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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

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

Observational Statistics: Procedures for comparing and presenting data in a convenient and meaningful form.

Inferential Statistics: Procedures designed 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 obtained 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 inference.

VARIABLE: An attribute of elements of a population or sample that can be measured, or height, weight, IQ, hair color and palm size can count of the same variables that can be measured for people.

DATA: Values of variables that have been observed.

Types of data:

- Qualitative (or "categorical") data:** are descriptive but not numeric; ex: your gender, your hair color, the color of an automobile.
- Quantitative data:** take numeric values.
- Discrete data:** take counting numbers (0, 1, 2, ...).
- Continuous data:** take any value in between.

Levels of measurement:

- Qualitative data:** can be measured at the:
 - Nominal level:** Values are categories, without any order; ex: color of a car, type of coffee.
 - Ordinal level:** Values have some natural order; ex: high school class (freshman / sophomore / junior / senior), ability to read.
- Quantitative data:** can be measured at the:
 - Interval level:** Numeric data without a natural zero point; intervals (differences are meaningful), but ratios are not; ex: temperature in Fahrenheit degrees (90° is 20° warmer than 70°), but 100° is not 100% as hot.
 - Ratio level:** Numeric data for which there is a true zero; both intervals and ratios are meaningful; ex: weight, length, distance, and physical properties.

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

PARAMETER: A numeric 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 11: Andrew is a diving club and is polled regarding number of pool visits that he had.

Number of pool visits (x)	Frequency (f)	Relative Frequency (rf)
2	5	0.1250
4	3	0.0750
1	9	0.2250
7	15	0.3672
1	16	0.3807
0	12	0.2105

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

Table 12: The scores on a midterm exam are grouped into classes.

class	f	relative freq.
60-69	4	80
70-79	12	76
80-89	31	58
90-99	19	27
100-109	3	8
110-119	1	1

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; see third column of Table 1.

CUMULATIVE FREQUENCY DISTRIBUTION: Frequencies listed all observations at a particular value and all those less. See third column of Table 2.

MEASURES OF DISPERSION

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

Population MS: $\sum (x_i - \mu)^2 / n$ or $\sum x_i^2 / n - \mu^2$

Sample MS: $\sum (x_i - \bar{x})^2 / (n-1)$ or $\sum x_i^2 / (n-1) - \bar{x}^2$

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

Population variance: $\sigma^2 = \frac{1}{n} \sum (x_i - \mu)^2$

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

Standard Deviation: The square root of the variance; unlike variance, it has the same units as the original data and is more commonly used.

Population SD: $\sigma = \sqrt{\sigma^2}$

Sample SD: $s = \sqrt{s^2}$

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

z is positive if score indicates a value greater than the mean; a negative score indicates a value less than the mean; a score of zero indicates the mean value.

Counting every value in a data set or distribution in a normal distribution and adding up every data set or distribution has been standardized, if that is not true, $\mu = 0$, and a non-standard deviation, $\sigma = 1$.

MEASURES OF CENTRAL TENDENCY

MEAN: Also variously used measure of central tendency, usually meant by "average"; sensitive to extreme values.

POPULATION MEAN: $\mu = \frac{\sum x_i}{n}$

SAMPLE MEAN: $\bar{x} = \frac{\sum x_i}{n}$

Trimmed mean: Computed discarding some number of the highest and lowest values; less sensitive than extreme mean.

Weighted mean: Compared with a $\sum (w_i x_i) / \sum w_i$, 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 for 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; ex: in Table 1, the median is the average of the 20th and 21st observations, or 1.5.

MODE: Observations that occur with the greatest frequency; a distribution can have one or more modes.

GRAPHING TECHNIQUES

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

Histogram: A bar graph used with qualitative, continuous variables.

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

Cumulative frequency curve: A continuous line that rises as a histogram when bars in all the lower classes are stacked up to the adjacent higher class; cannot have a negative slope.

Frequency curve: The frequency curve is constructed around the mean; median if mean.

Normal curve: Both skewed curves symmetric.

Skewed curves: Deviates from symmetry; frequency curve is shifted to the larger "tail" to the left (mean < median) or to the right (mean > median).



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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