Psychology 225
Practice #1 Answers

1. Describe the purposes of both inferential statistics and descriptive statistics. Give an example (of your own, rather than one used in class) of when either type is likely to be useful.

   The purpose of inferential statistics is to make predictions (or inferences) about populations, based on studying a sample taken from that population. Descriptive statistics organizes and summarizes information (either from a sample or a population) so that the information is made more meaningful for the reader. Inferential statistics is useful when we want to know something about a population (e.g., how U.S. citizens feel about the death penalty) but it would be too costly and time consuming to study everyone. We could randomly sample from the U.S. population, determine the sample's attitude about the death penalty, and make meaningful inferences about how the total U.S. population feels about the death penalty. Descriptive statistics is likely to be useful if we have a lot of information (e.g., all exam scores for a given class) that we want to give feedback on. Here, we could report class average (mean).

2. How does random assignment help reduce the likelihood of confounds? Why are confounds a problem in research? What assumption do researchers make when they use random assignment?

   Random assignment, making sure that each subject has an equal chance of being assigned to each of the treatment conditions, is necessary in order to reduce the likelihood of confounds. An experimental confound is a factor which may influence the dependent variable (what you're measuring) that is not one of the independent variables (what you're intentionally manipulating). This can pose a problem because the researcher may not be sure if the results of the experiment are actually due to what is being manipulated or from the interference of the confound. Let's say a researcher wants to test the effects of room temperature on memory performance. They have two rooms, one which is kept very warm, and the other which is kept much cooler. If an experimenter, for example, assigned all of the participants in their 20s to one condition and those in their 40s to another condition, the researcher could not be sure that differences in memory performance (dependent variable) were actually due to the temperature of the room (independent variable). Memory performance, could in fact, be due to age (the confound). This is why it is necessary to control for as many variables as possible when designing an experiment. When using random assignment, researchers make the assumption that the subjects in each treatment condition do not significantly differ. In the above example, by randomly assigning subjects to the two rooms, we can assume that the age of participants in one room *is not different than the age in the other room. The researcher could then assume that the memory results are not due to age.*

3. How does random selection differ from random assignment, and how do these techniques relate to issues of internal and external validity?

   Random selection, or random sampling, is when a researcher follows a specific set of procedures to ensure that each person in the population has an equal chance of being represented in the sample. Often times, it is both too costly and time consuming to include every member of the population in an experiment, so the researcher must randomly select from the population pool. The researcher then uses this sample to infer characteristics about the total population. Studies based on non-random samples may lack external validity or the extent to which the sample accurately reflects the population—that is, the results of the experiment generalize to the population. Random selection aids external validity by increasing the chance that our sample is a good representation of the population. Random assignment, as described above, is ensuring that each member of this already randomly selected sample has an equal chance or probability of being included in the respective treatment groups. Random assignment assists an experiment's integrity or internal validity by ensuring any group differences (other than the independent variable manipulation) are due to chance. It establishes a clear cause-effect relationship because any differences in the dependent variable are assumed to be caused by the independent variable.

4. Discuss the issue of construct validity in relation to operational definitions. Why is construct validity sometimes a problem and how do researchers deal with it?

   The concepts of intelligence and self esteem, for example, are called psychological constructs cannot be directly observed. In order measure these constructs so that they can actually be studied, researchers form operational definitions. An operational definition is the manner in which we have chosen to measure something for the purpose of the experiment. A common operational definition for intelligence might be the results from an IQ test. Construct validity concerns whether we are measuring what we think we are measuring – (e.g., are we measuring intelligence or something else?). Construct validity can sometimes pose a problem because one researcher's choice of measures is poor, or not agreed upon by other researchers. For example, if we used heart rate as a measure for pain, some might argue it is not measuring pain as much as it is measuring fear or anxiety. Researchers deal with this problem by taking multiple measures of the same construct and examine whether the measures are in agreement (e.g., as one pain score increases, so does the other).

5. Discuss the relationship between univariate, multivariate, and factorial designs with reference to independent variables, dependent variables, and levels. Give an example of a study (or suggest a study) which is univariate but not factorial. Next, suggest how the study would change if the design was factorial univariate.

A univariate design is one in which there is one dependent variable. A multivariate study has multiple dependent variables. A factorial design contains multiple independent variables. If we have one independent variable (e.g., rested versus sleep deprived) and one dependent variable (memory test score), then we have a univariate design with one independent variable (with 2 levels of that independent variable). If we add an additional independent variable to this study (comparing males versus females), then we now have a factorial univariate design – two independent variables (sleep and gender) and one dependent variable (memory test score). In this instance, each independent variable has 2 levels, so we have a 2 x 2 factorial design.

6. Define and give examples of the four measurement scales.

Nominal scales- they simply categorize and classify without implying any natural order to the classifications. Political affiliation (e.g., democrat or republican) is one example.

Ordinal scales- they organize data into a specific order or ranking. Whether someone finished first, second, third, etc. in a race is an example.

Interval scales- this scale establishes the difference between data points. For example, you know that someone has an IQ that is 20 points higher than someone else. Because there is no meaningful zero point, you cannot make ratio statements such as: "it is twice as warm today as it was yesterday."

Ratio scales- these allow us to tell differences between data points AND establish a ratio comparison. Someone may have twice as much money in their pocket as someone else.

7. Can descriptive statistics concern both populations and samples? Why or why not?

Descriptive statistics (measures of central tendency, for example) can concern both populations and samples. It deals with using statistical procedures to summarize, organize, and simplify data. It is merely describing a set of data, so therefore that data may originate from a total population (of elementary school students, for example) or from a sample of that population (a random sample of students from that school).

8. Why can a random sample still have sampling error?

Sampling error occurs whenever the characteristics of the sample (e.g., sample mean and standard deviation) do not equal the characteristics of the population (e.g., population mean and standard deviation) from which the sample came. This is to be expected. Samples rarely exactly match the characteristics of the population. Random sampling gives us the greatest likelihood, in the long run, that our samples will be like our population.