SUMMARY: Steps of ANOVA *F* Test for Comparing Population Means of Several Groups

1. **Assumptions:** Independent random samples (either from random sampling or a randomized experiment), normal population distributions with equal standard deviations
2. **Hypotheses:** H_0: $\mu_1 = \mu_2 = \cdots = \mu_g$ (Equal population means for g groups), H_a: at least two of the population means are unequal.
3. **Test statistic:** $F = \dfrac{\text{Between-groups variability}}{\text{Within-groups variability}}$.

   F sampling distribution has $df_1 = g - 1$, $df_2 = N - g$ = total sample size − number of groups
4. **P-value:** Right-tail probability of above observed F value
5. **Conclusion:** Interpret in context. If decision needed, reject H_0 if P-value $<$ significance level (such as 0.05).

SUMMARY: Confidence Interval Comparing Means

For two groups i and j, with sample means $\bar{y}_i$ and $\bar{y}_j$ having sample sizes n_i and n_j, the 95% confidence interval for $\mu_i - \mu_j$ is

$$\bar{y}_i - \bar{y}_j \pm t_{.025} s \sqrt{\frac{1}{n_i} + \frac{1}{n_j}}.$$

The t-score from the t table has $df = N - g$ = total sample size − # groups.

SUMMARY: *F* Test Statistics in Two-Way ANOVA

For testing the main effect for a factor, the test statistic is the ratio of mean squares,

$$F = \frac{\text{MS for the factor}}{\text{MS error}}.$$

The MS for the factor is a variance estimate based on between-groups variation for that factor. The MS error is a within-groups variance estimate that is always unbiased.