

## Second Homework

### Geology - Physics 30

1. Cantor Middle Half Set (MHS). The Middle Half Set is constructed by removing the middle half of each line at the next generation. (Recall that the Middle Thirds Set was constructed by removing the middle third of each line at the next generation). We want to measure the length at each stage of construction of the MHS.

a) First, measure the length at each stage in constructing the Cantor MHS. We cover the MHS with one interval of length 1. Next, we cover it with two intervals of length  $1/4$ , so its length is  $2 \cdot 1/4 = 1/2$  (actually, slightly less, since we don't count the points at the end of the two lines). Continue this line of reasoning, and state your conclusion (in words) what you think about the length the Cantor MHS will be.

b) Remainder: Now measure the lengths of the intervals removed in forming the MHS and see what remains. For example, first we remove one interval of length  $1/2$ , then two intervals of length  $1/2 \cdot 1/4 = 1/8$ , and so on. Using a calculator, add up the lengths removed ( $1/2 + 2 \cdot 1/8 + \dots$ ) up to the 5<sup>th</sup> generation, and extrapolate to the  $n^{\text{th}}$  generation. What do you get for the removed length of the MFS? What remains?

c) Using the equations in the Fractal Dimension Summary [link](http://rundle.physics.ucdavis.edu/PHYGEO30/Fractal_Dimensions_Summary.pptx) on this web site, compute the fractal dimension of Cantor MHS, the Cantor Set formed from the unit interval (0 to 1) by removing the middle half of the interval. Note that the link is at:  
([http://rundle.physics.ucdavis.edu/PHYGEO30/Fractal\\_Dimensions\\_Summary.pptx](http://rundle.physics.ucdavis.edu/PHYGEO30/Fractal_Dimensions_Summary.pptx))