

# Introduction to Statistics in Psychology: PSY 201

Greg Francis, PhD

Department of Psychological Sciences

Psychological Sciences Building, Room 3186, (765) 494-6934

email: [gfrancis@purdue.edu](mailto:gfrancis@purdue.edu)

<http://www.psych.purdue.edu/~gfrancis/Classes/PSY201/indexF23.html>

## Study Guide for Exam 1

*Exam Date: September 22, 2023 (during the regular class period)*

The exam will consist of 10 short-answer questions that will either involve some computation or will require a short essay to explain a concept in statistics. Drawings, graphs, and examples are often helpful when answering an essay question. For computations, you can receive partial credit as long as you show your work. Bring a calculator.

### Chapter 1

1. Know the distinctions between populations and samples and between descriptive and inferential statistics.
2. Know the difference between dependent and independent variables. Be able to identify which variables are which for a given study.
3. Be able to compute a percentile (third definition) for a given (small) set of data.
4. Know the properties and limitations of the scales of measurement. Know examples of each. Be able to identify a variable's scale of measurement (when appropriate).
5. Understand the basics of data collection.
6. Understand what a "distribution" refers to and how it is constructed.
7. Know the meaning of the terms positive skew, negative skew, symmetry, kurtosis, bimodal, leptokurtic, and platykurtic.
8. Know the summation notation that is used for the various formulas and how parentheses and squaring should be interpreted in these formulas.
9. Know what a linear transform refers to.

## Chapter 2

1. Know how to create a frequency table from a set of raw data and know how to convert it to a bar chart.
2. Understand some of the mistakes that can mislead people with poor graphs.
3. Know how to create and extract information from a grouped frequency table. Know how to create a histogram from such a table.
4. Know how to create and extract information from a frequency polygon.
5. Know how to create and extract information from a cumulative frequency polygon.
6. Know how to create and interpret a bar chart.
7. Know how to create and interpret a line graph.

## Chapter 3

1. Understand the various definitions of central tendency: balance scale, smallest absolute deviation, smallest squared deviation.
2. Know how to find/calculate the mode, median, and (arithmetic) mean from a set of data. Know how they are generally affected by the shape of distribution. Know the differences between these measure of central tendency.
3. Understand in what sense the different measures of central tendency are the “middle” of a distribution of scores.
4. Know how the mode, median, and mean are affected by symmetry, and skew in a distribution of scores.
5. Know how to compute variance for a population and for a sample. Understand why there are slightly different formulas.
6. Know how to compute standard deviation for a population and for a sample.
7. Be able to compute the statistics for skew (third moment about the mean) and kurtosis.
8. Know the effect of a linear transformation on the mean and variance of a dataset.
9. Understand the variance sum law (I).

## Chapter 4

1. Know the basic properties of the normal distribution.
2. Know how the normal distribution changes for different values of  $\mu$  and  $\sigma$ .

3. Be able to explain the basics of the Central Limit Theorem.
4. Know how to find an area under the normal distribution (using the on-line app). Know what information these areas provide about proportions of scores in a data set.
5. Know how to find percentiles and percentile ranks for the normal distribution (using the on-line app).
6. Know the properties of the standard normal distribution.
7. Know what  $z$  scores are and their properties. What are their “units”?

## Chapter 5

1. Know what properties make a data set “bivariate”.
2. Understand the basic idea of correlation and correlation coefficients.
3. Understand positive and negative correlations.
4. Understand the difference between a linear and a nonlinear relationship in bivariate data.
5. Know how to compute the Pearson  $r$ . (The equations will be given, but you must know how to use them.)
6. Know how the values of  $r$  relate to the scatterplot.
7. Understand the effect of a restricted range on the value of  $r$ .
8. Understand the variance sum law II.

You may find the following equations useful. This page will be the last page of the exam.

$$P_X = X_{I_R} + (X_{I_{R+1}} - X_{I_R}) F_R$$

$$PR_X = \frac{cf + (0.5)f}{n} \times 100$$

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

$$s^2 = \frac{\sum_i (X_i - \bar{X})^2}{n - 1}$$

$$s^2 = \frac{\sum_i X_i^2 - [(\sum_i X_i)^2/n]}{n - 1}$$

$$\sigma^2 = \frac{\sum_i X_i^2 - [(\sum_i X_i)^2/n]}{n}$$

$$\text{skew} = \frac{\sum_{i=1}^N (X_i - \mu)^3}{N\sigma^3}$$

$$\text{kurtosis} = \frac{\sum_{i=1}^N (X_i - \mu)^4}{N\sigma^4} - 3$$

$$Y = bX + A$$

$$x_i = X_i - \bar{X}$$

$$r = \frac{\sum x_i y_i}{\sqrt{\sum x_i^2 \sum y_i^2}}$$

$$r = \frac{\sum_i X_i Y_i - \frac{1}{n} \sum_i X_i \sum_i Y_i}{\sqrt{\left[ \sum_i X_i^2 - \frac{(\sum_i X_i)^2}{n} \right] \left[ \sum_i Y_i^2 - \frac{(\sum_i Y_i)^2}{n} \right]}}$$

$$\frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

$$z = \frac{X - \mu}{\sigma}$$

$$X = z\sigma + \mu$$

$$z = \frac{X - \bar{X}}{s}$$

$$X = z(s) + \bar{X}$$