ANOVA

Uses of ANOVA

- Used to evaluate mean differences between two or more treatment.
- Uses sample data as basis for drawing general conclusions about populations

Advantage over multiple *t* test: it can be used to compare more than *two* treatments at a time

Factor- The independent (or quasi-independent) variable that designates the groups being compared

- Ex. Gender

Levels- Subdivision of factors

- Ex. Two levels for the factor of gender

One-way ANOVA- where the research only involves **one** factor

Two-way ANOVA- where the research involves **two** factors

Factorial design- A study that combines two or more factors

- **Null hypothesis**: In the population, the means of the groups do not differ from each other. $$H_0 : \mu_1 = \mu_2 = \mu_3$$
- **H_1: There is *at least one* mean difference among the populations**

ANOVA is a non-specific test

- Rejecting the null hypothesis indicates that <u>at least one of the means</u> is significantly different from the others
  - Doesn't say which one or if all the means are different
  - ANOVA is also called an omnibus test

$$F = \frac{variance(differences)\,between\,sample\,means}{variance(differences)\,expected\,with\,no\,treatment\,effect}$$

ANOVA

- **Between-treatments variance (i.e., treatment variance)**
  - Variability results from general differences between the treatment conditions
  - Variance between treatments measures differences among sample means
- **Within-treatments variance (i.e., error variance)**
  - Variability within each sample
  - Individual scores are not the same within each sample
  - Variance within treatments measures expected differences under H0

1) ANOVA allows researchers to compare several treatment conditions without conducting several hypothesis tests. **TRUE**

2) If the null hypothesis is true, the *F*-ratio for ANOVA is expected (on average) to have a value of 0. **FALSE**

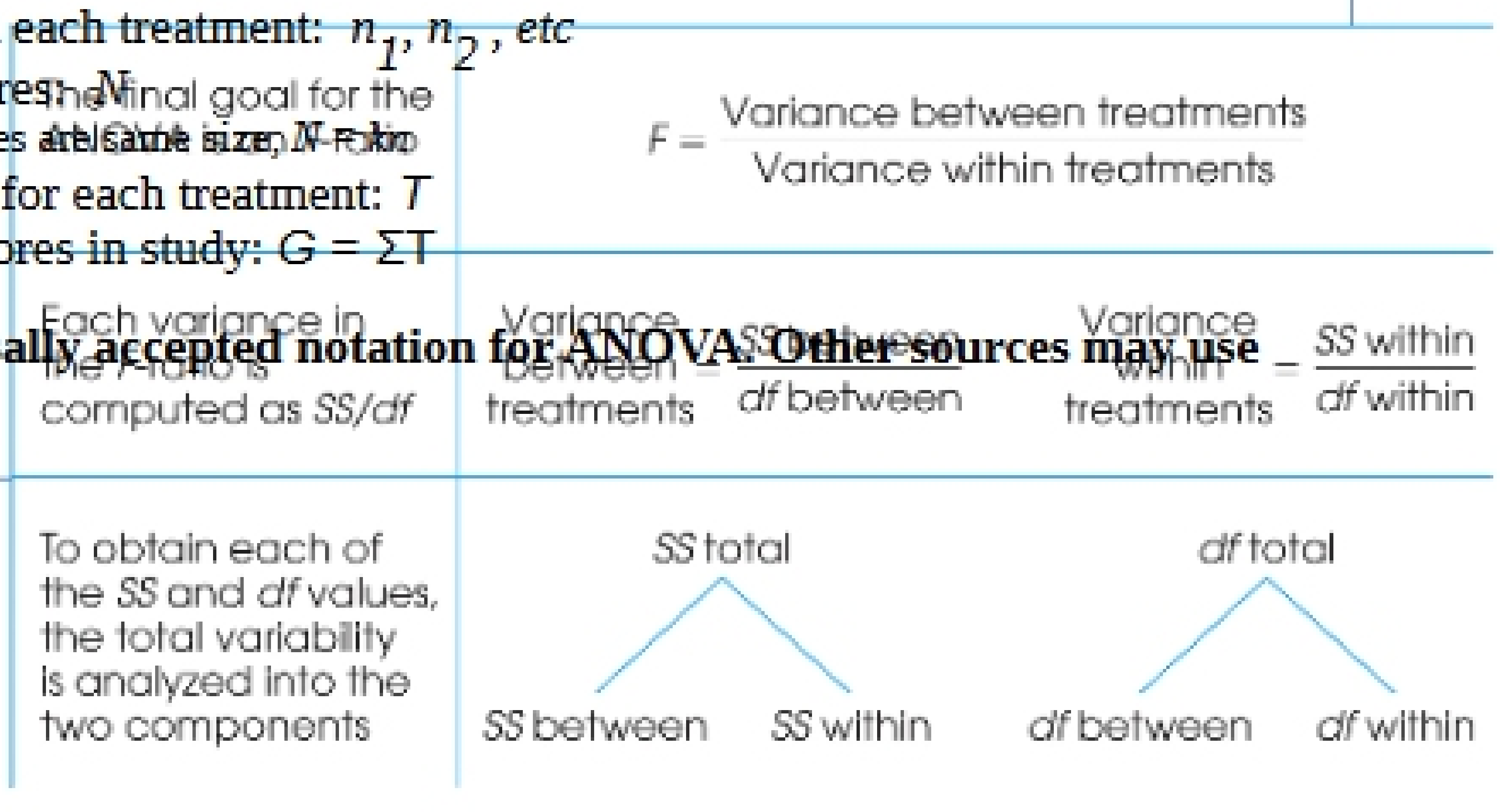
3) An analysis of variance produces $SS_{total} = 80$ and $SS_{within} = 30$. For this analysis, what is $SS_{between}$? **50**

4) Which combination of factors is most likely to produce a large value for the F-ratio? **large mean differences and small sample variances**

5) Post tests are needed if the decision from an analysis of variance is to fail to reject the null hypothesis. **FALSE**

6) A report shows ANOVA results: $F(2, 27) = 5.36$, $p < .05$. You can conclude that the study used a total of 30 participants **TRUE**

- Number of treatment conditions: k
- Number of scores in each treatment: n_1, n_2, *etc*
- Total number of scores: N
  - When all samples are same size, $N = kn$
- Sum of scores (ΣX) for each treatment: T
- Grand total of all scores in study: $G = \Sigma T$
- **There is no universally accepted notation for ANOVA. Other sources may use other symbols.**



ANOVA

$$SS_{total} = \sum (X^2) - \frac{G^2}{N}$$

$$SS_{between-treatments} = \sum (\frac{T^2}{n}) - \frac{G^2}{N}$$

$$SS_{within-treatments} = \sum SS_{inside each treatment}$$

$$MS_{between} = s^2_{between} = \frac{SS_{between}}{df_{between}}$$

$$MS_{within} = s^2_{within} = \frac{SS_{within}}{df_{within}}$$

$$F = \frac{s^2_{between}}{s^2_{within}} = \frac{MS_{between}}{MS_{within}}$$