The F test for variances

One of the assumptions of any method that pools sample variances is that the samples arise from populations with homogeneous variances. Before proceeding with a test that pools variances, it is recommended that you test for the assumption of homogeneous variances.

Null hypothesis: No difference in population variances

Alternative hypothesis: There is a difference

Data: Variances of samples 1 and 2

Method: Inspect the two sample variances. One of them should be larger than the other. Make a fraction by putting the larger variance over the smaller variance.

$$F \text{ observed} = \text{Larger variance} / \text{Smaller variance}$$

You compare the F observed to the F critical from a table of F statistics. The degrees of freedom are numerator sample size - 1, denominator sample size - 1. Reject the null hypothesis if the F observed is larger than the F critical.

(The only wrinkle in all of the above is that you are doing a two-tailed test . . . you don't care which sample has the larger variance, you will put the larger variance from either sample in the numerator. Thus you are doing a two-tailed test, and you will have to double the probability level for the F statistics that you find in most F tables. Thus instead of working at $p = 0.05$, you are really using 0.1, and instead of working at $p = 0.01$, you are really using 0.02).

Example:

Two methods are used to measure the business acumen expressed by heroines of romance novels. The mean of method 1 is 88.6 with a variance of 109.63 in a sample of size 41. The mean of method 2 is 85.1 with a variance of 65.99 in a sample of size 21.

Before you test if the means of these two methods are the same, you should test if they possess homogeneous variances.

Ho: No difference

Ha: Difference

Observed F = 109.63 / 65.99 = 1.66

Critical F (40,20) at alpha (0.1) = 1.84

Retain Ho, and proceed to use a method that pools sample variances.