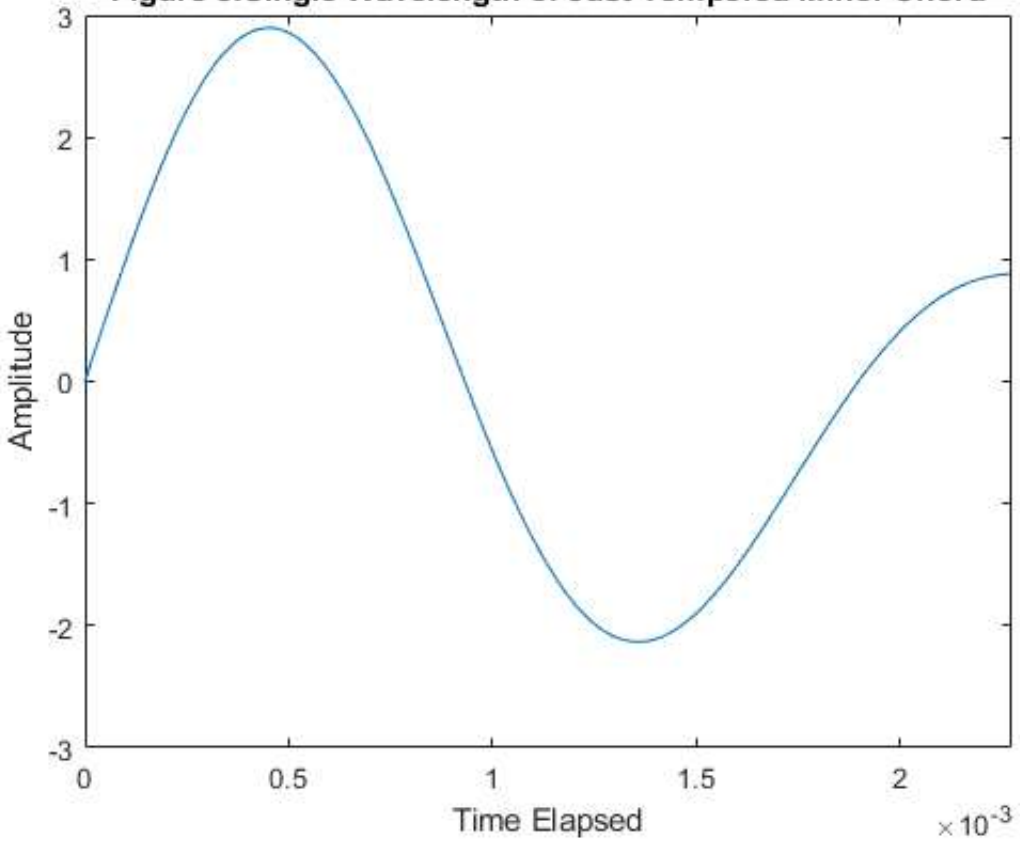
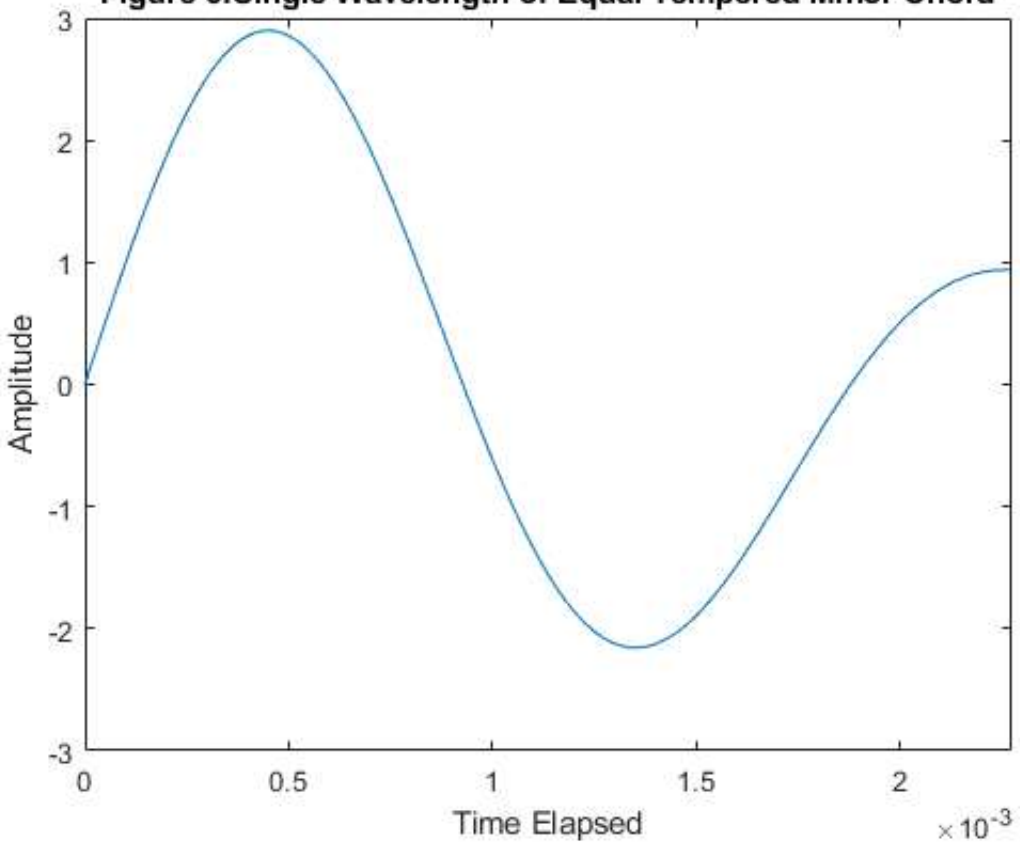
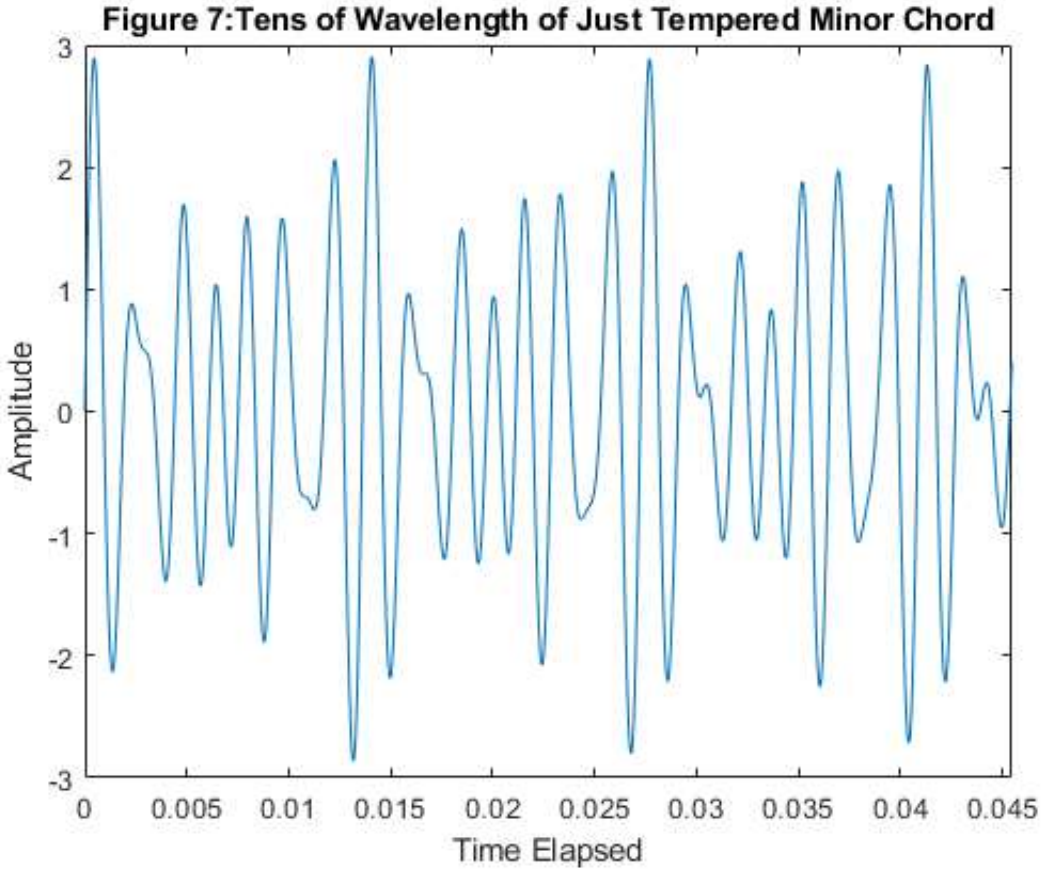
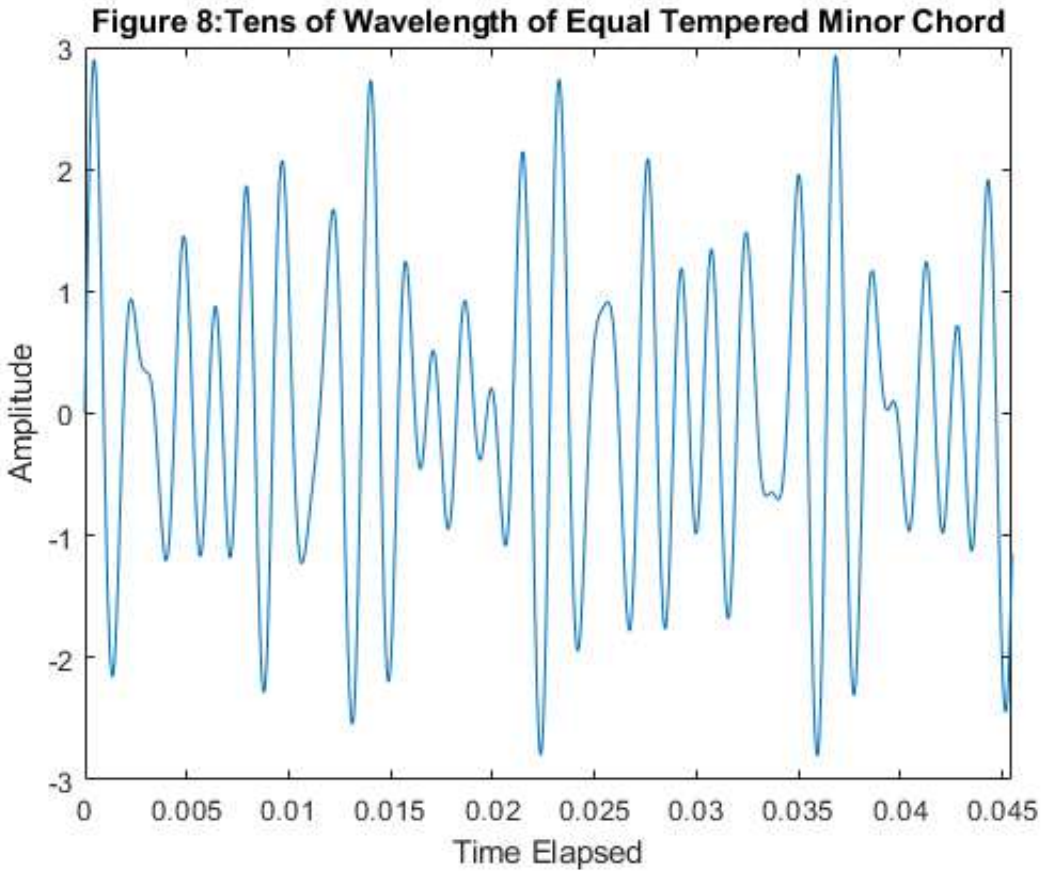


Figure 6:Single Wavelength of Equal Tempered Minor Chord







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