# Review Questions for Chapter 11

1. What are the advantages of doing an experiment that has more than two groups?
2. What is the fewest number of groups you would need to draw a line through your group means that

\_\_\_\_\_ Had no bends in it (i.e., a straight line)

\_\_\_\_ Had one bend in it (e.g., a “u” shaped line, a simple curve)

\_\_\_\_ Had two bends in it (e.g., a “w” shaped line)

1. Random assignment is vital for \_\_\_\_\_\_\_ validity.
2. Using an empty control group in a simple experiment may cause people to question your experiment’s \_\_\_\_ validity.
3. Empty control group participants will not all score the same because of \_\_\_\_\_ \_\_\_\_\_\_.
4. If the null hypothesis is false, variability within-groups represents \_\_\_\_\_ \_ \_\_\_\_\_.
5. If the null hypothesis is true, variability within-groups represents ..
6. If the null hypothesis is false, variability between-groups represents \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
7. If the null hypothesis is true, variability between-groups represents .
8. When analyzing a multiple-group experiment, why should you use an F test rather than a t test?
9. A stronger \_\_\_\_\_\_\_\_\_ \_ \_\_\_\_\_\_\_\_\_would increase between groups variance but not within groups variance.
10. Having more random error in your study will
    1. Increase within groups variance
    2. Increase between groups variance
    3. Increase both within and between groups variance
11. If you are told that *F* is 2.72, do you know whether the treatment effect is statistically significant?
12. If you are told that *F* is less than 1, do you know whether the treatment effect is statistically significant?
13. If you have 2 levels of the IV, how many trends can you look for? What if you have 3 levels? 4 levels?
14. If you have 100 participants and 5 groups, what would be the
    1. Degrees of freedom for your group variable?
    2. Degrees of freedom for error 95(100-5); N – G
    3. Total degrees of freedom 99 (100 -1), N – 1
15. In analysis of variance, the between groups variance is called \_\_\_\_ or \_\_\_\_\_ and the within groups variance is called \_\_\_\_\_ \_\_\_\_ or \_\_\_\_ \_\_\_\_\_.
16. If you do an ANOVA on a 3-group experiment, have a significant effect with a 3-group ANOVA, you know that the null hypothesis that Group 1 mean = Group 2 mean = Group 3 mean is false. So, do you know which groups differ from each other?

# Answers to Review Questions for Chapter 11

1. What are 3 advantages of doing an experiment that has more than two groups?
   1. You can more than two options or more than two ***kinds*** of treatments. For example, if you were looking at the effects of color in a simple experiment, you could only compare two colors; with a multiple-group experiment, you could compare several colors.
   2. You can map the ***functional relationship*** between amount of treatment and effect. To be a practical science, psychology needs to be able to specify how much of a treatment leads to what effect. It is not enough to say that 30 minutes of exercise improves mood more than 0 minutes of exercise because few people get exactly 30 minutes of exercise. We want to know the effect of different amounts of exercise because amounts matter-- Dosage often determines whether something is a medicine or a poison. Furthermore, we know that more is not always better: There is often a point at which increasing the amount of a variable (exercise, meditation, Prozac, studying) leads to diminishing returns. That is, many functional relationships are nonlinear. With a two-group study, you cannot map nonlinear relationships: The line you draw between two means will be a straight line. With a three-group study, on the other hand, it may be that all three means do not fit on a straight line. You might, for example, end up drawing a “v” or a “u” shaped line.
   3. You can use ***several control groups***. For example, you could compare a treatment to an empty control group ***and*** to a placebo control group. That way, you could see whether the treatment was better than nothing, whether the treatment was better than a placebo, and whether there was a placebo effect. Similarly, you don’t have to choose between two different control groups—you could have both.
2. What is the fewest number of groups you would need to draw a line through your group means that

\_\_2\_\_ Had no bends in it (i.e., a straight line)

\_\_3\_Had one bend in it (e.g., a “u” shaped line, a simple curve)

\_\_4\_Had two bends in it (e.g., a “w” shaped line)

1. Random assignment is vital for ***internal*** validity.
2. Using an empty control group in a simple experiment may cause people to question your experiment’s ***construct*** validity.
3. Empty control group participants will not all score the same because of ***random error***.
4. If the null hypothesis is false, variability within-groups represents ***random error***.
5. If the null hypothesis is true, variability within-groups represents ***random error***.
6. If the null hypothesis is false, variability between-groups represents ***the treatment effect and random error.***
7. If the null hypothesis is true, variability between-groups represents ***random error***.
8. When analyzing a multiple-group experiment, why should you use an *F* test rather than a *t* test?

Suppose you did one F test using a .05 significance level. In that case, your Type 1 error risk would be about .05. If you did tests using a .05 significance level, although your Type 1 error risk was .05 for each test, your risk of at least one of the tests being a Type 1 error would be much higher. For example, if you had a 3 group experiment, you would need to do 3 *t* tests, and so even if you used a .05 significance level, the chances of making a Type 1 error when the null is true would be 3 X .05 or .15 (The logic is similar to the chances of getting a head when flipping coins: The chances of getting a head are .5 if you flip one coin, but the chances of getting at least one head are much higher if you flip 3 coins.)

1. A stronger **treatment effect** would increase between groups variance but not within groups variance.
2. Having more random error in your study will
3. Increase within groups variance
4. Increase between groups variance
5. **Increase both within and between groups variance**
6. If you are told that *F* is 2.72, what do you know about the treatment effect?

Nothing. As with the *t*, you would need to know the degrees of freedom for the F and then look up the critical value for an *F* with those degrees of freedom.

1. If you are told that *F* is less than 1, what do you know about the treatment effect?

There is no evidence of a treatment effect. Between group variance (which includes an estimate of the treatment effect and an estimate of random error) is no bigger than within group variance(an estimate of random error).

1. If you have 2 levels of the IV, how many trends can you look for? What if you have 3 levels? 4 levels?
   1. One- the linear trend (a straight line with no bends in it)
   2. Two- the linear trend (a straight line with no bends in it) and a quadratic trend (a line with one bend in it)
   3. Three- the linear trend (a straight line with no bends in it), a quadratic trend (a line with one bend in it), and a cubic trend (a line with two bends in it).
2. If you have 100 participants and 5 groups, what would be the
   1. Degrees of freedom for your group variable? 4 (5 -1); G-1
   2. Degrees of freedom for error 95(100-5); N – G
   3. Total degrees of freedom 99 (100 -1), N – 1
3. In analysis of variance, the between groups variance is called **MS Between** or **MS Treatment** and the within groups variance is called **MS Within** or  **MS Error.**

1. If you do an ANOVA on a 3-group experiment, have a significant effect with a 3-group ANOVA, you know that the null hypothesis that Group 1 mean = Group 2 mean = Group 3 mean is false. So, do you know which groups differ from each other?

No,

The only difference between means might be between Group 1 and Group 2

Or

The only difference between means might be between Group 1 and Group 3

Or

The only difference between means might be between Group 2 and Group 3.

Or

Group 1 might differ from Group 2 and from Group 3, but Groups 2 and 3 don’t differ.

Or

Group 2 might differ from Group 1 and from Group 3, but Groups 1 and 3 don’t differ.

Or

Group 3 might differ from Group1 and Group 2, but Groups 1 and 2 don’t differ.

Or

All the groups differ from each other.

To figure out which possibilities are correct, you need to do post hoc tests.