

NRES 746, Week 11, Lecture 2: Two Cores from One Tree

Name: _____

Instructions: Work alone on Part 1 (about 4 minutes), then work with a neighbor on Part 2. Keep laptops closed.

You want the mean annual ring width of the pinyon pines in a stand. Each increment core gives one measurement X with variance $\sigma^2 = 0.04 \text{ mm}^2$ ($\sigma = 0.2 \text{ mm}$). Two facts you'll need:

$$\text{Var}(aX) = a^2 \text{Var}(X) \quad \text{Var}(X + Y) = \text{Var}(X) + \text{Var}(Y) + 2 \text{Cov}(X, Y)$$

where $\text{Cov}(X, Y) = \rho \sigma_X \sigma_Y$ and ρ is the correlation between X and Y .

Part 1: Two cores (individual)

You average two cores, $M = (X_1 + X_2)/2$.

1a. If the two cores come from different trees ($\rho = 0$), $\text{Var}(M) = \text{_____} \text{ mm}^2$.

1b. If both cores come from the same tree ($\rho = 0.6$), $\text{Var}(M) = \text{_____} \text{ mm}^2$.

Part 2: Ten cores (with a neighbor)

2a. Design A: ten cores from one tree (every pair has $\rho = 0.8$). Design B: one core from each of ten trees (independent). Which design estimates the stand's mean more precisely, and by how much? Ten cores from one tree are worth about how many independent cores?

More precise: Design _____, by a factor of about _____. Ten cores from one tree $\approx$ _____ independent cores.