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# Statistics Laminate Reference Chart: Parameters, Variables, Intervals, Proportions (Quickstudy: Academic)

**STATISTICS**  
THE BASIC PRINCIPLES OF STATISTICS FOR INTRODUCTORY COURSES

**BASIC DEFINITIONS**

**STATISTIC:** The study of methods for collecting, organizing, and analyzing data.

**Quantitative Statistics:** Procedures used to organize and present data in a consistent and meaningful form.

**Qualitative Statistics:** Procedures employed to arrive at broader conclusions or inferences about populations on the basis of samples.

**POPULATION:** The complete set of actual or potential elements about which inferences are made.

**SAMPLE:** A subset of the population selected using some sampling method.

- **Sampling methods:**
  - **Cluster sample:** A population is divided into groups called clusters, some clusters are randomly selected, and every member in them is observed.
  - **Stratified sample:** The population is divided into strata, and a fixed number of elements of each stratum are selected for the sample.
  - **Simple random sample:** A sample selected so that each possible sample of the same size has an equal probability of being selected, used for most elementary inferences.

**VARIABLE:** An attribute of elements of a population or sample that can be measured (e.g., height, weight, IQ, hair color) and whose value can vary for the same variable that can be measured by graphs.

**DATA:** Values of variables that have been observed.

- **Types of data:**
  - **Qualitative (or "categorical") data:** are descriptive but not numeric, on your gender, your hair color, the color of an automobile.
  - **Quantitative data:** take numeric values.
    - **Count data:** take counting numbers (0, 1, 2, ...), as values, usually representing things that can be counted, as the number of stars on a dog, the number of letters a professor is late in a lecture.
    - **Continuous data:** are like a range of numeric values, not just counting numbers, as the height of a child, the weight of a bag of flour, the amount of time a professor is late.
- **Level of measurement:**
  - **Qualitative data:** can be measured at the:
    - **Nominal level:** values are just names without any order, as color of a car, height in college.
    - **Ordinal level:** values have some natural order, as high school class (freshman / sophomore / junior / senior), military rank.
    - **Quantitative data:** can be measured at the:
      - **Interval level:** numeric data with no actual zero point, numeric differences are meaningful, but ratios are not, as temperature in Fahrenheit degrees (80°F is 20°F warmer than 60°F, but it is not 1/3 as hot).
      - **Ratio level:** numeric data for which there is a true zero, both intervals and ratios are meaningful, as weight, length, distance, most physical properties.

**STATISTIC:** A numerical measure computed from sample data, used to describe the sample and to estimate the corresponding population parameter.

**PARAMETER:** A numerical measure that describes a population. Parameters are usually not computed, but are inferred from sample statistics.

**FREQUENCY DISTRIBUTION**

Provides the frequency (number of times observed) of each value of a variable.

Table 91: Andrea is a diving club and is polled regarding number of pool visits they've had.

all observations (Population) (relative frequency)	$x$	$f$	RF
	2	3	0.2250
	4	3	0.2143
	5	9	0.2571
	7	15	0.2679
	7	16	0.2857
	8	12	0.2143

**GROUPED FREQUENCY DISTRIBUTION:** Values of the variable are grouped into classes.

Table 92: The scores on a midterm exam are grouped into classes.

class	$f$	relative freq.
50-60	4	80
60-70	13	76
70-75	31	58
80-90	19	27
90-100	3	5

**RELATIVE FREQUENCY DISTRIBUTION:** Each frequency is divided by the total number of observations to produce the proportion or percentage of the data set having that value, as listed in column 3 of Table 92.

**CUMULATIVE FREQUENCY DISTRIBUTION:** Frequencies count all observations at a particular value and below that value, as listed in column 4 of Table 92.

**MEASURES OF CENTRAL TENDENCY**

**MEAN:** Most commonly used measure of central tendency, usually meant by "average", sensitive to extreme values.

**POPULATION MEAN:**  $\mu = \frac{1}{N} \sum_{i=1}^N x_i$

**SAMPLE MEAN:**  $\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$

- **Estimated mean:** Computed disregarding some number of the highest and lowest values, less sensitive than ordinary mean.
- **Weighted mean:** Computed with a  $w_i$  weight multiplied to each value, making some values influence the mean more heavily than others.
- **MEDIAN:** Value that divides the set in the same number of observations by on each side of it, less sensitive to extreme values, for an odd number of values, it is the middle value; for an even number, it is the average of the middle two, as in Table 1, the median is the average of the 20th and 21st observations, or 1.5.
- **MODE:** Observation(s) that occur(s) with the greatest frequency, **UNIMODAL DISTRIBUTION**.

**MEASURES OF DISPERSION**

**MEAN OR SQUARES (MS):** The sum of squared deviations from the mean.

• Population MS:  $\sum_{i=1}^N (x_i - \mu)^2$  or  $\sum_{i=1}^N x_i^2 - 2\mu \sum_{i=1}^N x_i + N\mu^2$

• Sample MS:  $\sum_{i=1}^n (x_i - \bar{x})^2$  or  $\sum_{i=1}^n x_i^2 - 2\bar{x} \sum_{i=1}^n x_i + n\bar{x}^2$

**VARIANCE:** The average of square differences between observations and their mean.

• Population variance:  $\sigma^2 = \frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2$

• Sample variance:  $s^2 = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$

• Variances for grouped data:

- Population:  $\sigma^2 = \frac{1}{N} \sum_{j=1}^k f_j(x_j - \mu)^2$
- Sample:  $s^2 = \frac{1}{n} \sum_{j=1}^k f_j(x_j - \bar{x})^2$

**STANDARD DEVIATION:** The square root of the variance (either variance, if that the case, or MS as the original data set is not normally used).

• Pop. SD:  $\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$

**STANDARD SCORES:** Also known as Z scores, the standard score of a value is the standard number of standard deviations from the mean at which the value is found, that is,  $z = \frac{x - \mu}{\sigma}$ .

- A positive Z score indicates a value greater than the mean, a negative Z score indicates a value less than the mean, a Z score of zero indicates the mean value.
- A scoring every value in a data set or distribution in a normal standard distribution, mean a data set or distribution has been standardized, if that is not mean=0, SD=1, and a normal distribution at 0.

**GRAPHING TECHNIQUES**

**BAR GRAPH:** A graph that uses bars to indicate the frequency of occurrence of observations.

**Histogram:** A bar graph used with quantitative, continuous variables.

**FREQUENCY CURVE:** A graph representing a frequency distribution in the form of a continuous line that makes a histogram.

**Continuous Frequency curve:** A continuous line that makes a histogram when bars in all the vertical classes are stretched up in the adjacent higher class, except for a negative class.

**Relative mean curve:** The frequency curve is reshaped if each interval is wider or smaller than the mean.

**Normal curve:** Both skewed curves, symmetric.

**Skewed curves:** Deviates from symmetry, frequency curve is shifted to the longer "tail" to the left (skew to the right) or to the right (skew to the left).



## Synopsis

This guide is a perfect overview for the topics covered in introductory statistics courses.

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## Customer Reviews

The Graduate School I attend has a mandatory requirement- all students must register and pass (with a B or better) Introductory and Advanced Statistics. Intro Statistics was "instructed" by a gentleman who wanted to be anywhere else but the classroom. (Read: Taught myself Intro Stats). There are many texts that review statistical concepts and provide a step-by-step illustrations of the never-ending list of formulas. Having read a stack of textbooks, not one provides a condensed summary of all the procedural and conceptual explanations. This chart is the "missing link" . If for nothing else, you can use it as a placemat.

I'm currently taking a nasty class in modeling and simulation, with an emphasis on statistical analysis of inputs and outputs. This cheat sheet has been a lifesaver. Its great for doing homework and midterms when I don't want to fish out my book and look through all 700 pages for a formula or t-distribution table. The theories are well-written and straightforward. This has actually helped me understand lecture material that didn't absorb during class. I've used about 3/4 of the items provided in one class alone. I highly recommend this product for anyone taking a similar class.

This is one of the best of the Quick Study guides. It's about as helpful a condensation of the first

semester or two of stat that you'll find. With so many grad programs, from psychology to biology to MBAs requiring at least a semester or two of stat there's a great need for a terrific little primer like this. I've been using the Quick Study guides (now BarCharts) for almost 40 years and they're the best short guides out there. I like the plastic format which won't stain or if it gets dirty you can just wipe it off or clean it with a little soap and water. Many of these, from philosophy to stat to psychology to chemistry, were almost constant companions in college. This one covers basic concepts, formulas, and tests for introductory inferential statistics. It's a great reference and teaching aid for this often confusing area.

I bought this for a college stats class. I did not need that expensive textbook after this. Wish I would have purchased this first. It has examples for everything you use in a college stats class. Homework was never easier and it was handy to have. I resold it to people taking the class after me for 100% of the price because it is easy to use and well worth it. The other student took one look at it and did not try to haggle or anything, just handed me the money and said thanks.

This chart was a lifesaver during my Social Statistics class. I doubt I would have passed the course without it.

If it can be done statistically, it is here. I needed a quick fix to brush up on teaching AP Statistics and this helps greatly.

For a math challenged person as myself, this chart is excellent as a quick resource for statistics when working on a dissertation. Formulas and examples are provided that cover the content of a \$100 book, conveniently hole-punched and laminated for quick reference. I wish it also gave a brief description of how each statistic is used to come to certain conclusions why the measures are used, such as what conclusions can be made in reference to educational measurement. But, for a quick reference guide, it has everything covered in basic statistics and then some (such as ANOVA and linear regression).

I only used the Critical Values of Z and T tables from this little guide and that's it. Nothing else was of value to me, and even those two tables were provided in the textbook (it was just more convenient to refer to this guide than the textbook). The guide doesn't even have the correlation coefficient, or critical values of r, table, which it should have. Anyway, I guess this guide is okay, but

I don't see it being a huge help for a Stats class.

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