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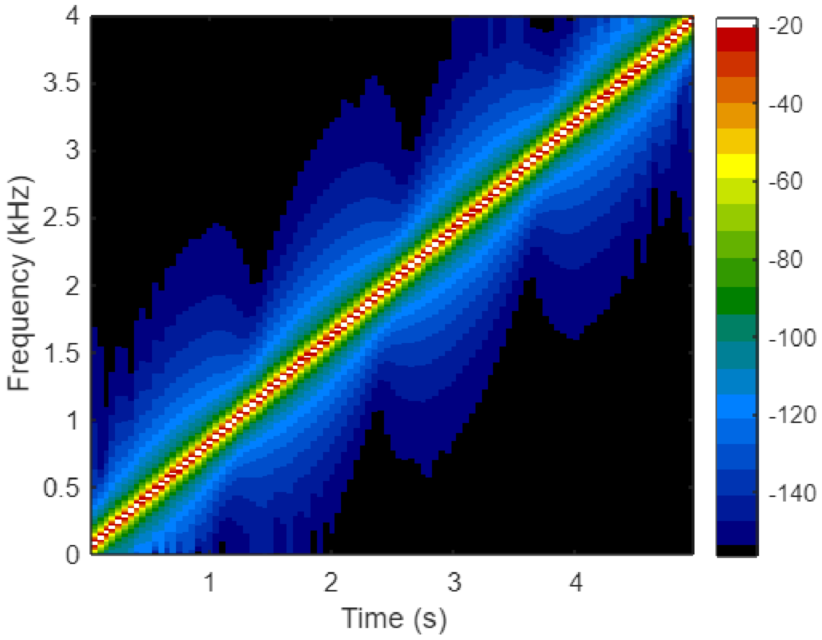
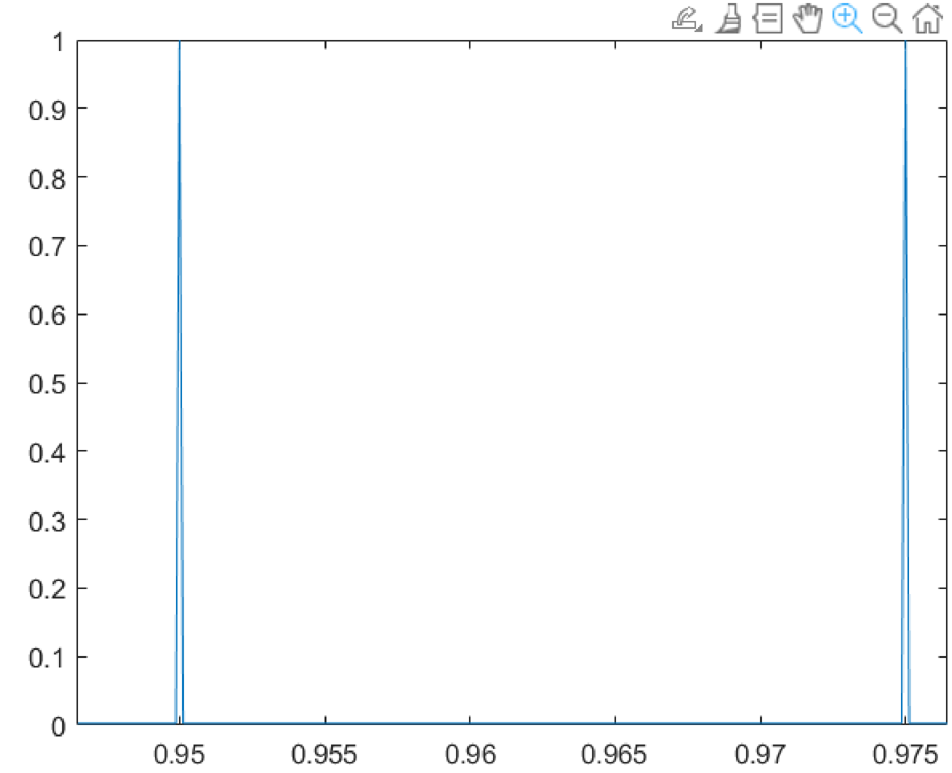
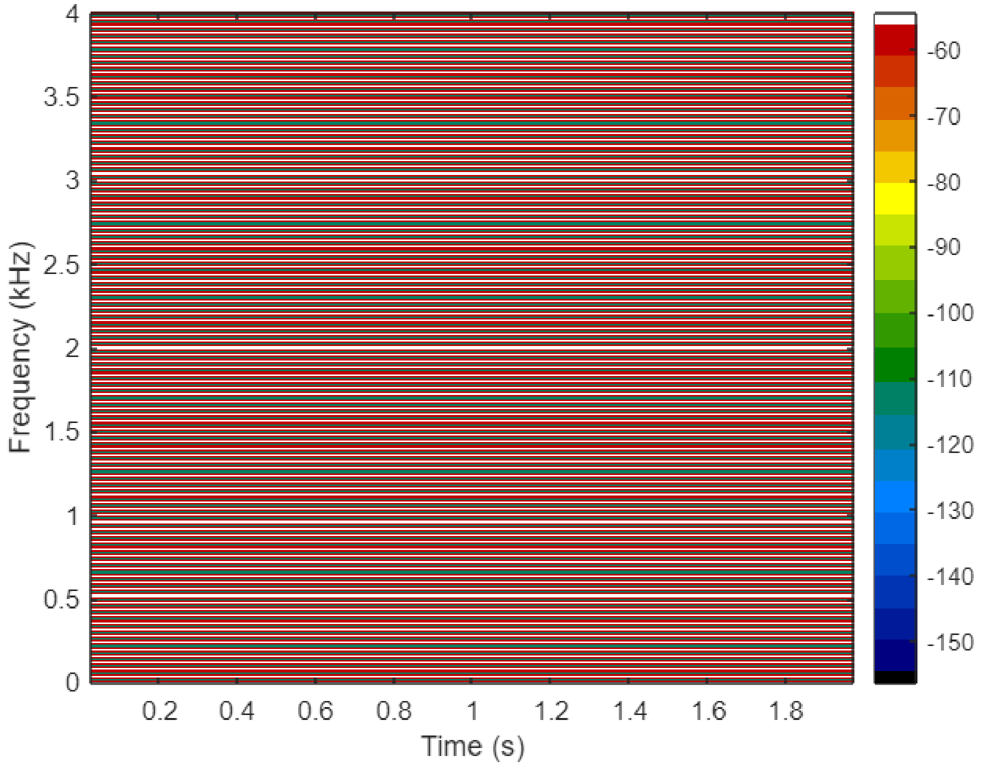
Lab 2: Audio Spectrograms – Worksheet

ECE180: Introduction to Signal Processing

1.7 ✎	From what we've observed the spectrum remains unambiguous from 30 hz until 3970 hz. Below 30 hz and above 3970 column-shaped discoloration occurs as time moves forward. When testing above 4000 hz it repeats the pattern. The same thing is noted for 4030 hz and 7970 hz. 4000 – 4029 hz and 7971-8000 hz show ambiguity as time progresses. The highest value is 8000 hz because the period of the sinusoid is 8000hz. Because we labeled the frequency sampling as 8000, anything above that would be in a different period of the same sinusoid.
2.2 ✎	The yellow line going straight from the bottom left corner to the top right becomes longer, thinner and appears to have a sharper resolution.
2.3 ✎	The yellow line that was previously linear now appears to follow an exponential curve. With the new spectrum gram, the pitch of the sound increases at an increasing rate. We would use the previous spectrum without the 'lo' argument. Without it the sound's pitch increases at a constant rate.
2.7 🖼	We liked spectral the most, as it we believe it offers the best color distinction and it is easier to red specific values in time . 
3.2 ✎	There is new line every f_0 * n. So with f_0 = 50 hz and n = 6. There is a line at 50hz, 100hz, 150hz, 200hz, 250hz, and 300hz. Because every nth line is f_0 above the previous.
3.3 ✎	So as n increases the sound becomes less smooth and becomes more distorted. We noted that the pitch doesn't seem to change much as the only major difference we noted was the distortion.

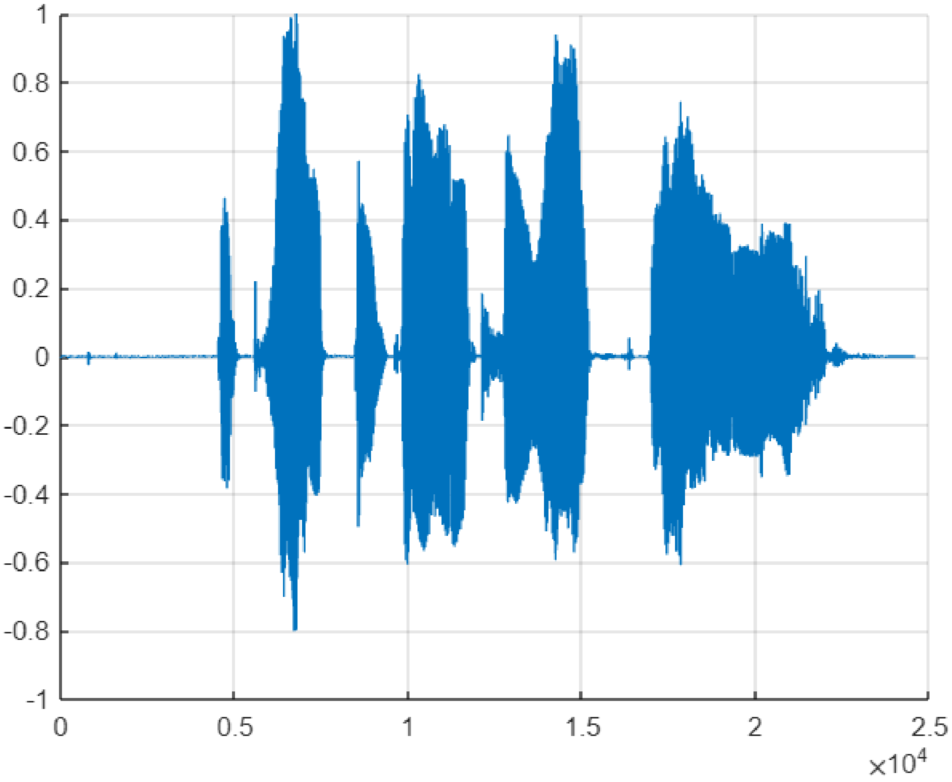
<table>
<tr><td>3.4 ✎</td><td>$f_s \geq n * f_0$</td></tr>
<tr><td>3.6 🖼</td><td>


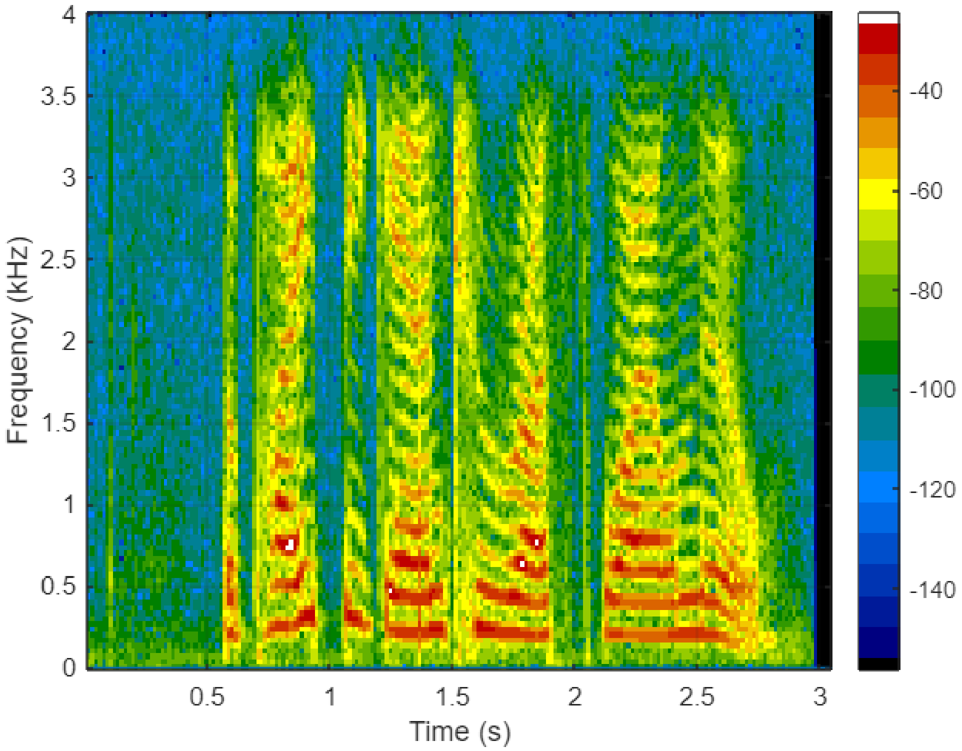
</td></tr>
<tr><td>3.7 🖼</td><td>


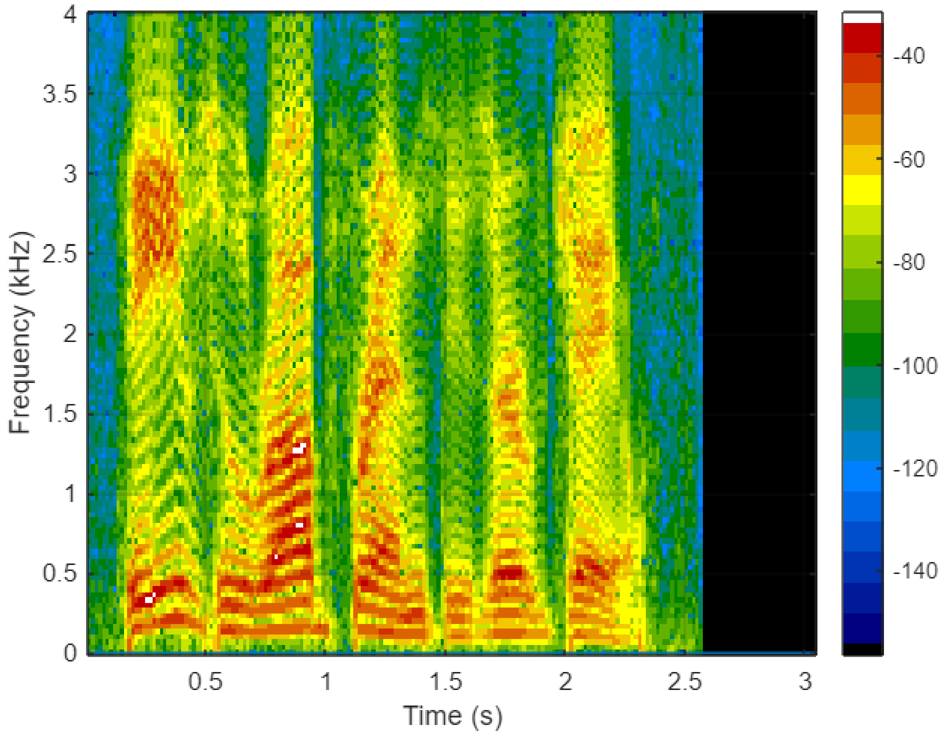
</td></tr>
</table>

4.2 ✎	Visually, pink noise is yellow near the 4 kHz frequency. It transitions to more red as it approaches 0 hz. Whilst white noise is completely red across all frequency. Aurally, Pink noise feels more mellowed out than white noise. It is less intense at frequencies near 4k, and is less loud.
4.3 ✎	So as the first argument approaches 0, the entire spectrum becomes red and more violent sounding. As it approaches -1.5 and 1.5 away from 0, the spectrum begins to introduce yellow and eventually green on the spectrum. Although, from 0 → 1.5 transitions faster than 0 → -1.5, as 1.5 has more yellow and green than -1.5 does.
5.1 ✎	The sampling rate is 8000 hz.

5.2 🗎	`[x, fs] = audioread('s1.wav');`
	`d = length(x)`
	`tt = (0:d-1);`
	`spectro(x,fs);`
	`colormap(spectral);`

5.4 🖼	
5.5 ✎	The [0.5, 0.63] Pipe [0.52, 0.75] Begins [1.03, 1.5] To [1.5,1.7] Rust [1.7,2.09 While [2.09, 2.44] New [2.45, 2.73]

5.6	The vowels have higher peaks with green and yellow on the spectrum. On the Time-domain the vowels have the higher light blue peaks in the back. They look similar to the plot in 3.6.
5.7	The blocks that make up the spectrum become wider and longer and the graph becomes more distorted and blocky.
5.8	The blocks become less wide and long, and becomes smoother.
5.9	 TRES = 30
5.10	Vowels have taller columns of yellow and green. The more distorted parts of the voice had a higher concentration of red blocks .

5.11	 Speech clip 2

6.1	**Luis Antonio Hernandez Aguirre & Fox Warner**
	ECE180 Lab 2
	12 September 2023
	Part 1
	`fs = 8000;`
	`D=2;`
	`tt = (0:fs*D-1)'/fs;`
	`% f0 = 8000;`
	`% x = sin(2*pi*f0*tt);`
	`% spectro(x, fs);`
	Part 2
	`% x = chirp(tt,40,D,4000);`
	`% spectro (x, fs);`
	`% colormap(spectral);`

Part 3

```
% n = 200;
% x = diric(2*pi*f0*tt,2*n+1);
% spectro(x,fs);
% colormap(spectral);
% figure;
% plot(tt,x);
```

Part 4

```
% n = dsp.ColoredNoise(1.5,length(tt),1);
% x = step(n);
% spectro(x, fs);
% colormap(spectral);
```

Part 5

```
[x, fs] = audioread('s2.wav');
spectro(x,fs, 30);
d = length(x);
tt = (0:d-1);
colormap(spectral);


hold on;
grid on;
plot(tt,x);


%[t1,t2] = snippet(x, fs)
```