Q: In the slides, you present two formulas for the sample correlation coefficient, *r*:

(1)

And

(2) .

Why are they equivalent?

A: Let’s start by remembering that , the standard deviation of which figures in the first formula, is defined as

(3) ,

And similarly, , the standard deviation of , is defined as

(4) .

If we plug in (3) and (4) into (1), we get:

(5)

which shows that (1) and (2) are equivalent. Note that in (5) above, the *n – 1* term that you see in equation (1) disappears – after the substitution of and , it appears in both the numerator and denominator and cancels out, which is why you don’t see it in equation (2).