Assignment 8

Due: 11/20/2017

(1) Consider a sound represented by the following function:

$$s(t) = \sin(2\pi \times 523.25t) + \sin(2\pi \times 783.99t) + \sin(2\pi \times 1046.50t) + \sin(2\pi \times 1318.51t).$$

What is the fundamental frequency and what are the overtones?

Fundamental = 523.25 Hz, Overtones = 783.99 Hz, 1046.50 Hz, 1318.51 Hz

(2) List all of the unique combinations for 4 bits.

0000 0010 ⋮ ⋮ There are $2^4 = 16$ in total.
0100 0001

(3) Suppose you sample a 3 minute song at 48,000 samples per second.

(a) How much time is between sample? $1/48{,}000^{th}$ of a second

(b) How many samples will be taken? $48{,}000 \times 3 \times 60 = 48{,}000 \times 180$

(c) List the first 8 times at which samples will be recorded.

$0, 1/48{,}000, 2/48{,}000, 3/48{,}000, 4/48{,}000, 5/48{,}000, 6/48{,}000, 7/48{,}000$

(4) Repeat steps (a)-(c) in #3 but using a sampling rate of 96,000 samples per second.

Just replace every "48,000" by "96,000"

(5) **Extra Credit:** As in #3, consider a 3 minute song sampled at 48,000 samples per second. Suppose you record this sound with using 16 bits. How big of a file in Megabytes will this song be on your computer? To figure this out, follow the following steps:

(a) Each sample is recorded using 16 bits. You calculated how many samples there are in #3(b). Now use these two pieces of information to calculate the total number of bits the sound will use.

(b) Using the hint in part (a), you should now have an answer in bits. There are 8 bits in 1 Byte and 1000000 Bytes in 1 Megabyte.

(c) (**More Extra Credit**) Repeat the same steps for a 3 minute song sampled at 96,000 samples per second using 16 bits. Compare the size of this audio file to the one you previously found using only 48,000 samples per second.