Assignment 1; Due Friday, September 30

Read the preface. Skim section 0, ignoring everything about groups for now. Carefully read section 1 on metric spaces. I will probably not lecture on this section until Friday, so you will be on your own with the first exercise set. *This will never happen again.* If you are puzzled, come to my office hours on Thursday.

For Friday, do exercises 1.2, 1.3abe. In part a), only do the cases $d = ||x - y||$ and $d = \sum |x_i - y_i|$. When you do the first of these cases, you will find it useful to use the inequality $||x + y|| \leq ||x|| + ||y||$. Undergraduates can just assume this.

Graduate students should prove this inequality. I recommend the following approach. Define $< x, y >$ to be the standard dot product $\sum x_i y_i$. Prove the Schwarz Inequality $| < x, y > | \leq ||x||\ ||y||$. The required inequality should follow from this by noticing that $||x + y||^2 =< x + y, x + y >$. To prove the Schwarz inequaltiy, notice that the following expression is nonnegative:

$$\left\langle x - \frac{< x, y >}{||y||^2} y, x - \frac{< x, y >}{||y||^2} y \right\rangle$$