Contents


```
%{
Yonatan Carver
ECES 352 - Lab 5

%}
clear; clc; close all
```

3.1 Note Frequency Function

```
%{

function xx = key2note(X, keynum, dur)
% KEY2NOTE      Produce a sinusoidal waveform corresponding to a given piano
% key number

% usage:
% xx = the output sinusoudal waveform
% X = complex amplitude for the sinusoid, X = A*exp(j*phi)
% keynum = the piano keyboard number of the desired note
% dur = the duration (in seconds) of the output note

fs = 11025;
tt = 0 : (1/fs) : dur;
freq = (440) * 2^((keynum-49)/12);
xx = real( X * exp(j * 2 * pi * freq * tt));

%}
```

3.2 Synthesize a Scale

playscale.m

```
scale.keys = [40 42 44 45 47 49 51 52];
% Notes =         C  D  E  F  G  A  B  C

% Key 40 is middle-C
scale.durations = 0.3 * ones(1, length(scale.keys));
fs = 11025;             % 8000Hz
xx = zeros(1, sum(scale.durations) * fs + length(scale.keys));
n1 = 1;
for kk = 1:length(scale.keys)
        keynum = scale.keys(kk);
        % function xx = key2note(X, keynum, dur)
        tone = key2note(20, keynum, scale.durations);
        n2 = n1 + length(tone) - 1;
```

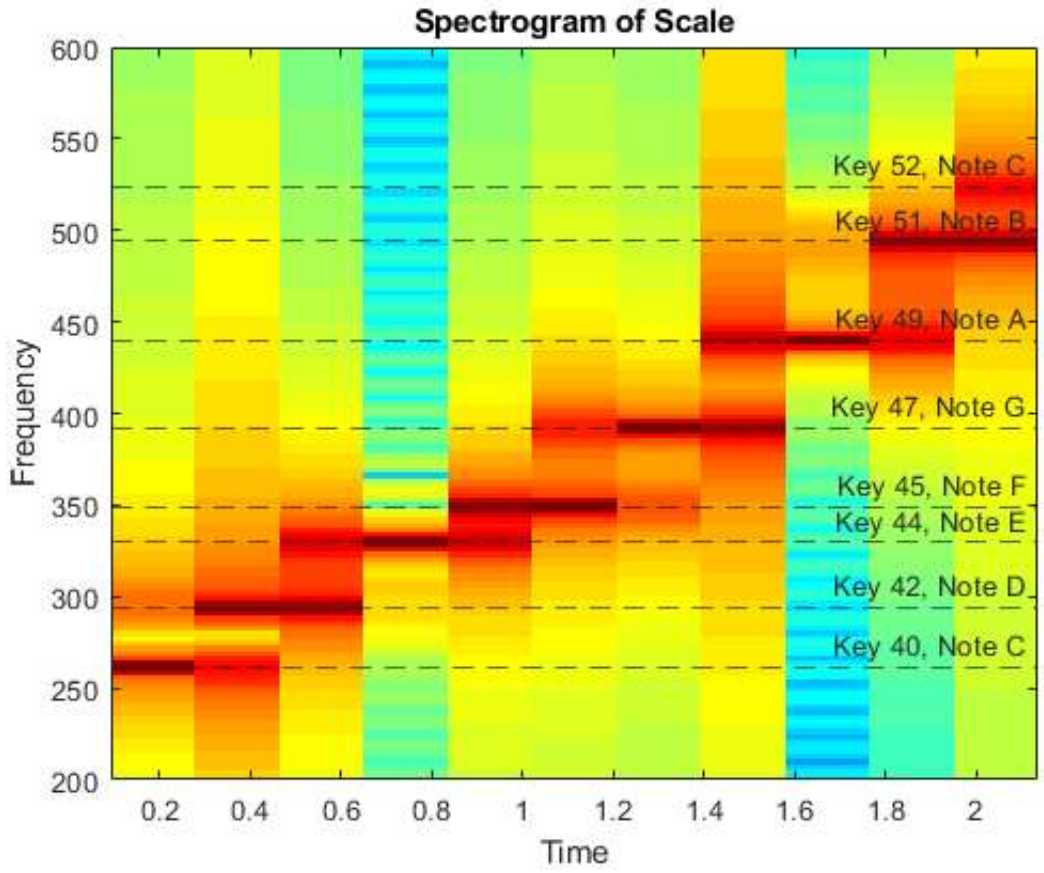
```
        xx(n1:n2) = xx(n1:n2) + tone;
        n1 = n2 + 1;
end

% soundsc(xx, fs)
```

3.3 Spectrogram: Two M-files

```
specgram(xx, 4096, fs);
title('Spectrogram of Scale')
ylim([200 600])

yline(261.63, '--','Key 40, Note C');
yline(293.66, '--','Key 42, Note D');
yline(329.63, '--','Key 44, Note E');
yline(349.23, '--','Key 45, Note F');
yline(392.00, '--','Key 47, Note G');
yline(440.00, '--','Key 49, Note A');
yline(493.88, '--','Key 51, Note B');
yline(523.25, '--','Key 52, Note C');
```



Beethoven Ode To Joy

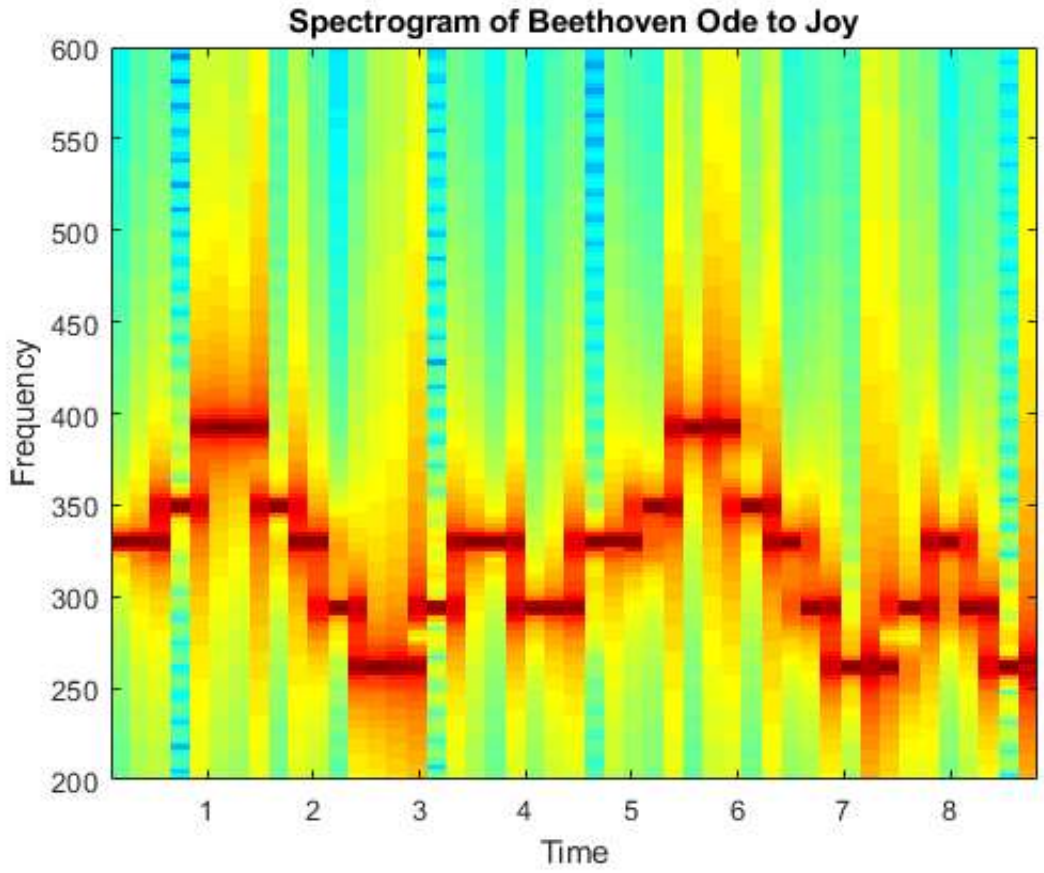
```
scale.keys = [44 44 45 47 47 45 44 42 40 40 42 44 44 42 42 44 44 45 47 47 45 44 42 40 40 42 4
4 42 40 40];
% Notes =     E  E  F  G  G  F  E  D  C  C  D  E  E  D  D  E  E  F  G  G  F  E  D  C  C  D  E
```

```
  D  C  C

% Key 40 is middle-C
scale.durations = 0.3 * ones(1, length(scale.keys));
fs = 11025;             % 8000Hz
xx = zeros(1, sum(scale.durations) * fs + length(scale.keys));
n1 = 1;
for kk = 1:length(scale.keys)
        keynum = scale.keys(kk);
        % function xx = key2note(X, keynum, dur)
        tone = key2note(20, keynum, scale.durations);
        n2 = n1 + length(tone) - 1;
        xx(n1:n2) = xx(n1:n2) + tone;
        n1 = n2 + 1;
end

% soundsc(xx)

specgram(xx, 4096, fs);
title('Spectrogram of Beethoven Ode to Joy')
ylim([200 600])
```



Published with MATLAB® R2018b