# Lab 7 Report

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## Write-up Questions

### Part B

1.- What is the highest frequency you can hear?

Around 17000 hertz.

2.- Does this change when you are using headphones versus the built-in computer speakers?

Yes, it's slightly lower using the built-in computer speakers. Somewhere around 14000 hertz.

3.- When you keep the amplitude of the sine wave constant, what is the loudest frequency for you when you are using headphones?

Around 8-9 thousand.

4.- What is the loudest frequency when you are using the built-in computer speakers? Is it the same as when you are using headphones? Why do you think this is the case?

When using the built-in computer speakers the loudest frequency is around 5-6 thousand, so lower than when using headphones. This might be due to the lower sound quality of the built-in computer speakers that may not be able to produce those higher frequencies.

5.- Using the SineWaveKeyboard example, listen to the difference between a sine at 400 Hz and a sine at 500Hz. (In music, this difference is called an "interval.") Now, listen to the difference between a sine at 1600 Hz and a sine at 1700 Hz. Does the 1600/1700Hz pair sound closer together or further apart than the 400/500Hz pair?

The 1600/1700Hz pair sounds closer together than the 400/500Hz pair.

6.- 500 Hz is exactly 100 Hz above 400 Hz, and 1700 Hz is exactly 100 Hz above 1600 Hz. So why don't these two intervals sound the same?

This might be due to our hearing being more sensitive to lower frequencies, such as 400 and 500 Hz compared to higher ones, like 1600Hz and above.

7.- What frequency would you pair with 1600Hz to get the same interval (perceptual distance) as the 400/500Hz pair?

I would say 1600 and 2000 Hz have about the same interval as 400 and 500 Hz.

**Part C**

1.- Play multiple sine waves that are harmonically related—that is, whose frequencies are all integer multiples of a single fundamental frequency. For instance, if your fundamental is 400 Hz, add together sines of 400Hz, 2*400=800 Hz, 3*400=1200Hz, etc. Note: be careful to scale the amplitude so that the maximum value of your sum is never greater than 1! The easiest way to do this is to set the amplitude of each maxiOsc to 1.0/N, where N is the number of sines you're playing. Now answer the following questions:

- What happens to the pitch of the sound as you add more frequencies?

  As more frequencies are added, the pitch of the sound gets higher.

- What happens to the sound colour / timbre / tone quality as you add more frequencies?

  With more frequencies, the sound colour becomes sharper and brighter, but also harsher.

2.- Make a copy of your sketch and change it so that you instead play sine waves of different frequencies which are not harmonically related.

- What do you hear as you add more frequencies? How is this different from when you added frequencies that were harmonically related?

  When adding sine waves of different frequencies that are not harmonically related, the sound produced seems much more inconsistent than that one obtained when adding harmonically related frequencies. It also feels like a fuller and more diverse sound.

- How does the sound change when the range of frequencies is very big (e.g., a spread of thousands of Hertz) or very small (e.g., all within a few Hertz of each other)?

  The sound is more consistent when the range is very big. On the other hand, when the range is small, the sound is more chaotic.