# PSYC 5322: Psychometrics

Tarleton State University | Homework 4 | Spring 2020

1. Given the assumptions of classical test theory, answer the following:
   (a) If $X = 10$ and $E = 2$, what does $T$ equal?
   (b) If $\sigma_T^2 = 5$ and $\sigma_X^2 = 10$, what does $\sigma_E^2$ equal?
   (c) If $\sigma_E^2 = 3$ and $\sigma_X^2 = 9$, what does $\rho_{XT}^2$ equal?
   (d) If $\sigma_E^2 = 1$ and $\sigma_X^2 = 4$, what does $\rho_{XT}^2$ equal?
2. Suppose $\rho_{XX'} = 0.8$ and the observed test-score variance is 25.
   (a) Compute and interpret the values of $\sigma_T^2/\sigma_X^2$, $\sigma_E^2/\sigma_X^2$, $\rho_{XE}^2$, and $\rho_{XT}^2$
   (b) Compute the true-score variance and the error variance.
3. If $\rho_{XX'} = 0.6$ and $\sigma_X^2 = 25$, what are the true-score variance, the error variance, and the standard error of measurement?
4. (extra credit) Suppose $X$ and $X'$ are parallel tests; that is, each subject has the same true score on both tests, error variances are equal, and the correlation between errors on the parallel forms is 0. Prove that the correlation between $X$ and $X'$ is equal to $\sigma_T^2/\sigma_X^2$. *Note: this problem establishes the validity of using $\sigma_T^2/\sigma_X^2$ as the definition of reliability.*