Center of Mass [1]

Consider the stack of identical books pictured in Figure 1. Notice the top

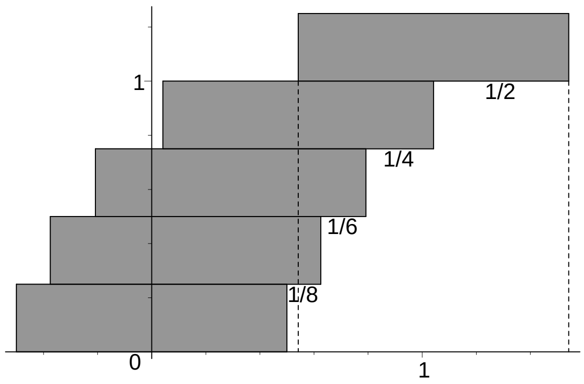

Figure 1: A precarious stack of books.

book on the stack extends completely beyond the footprint of the bottom book. Show that given enough identical books one can create a stack such that the top book extends as far to the right of the bottom book as you want. Let the sequence $\{1/2, 1/4, 1/6, 1/8\}$ be know as the **overhang sequence**.

1. Begin by computing the center of mass of the stack of books in Figure 1. (Hint: compute the center of mass along the x-axis of each book and average.) Is the stack stable? What does the center of mass tell about the stability of the stack?

2. Compute the center of mass for an arbitrary extension of the overhang sequence $\{1/2, 1/4, 1/6, 1/8, 1/10, \ldots, 1/(2n)\}$. You may assume all of the books are of uniform size, density and have length 1.

3. Compute how far the top book extends beyond the footprint of the bottom book for the arbitrary length overhang sequence in Part 2.

4. Explain how this problem is related to the *harmonic series*.

[1] adapted from *Calculus: Early Transcendentals*, 4th ed. Stewart, pg 780