# Runs Test and Random Sampling

The null hypothesis H₀: F(z) = G(z) for the runs test is equivalent to testing whether data are randomly sampled because it tests the fundamental property of random sampling - independence and identical distribution of observations.

When we state F(z) = G(z), we're essentially saying that the two samples come from the same distribution. In the context of a runs test, we're examining the sequence of observations after ordering them, marking each as belonging to one of two groups (often above or below the median, or from sample 1 or sample 2).

If observations are truly randomly sampled, then the sequence of group memberships should appear random - neither clustered (too few runs) nor alternating (too many runs). The runs test specifically examines whether the pattern of runs (consecutive observations from the same group) matches what we would expect under random sampling.

When F(z) = G(z), it implies no systematic differences between groups, meaning observations are exchangeable and should be randomly distributed throughout the sequence. Any departure from the expected number of runs suggests non-randomness - either dependence between observations or systematic differences between the distributions.

Therefore, testing H₀: F(z) = G(z) is mathematically equivalent to testing whether the data follow the pattern we would expect from a random sample, where group membership has no influence on the ordering of observations.