Requirements

1. The sample data are arranged according to some ordering scheme, such as the order in which the sample values were obtained.

2. Each data value can be categorized into one of *two* separate categories (such as male/female).

Test Statistic and Critical Values

For Small Samples and $\alpha = 0.05$: If $n_1 \leq 20$ and $n_2 \leq 20$ and the significance level is $\alpha = 0.05$, the test statistic and critical values are as follows:

Test statistic: G

Critical values: Use Table A-10.

Decision criterion: Reject randomness if the number of runs G is

• less than or equal to the smaller critical value found in Table A-10.

or

• greater than or equal to the larger critical value found in Table A-10.

For Large Samples or $\alpha \neq 0.05$: If $n_1 > 20$ or $n_2 > 20$ or $\alpha \neq 0.05$, the test statistic and critical values are as follows:

Test statistic: $z = \dfrac{G - \mu_G}{\sigma_G}$

where $\quad \mu_G = \dfrac{2n_1 n_2}{n_1 + n_2} + 1$

and $\quad \sigma_G = \sqrt{\dfrac{(2n_1 n_2)(2n_1 n_2 - n_1 - n_2)}{(n_1 + n_2)^2 (n_1 + n_2 - 1)}}$

Critical values of z: Use Table A-2.

Decision criterion: Reject randomness if the test statistic z is

• less than or equal to the negative critical z score (such as -1.96)

or

• greater than or equal to the positive critical z score (such as 1.96).

Example 1   **Small Sample: NBA Champs**

Listed below are the most recent (as of this writing) winners of the NBA basketball championship game. The letter W denotes a winner from the Western Conference, and E denotes a winner from the Eastern Conference. Use a 0.05 significance level to test for randomness in the sequence.

E E W W W W W E W E W E W W W

Solution

Requirement check (1) The data are arranged in order. (2) Each data value is categorized into one of two separate categories (Western/Eastern). The requirements are satisfied. ✅

We will follow the procedure summarized in Figure 13-6. The sequence of two characteristics (Western/Eastern) has been identified. We must now find the values of n_1, n_2, and the number of runs G. The sequence is shown below with spacing used to better identify the separate runs.

E E   W W W W W   E   W   E   W   E   W W W
1st run   2nd run   3rd run 4th run 5th run 6th run 7th run   8th run

continued