

Figure 1

$$\rho = \frac{1}{n} \sum_{i=1}^n \left(\frac{x_i - \mu_x}{\sigma_x} \right) \left(\frac{y_i - \mu_y}{\sigma_y} \right)$$

Figure 2-3

i -th entry of
x is $\left(\frac{x_i - \mu_x}{\sigma_x} \right)$ SDs
away from
the average

y_i is
 $\left(\frac{y_i - \mu_y}{\sigma_y} \right)$ SDs
away from
the average *y*

Figure 4

product of

$$\left(\frac{x_i - \mu_x}{\sigma_x} \right) \left(\frac{y_i - \mu_y}{\sigma_y} \right)$$

**will be positive
as often as negative
and will average
to about 0**

Figure 5

$$\rho = \frac{1}{n} \sum_{i=1}^n \left(\frac{x_i - \mu_x}{\sigma_x} \right)^2 = 1/\sigma^2 \frac{1}{n} \sum_{i=1}^n (x_i - \mu_x)^2 = 1$$

Figure 6

