Economics 250
Summation

Often when we calculate statistics we need to add or average something across the observations. A very useful tool for describing how we do this is the summation operator, given by the capital greek letter sigma: $\sum$.

Imagine that some data or values of a random variable are labelled x and indexed with a second label i that counts from 1 to n. Then the sum of the values is:

$$\sum_{i=1}^{n} x_i.$$

We'll need (and prove) four different, but straightforward rules for using this shorthand operator:

1. Suppose that c is a constant:

$$\sum_{i=1}^{n} cx_i = c\sum_{i=1}^{n} x_i.$$

2. Suppose we are simply adding constants:

$$\sum_{i=1}^{n} c = nc.$$

3. Suppose y_i is a second random variable:

$$\sum_{i=1}^{n}(x_i + y_i) = \sum_{i=1}^{n} x_i + \sum_{i=1}^{n} y_i.$$

4. Finally, suppose a and b are constants:

$$\sum_{i=1}^{n}(a + bx_i) = na + b\sum_{i=1}^{n} x_i.$$