

Example 1 Pulse Rates of Males and Females

Table 13-5 lists pulse rates of samples of males and females (from Data Set 1 in Appendix B). Use a 0.05 significance level to test the claim that males and females have the same median pulse rate.

Solution

Requirement check (1) The sample data are two independent simple random samples. (2) The sample sizes are 12 and 11, so both sample sizes are greater than 10. The requirements are satisfied. ✓

The null and alternative hypotheses are as follows:

H_0 : The median pulse rate of males is equal to the median pulse rate of females.

H_1 : The median pulse rate of males is different from the median pulse rate of females.

Rank the combined list of all 23 pulse rates, beginning with a rank of 1 (assigned to the lowest value of 54). The ranks corresponding to the individual sample values are shown in parentheses in Table 13-5. R denotes the sum of the ranks for the sample we choose as Sample 1. If we choose the pulse rates of males as Sample 1, we get

$$R = 4.5 + 11 + 19 + \cdots + 6 = 123.5$$

Because there are pulse rates from 12 males, we have $n_1 = 12$. Also, $n_2 = 11$ because there are pulse rates from 11 females. We can now find the values of μ_R and σ_R and the test statistic z .

$$\begin{aligned}\mu_R &= \frac{n_1(n_1 + n_2 + 1)}{2} = \frac{12(12 + 11 + 1)}{2} = 144 \\ \sigma_R &= \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}} = \sqrt{\frac{(12)(11)(12 + 11 + 1)}{12}} = 16.248 \\ z &= \frac{R - \mu_R}{\sigma_R} = \frac{123.5 - 144}{16.248} = -1.26\end{aligned}$$

The test is two-tailed because a large positive value of z would indicate that disproportionately more higher ranks are found in Sample 1, and a large negative value of z would indicate that disproportionately more lower ranks are found in Sample 1. In either case, we would have strong evidence against the claim that the two samples come from populations with equal medians.

The significance of the test statistic z can be treated as in previous chapters. We are testing (with $\alpha = 0.05$) the hypothesis that the two populations have equal medians, so we have a two-tailed test with critical values $z = \pm 1.96$. The test statistic of $z = -1.26$ does *not* fall within the critical region, so we fail to reject the null hypothesis that the populations of males and females have the same median.

Interpretation

There is not sufficient evidence to warrant rejection of the claim that males and females have the same median pulse rate. Based on the available sample data, it appears that males and females have pulse rates with the same median.