Start

↓

Are the n pairs of data in the form of ranks? — **No** → **Convert the data of the first sample to ranks from 1 to n and then do the same for the second sample.**

Yes ↓

Does either variable have ties among its ranks? — **No** → **Calculate the difference d for each pair of ranks by subtracting the lower rank from the higher rank.**

↓

Square each difference d and then find the sum of those squares to get $\Sigma(d^2)$.

Yes ↓

Calculate r_s using Formula 10-1 with the ranks:

$$r_s = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{n(\Sigma x^2) - (\Sigma x)^2}\,\sqrt{n(\Sigma y^2) - (\Sigma y)^2}}$$

Complete the computation of

$$r_s = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$$

to get the test statistic.

↓

Is $n \le 30$? — **No** → **Calculate the critical values**

$$r_s = \pm \frac{z}{\sqrt{n-1}}$$

where z corresponds to the significance level.

Yes ↓

Find the negative and positive critical values of r_s from Table A-9.

↓

- If r_s is between the negative and positive critical values, fail to reject the null hypothesis $\rho_s = 0$ (no correlation).
- If r_s is not between the negative and positive critical values, reject the null hypothesis $\rho_s = 0$ and conclude that there is sufficient evidence to support a claim of a correlation.

Figure 13-5 Rank Correlation Procedure for Testing H_0: $\rho_s = 0$

Direct Link Between Smoking and Cancer

When we find a statistical correlation between two variables, we must be extremely careful to avoid the mistake of concluding that there is a cause-effect link. The tobacco industry has consistently emphasized that correlation does not imply causality as they denied that tobacco products cause cancer. However, Dr. David Sidransky of Johns Hopkins University and other researchers found a direct physical link that involves mutations of a specific gene among smokers. Molecular analysis of genetic changes allows researchers to determine whether cigarette smoking is the cause of a cancer. (See "Association Between Cigarette Smoking and Mutation of the p53 Gene in Squamous-Cell Carcinoma of the Head and Neck," by Brennan, Boyle et al, *New England Journal of Medicine*, Vol 332, No. 11.) Although statistical methods cannot prove that smoking *causes* cancer, statistical methods can be used to identify an association, and physical proof of causation can then be sought by researchers.