Homework for Chapter 1

1.1.   Install software that allows you to record and analyze sound. I recommend Audacity for a computer, TwistedWave for iPhone, and MixPad for Android, all of which are free.[1] Make two five-second recordings of "found sounds" that are not intended to be music. One recording should be a sound that you perceive as highly musical and the other should be something that doesn't sound like music to you.

  (a) Identify and describe the sounds that you recorded. Why did you choose them?

  (b) Comment on the differences between the pattern (or lack of pattern) in their waveforms, both zoomed out and zoomed in.

  (c) Extra Credit: If you don't have one already, create an account at SoundCloud.com. Upload your sounds and add the hashtag #thesoundofnumbers. Send me email at rhall@sju.edu with links to your sounds. Please identify yourself in the email so I know who you are.

  (d) Extra Credit: Audacity lets you copy, cut, and paste sounds. You can also take a sound and transform it into a different sound using Effects. Incorporate your found sounds into a short composition. Upload your composition as described above.

1.2.   Suppose you flip a coin four times and write the outcome as a sequence of heads and tails, like HTHH. How many different sequences of four flips are possible? List them.

1.3.   For each sequence of heads and tails in the previous exercise, count the number of T's and H's. For example, HTHH has 3 H's and 1 T. Of the patterns in the previous exercise, how many have 4 T's? 3 T's? 2 T's? 1 T? no T's? Do a web search for Pascal's Triangle. Which row of the triangle corresponds with your answers?

1.4.   Find the number of binary codes of length 10 made from 0 and 1. Of those, how many start with a 0? How many start with a 1? Explain.

1.5.   Find the number of ways 1-beat notes (1's) and 2-beat notes (2's) form a pattern of duration 9 beats. Of those patterns, how many start with a 1? How many start with a 2? Explain how you know.

1.6.   Which of the following is a counterexample to the false statement "If x is an integer, then $1/x$ is an integer":
(a) $x = -1$; (b) $x = 0.5$; (c) $x = -3$, (d) $x = \pi$ Explain why the other values of x are not counterexamples.

1.7.   Use a counterexample to prove that each of these statements is false.

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[1]Audacity is installed on all the computers in the Digital Media Zone, which is located on the second floor of the Post Learning Commons side of the library. If you would like help installing Audacity on your own computer, go to Science Center 129.

(a) If n is an integer, then $n \times 1/n = 1$.

(b) All musical compositions involve musicians making sound.

1.8. Definition: An integer a is *divisible* by an integer b if $a = bk$, where k is an integer.

Explain why the following is NOT a proof of the statement "The square of any even number is divisible by 4."
Proof. A number is even if it equals $2n$, where n is an integer. Suppose the number is 6, which is even because $6 = 2 \cdot 3$. Then $6^2 = 36$, which is divisible by 4 because $36 = 4 \cdot 9$. The square of any even number is divisible by 4 for the same reason. □

1.9. Extra Credit. Suppose a drummer wants to take a solo that is eight beats long and made up of 1-beat notes, 2-beat notes, and 3-beat notes. How many patterns are possible? Show your work. Hint: I don't recommend trying to list the patterns, because there are a lot. Rather, find the sequence of number of patterns, and find the eighth number in that sequence. *If you're a musician, the question is, "How many ways can you fill two measures in 4/4 time with quarter notes, half notes, and dotted half notes?"*