**Multiple Choice Questions**

1. True experiments require:

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| a. | measuring two continuous variables |
| b. | measuring a predictor and measuring an outcome |
| c. | manipulating an independent variable and measuring a dependent variable |
| d. | manipulating a binary categorical variable and measuring a dependent variable |

1. All of the following are **true** about confidence intervals around the mean difference, **EXCEPT**:

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| a. if the CI around the mean difference contains zero, you retain the null hypothesis of no differences between groups. |
| b. if your point estimate for the mean difference is 1.0, and your margin of error is calculated to be 2.50, then you should retain the null hypothesis that there are no differences in the means. |
| c. if your 95% CI is [-3.05, -.75], then you should retain the null hypothesis (it is credible). |
| d. your interpretation of your CI results should always align with your interpretation of  your p-values, for any given study. |

1. A researcher randomly assigns students to take notes using a laptop or take notes using a notebook, and is interested in whether note-taking method influences memory for the notes, as measured by an exam. In this study, the t-test that the researcher runs would compare:

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| a. | amount of notes taken between the laptop group and notebook group. |
| b. | the exam scores of the laptop group with the exam scores of the notebook group. |
| c. | the GPA of students who prefer taking notes on laptops with the GPA of students who prefer taking notes in a notebook. |
| d. | None of these. |

1. A 4th grade teacher wants to know whether there is a relationship between sex (male vs. female) and attention span in her classroom. Which is true about her study?

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| a. | It is a true experiment. |
| b. | It contains a within-subjects design. |
| c. | Attention span is the independent variable. |
| d. | Sex is a categorical variable. |

1. A researcher compares the mental health of students who regularly meditate with the mental health of students who do not regularly meditate. In this example, the predictor is \_\_\_\_\_ and the outcome is \_\_\_\_\_\_.

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| --- | --- |
| a. | higher meditation; lower meditation |
| b. | good mental health; poor mental health |
| c. | whether or not students meditate; students’ mental health |
| d. | students’ mental health; whether or not students meditate |

1. A statistics professor is interested in whether having lab period on the *same* day as lecture leads to more positive attitudes during lab than having lab period on a *different* day than lecture. She uses the students who chose to take statistics in two different semesters – one class in Fall 2018 (lecture on same day) and one in Spring 2019 (lecture on different day) – to test the hypothesis. *This design is*:

|  |  |
| --- | --- |
| a. | a true experiment with a between-subjects design. |
| b. | a study (but not technically a true experiment) with a between-subjects design. |
| c. | a true experiment with a within-subjects design. |
| d. | a study (but not technically a true experiment) with a within-subjects design. |

1. A statistics professor is interested in whether having lab period on the *same* day as lecture leads to more positive attitudes during lab than having lab period on a *different* day than lecture. She uses the students who chose to take statistics in two different semesters – one class in Fall 2018 (lecture on same day) and one in Spring 2019 (lecture on different day) – to test the hypothesis. If there are differences in the attitudes toward lab between the two classes, *systematic* variation would mean:

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| --- | --- |
| a. | differences in attitudes produced by differences in personalities of the students. |
| b. | differences in attitudes produced by differences in year of student (e.g., sophomore, junior, etc.). |
| c. | differences in attitudes produced by having lab on the same versus different days than lecture. |
| d. | None of these. |

1. A statistics professor is interested in whether having lab period on the *same* day as lecture leads to more positive attitudes during lab than having lab period on a *different* day than lecture. She uses the students who chose to take statistics in two different semesters – one class in Fall 2018 (lecture on same day) and one in Spring 2019 (lecture on different day) – to test the hypothesis. If there are differences in the attitudes toward lab between the two classes, *unsystematic variation* could mean:

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| a. | differences in personalities produced by differences in attitudes toward lab periods. |
| b. | differences in attitudes produced by differences in whether the lab was on the same or different day than lecture. |
| c. | differences in attitudes produced by differences in the types of students who choose to take statistics in the fall versus in the spring. |
| d. | None of these. |

1. The “alternative hypothesis” for t-tests states that:

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| a. | the two groups will differ on the independent variable; one group is assigned to one condition, and one is assigned to the other. |
| b. | there will be no differences between the two groups, except for their differences on the independent variable. |
| c. | the two groups of the independent variable will score differently from one another on the dependent variable. |
| d. | All of these could be the alternative hypothesis. |

1. As an example of a test-statistic, the *t*-statistic is a ratio of:

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| a. | error variance to variance explained by the model |
| b. | variance in the outcome explained by the predictor/independent variable to variance in the outcome *un*explained by the predictor/independent variable |
| c. | error variance to total variance |
| d. | variance in the predictor explained by the outcome/dependent variable to variance in the predictor unexplained by the outcome/dependent variable |
|  |  |

1. Assuming all else is held constant, the *larger* the *p*-value associated with the t-test:

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| --- | --- |
| a. | the *more* likely it is that the two groups of the IV differ on the DV. |
| b. | the *less* likely it is that the two groups of the IV differ on the DV. |
| c. | the *more* likely it is that the two groups of the DV differ on the IV. |
| d. | the *less* likely it is that the two groups of the DV differ on the IV. |

1. To analyze the data from the study described in question 5, a researcher would use:

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| a. | a paired-samples t-test. |
| b. | a within-subjects t-test. |
| c. | an between-subjects t-test. |
| d. | an independent samples t-test. |

**Indicate “True” or “False” for each statement. If False, explain why you think so and/or how to make the statement true.**

1. When running t-tests, the “predictor” is a qualitative/categorical, binary variable, and the “outcome” is a quantitative/continuous variable.
2. A within-subjects design requires an independent samples t-test.
3. A large *t* statistic is more likely to be statistically significant than a small *t* statistic.
4. A statistically significant p-value will have a value less than .05
5. A non-significant p-value suggests that your independent variable had no effect on your dependent variable.
6. If a t-test produced a p-value = .006, it would suggest that the scores on your dependent variable differ significantly between your independent variable conditions.
7. If I compare students’ critical thinking skills at the beginning of freshmen year with those same students’ critical thinking skills at the end of senior year, this would involve a within-subjects design.
8. When you run an independent samples t-test, you need to have two variables in your file: a predictor/IV and an outcome/DV.
9. When you run a paired samples t-test, you need to have two variables in your file: a predictor/IV and an outcome/DV.
10. When you run a t-test, you are essentially comparing the mean scores on one dependent variable among two groups; sometimes these groups are composed of the same people (within-subjects) whereas other times these groups are composed of different people (between-subjects).

**KEY**

1. C. True experiments are those in which you randomly assign Ps to conditions of a manipulated independent variable, and then measure a dependent variable, while standardizing procedures across conditions of the independent variable.
2. C. If your CI does NOT contain zero, then you reject the null hypothesis. The CI for mean differences is an interval that you are confident surrounds the population value of the mean difference. If this interval does not contain the value of zero, it suggests that the mean difference between the two groups is not zero (the two groups differ).
3. B. The researcher is comparing scores on the DV across the two groups (i.e., across note-taking strategy groups)
4. D. Sex is a categorical variable in this particular study (you may argue it is not categorical in reality, but the researcher is treating it as such here). This is NOT a true experiment because she did not randomly assign sex. The study contains a between-subjects design, because Ps are in only one group (male or female). Attention span is the DV, not the IV.
5. C. Remember that the predictor for a t-test will always be a two-category variable (i.e., a binary variable), in this case, whether or not students meditate. She measures the outcome, mental health.
6. B. The study contains a between subjects design, because students are only in one group/class, not both. It is not a true experiment, because random assignment is not used.
7. C. Systematic variation is variation in the DV (attitudes) produced by the IV/predictor, which is whether the lab is on the same day or different days from lecture.
8. C. Unsystematic variation is variation in the DV (attitudes) produced by factors *other than* the IV/predictor; the types of students who happen to choose a fall vs. spring statistics course could possibly differ and thus could possibly influence the attitudes displayed during lab.
9. C. This is the only item stating the alternative hypothesis. The alt hyp will always propose that the IV will influence the DV, such that the two groups of the IV will show differences on the DV.
10. B. This is just a definitional question, explained in the slides where we discussed the conceptual meaning of t-tests.
11. B. Large p-values (>.05) imply non-significance. If there is non-significance, it means the null hypothesis IS credible (should be trusted). And remember, the null states that there are no differences between the two groups. So as the p-value gets larger, the less likely it is that the two groups of the IV differ in terms of their scores on the DV (the more likely it is that the means on the DV are identical across the two IV conditions).
12. D. Options B and C and are not the way we refer to the t-tests themselves; they’re the way we refer to the designs. Since students are broken up into students who regularly meditate versus those who do not regularly meditate, it means we have two separate groups of students, and thus a between-subjects *design*, for which we’d use an independent samples t-test.
13. T
14. F. it requires a paired samples t-test.
15. T.
16. T
17. T
18. T
19. T
20. T
21. F. You do need two variables, but they are not a predictor variable and an outcome variable. You have a variable that captures the outcome/DV score for one condition, and a variable that captures the outcome/DV score for the other condition. (see the slide where we discussed how to set up your data in SPSS for a paired samples t-test).
22. T