Homework 5

Due Thursday, February 14th in class

Read Chapter 1 of *A Brief History of the Philosophy of Time*, available on the course site here:
`http://faculty.bard.edu/~hhaggard/teaching/phys125Sp19/homework/BardonCh1.pdf`
You should read the entire chapter, but these questions come from the first half of the reading.

1. Cutting Zeno some slack, thinking about adding up an infinite series of numbers is not easy.

   (a) The series he uses in the Dichotomy paradox is an example of what we now call a *geometric series*. You cannot add up the whole series, but add the first 10 terms, and give the sum,

   $$\text{Sum}_{10} = \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \cdots + \frac{1}{2^9} + \frac{1}{2^{10}}$$

   (b) Now, add up the first 20 terms, and give the sum,

   $$\text{Sum}_{20} = \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \cdots + \frac{1}{2^{19}} + \frac{1}{2^{20}}$$

   (c) What do you notice about the two sums, in particular in their relation to the number 1? We say (and can prove) the "1 is the limit of the harmonic series $1/1 + 1/2 + \ldots$."

2. Now consider this simpler sum, which we call the *harmonic series*.

   (a) You cannot add up the whole series, but add the first 10 terms, and give the sum,

   $$\text{Sum}_{10} = \frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{9} + \frac{1}{10}$$

   (b) Now, add up the first 20 terms, and give the sum,

   $$\text{Sum}_{20} = \frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{19} + \frac{1}{20}$$

   (c) What do you notice about these two sums?
   We say (and can prove) that "The geometric series $1/1 + 1/2 + \ldots$ has no limit."

3. Based on your reading of the Chapter from *A Brief History of the Philosophy of Time*,

   (a) How well does Aristotle's "relationalist" view of time address Zeno's paradoxes?

   (b) How well does this "relationalist" view of time mesh with what we learned about time in Einstein's system of Special Relativity?