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# Statistics Equations & Answers (Quickstudy: Academic)

**BarCharts, Inc.**  
**Quick Study ACADEMIC**  
**Statistics EQUATIONS & ANSWERS™**  
 Essential Tools for Understanding Statistics & Probability - Rules, Concepts, Variables, Equations, Formulas, Problems, Helpful Hints & Conversion Pitfalls

**DESCRIPTIVE STATISTICS**  
 Methods used to simply describe data set that has been observed

**KEY TERMS & SYMBOLS**

**quantitative data:** data variables that represent some numeric quantity in a numeric measurement.

**categorical (qualitative) data:** data variables with values that reflect some quality of the element, one of several categories, not a numeric measurement.

**population:** "the whole", the entire group of which we wish to speak or that we intend to measure.

**sample:** "the part", a representative subset of the population.

**simple random sampling:** the most commonly assumed method for selecting a sample; samples are chosen so that every possible sample of the same size is equally likely to be the one that is selected.

$n$ : size of a population.

$n$ : size of a sample.

$x$ : the value of an observation.

$f$ : the frequency of an observation (i.e., the number of times it occurs).

**frequency table:** a table that lists the values observed in a data set along with the frequency with which it occurs.

**(population) parameter:** some numeric measurement that describes a population; generally not known, but estimated from sample statistics.

**(sample) statistic:** some numeric measurement used to describe data in a sample; used to estimate or make inferences about population parameters.

**EX:** population mean  $\mu$ ; population standard deviation  $\sigma$ ; population proportion  $p$  (sometimes denoted  $\pi$ )

**EX:** sample mean  $\bar{x}$ ; sample standard deviation  $s$ ; sample proportion  $\hat{p}$

**Example: Definition & Distribution**

1. A student receives the following exam grades in a course: 67, 88, 75, 82, 78

a. Compute the mean:  $\bar{x} = \frac{67 + 88 + 75 + 82 + 78}{5} = \frac{390}{5} = 78$

b. What is the median exam score?  
 in order, the scores are: 67, 75, 78, 82, 88; middle element = **78**

c. What is the range? range = maximum - minimum = 88 - 67 = **21**

d. Compute the standard deviation:  
 $s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}} = \sqrt{\frac{(67-78)^2 + (88-78)^2 + (75-78)^2 + (82-78)^2 + (78-78)^2}{5-1}} = \sqrt{\frac{121 + 100 + 9 + 16 + 0}{4}} = \sqrt{\frac{326}{4}} = \sqrt{81.5} \approx 9.03$

e. What is the z score for the exam grade of 88?  $z = \frac{x - \bar{x}}{s} = \frac{88 - 78}{9.03} \approx \frac{10}{9.03} \approx 1.11$

2. The residents of a retirement community are surveyed as to how many times they've been married; the results are given in the following frequency table:

$x$ = # of marriages	0	1	2	3	4	5+	
$f$ = # of observations	12	17	11	4	11	4	
$n$	67	8	42	74	39	24	176

a. Compute the mean:  $\bar{x} = \frac{\sum(x_i \cdot f_i)}{n} = \frac{176}{67} \approx 2.63$

b. Compute the median: Since  $n=176$ , an even number, the median is the average of the observations with ranks  $\frac{n}{2}$  and  $\frac{n}{2} + 1$  (i.e., the 88<sup>th</sup> and 89<sup>th</sup> observations)

While we could count from either side of the distribution (from 0 or from 4), it is easier here to count from the bottom: The first 13 observations in rank order are all 0; the next 42 (the 14<sup>th</sup> through the 57<sup>th</sup>) are all 1; the 58<sup>th</sup> through the 82<sup>nd</sup> are all 2; since the 88<sup>th</sup> is a 1 and the 89<sup>th</sup> is a 2, the median is the average:  $(1 + 2) / 2 = 1.5$

c. Compute the IQR: To find the IQR, we must first compute Q1 and Q3; if we divide  $n$  in half, we have a lower 88 and an upper 88 observations; the "median" of each would have rank 44 = 28; the 28<sup>th</sup> observation in the lower half is a 1, so Q1 = 1 and the 28<sup>th</sup> observation in the upper half is a 2, so Q3 = 2; therefore, IQR = Q3 - Q1 = 2 - 1 = 1

**Formulating Hypotheses**

Type	Statistic	Formula	Important Properties
measures of center (measures of central tendency) indicate which value is typical for the data set	mean	from raw data: $\bar{x} = \frac{\sum x_i}{n}$ from a frequency table: $\bar{x} = \frac{\sum x_i f_i}{n}$	sensitive to extreme values; any outlier will influence the mean; more useful for symmetric data
	median	$n$ odd: median has rank $\frac{n+1}{2}$ $n$ even: median is the average of values with ranks $\frac{n}{2}$ and $\frac{n}{2} + 1$	not sensitive to extreme values; more useful when data are skewed
	mode	the observation with the highest frequency	only measure of center appropriate for categorical data
measures of variation (measures of dispersion) reflect the variability of the data (i.e., how different the values are from each other)	mid-range	$\frac{\text{maximum} + \text{minimum}}{2}$	not often used; highly sensitive to unusual values; easy to compute
	sample variance	$s^2 = \frac{\sum(x_i - \bar{x})^2}{n-1}$	not often used; units are the squares of those for the data
	sample standard deviation	$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$	square root of variance; sensitive to extreme values; commonly used
	interquartile range (IQR)	$IQR = Q3 - Q1$ (see quartile, below)	less sensitive to extreme values
measures of relative standing (measures of relative position) indicate how a particular value compares to the others in the same data set	range	maximum - minimum	not often used; highly sensitive to unusual values; easy to compute
	percentile	data divided into 100 equal parts by rank (i.e., the $k$ <sup>th</sup> percentile is that value greater than $k\%$ of the data)	important to apply to normal distributions (see probability distributions)
	quartile	data divided into 4 equal parts by rank: Q3 (third quartile) is the value greater than $\frac{3}{4}$ of the others; Q1 (first quartile) is greater than $\frac{1}{4}$ ; Q2 is identical to the median	used to compute IQR (see IQR, above); Q3 is often viewed as the "median" of the upper half, and Q1 as the "median" of the lower half; Q2 is the median of the data set
z score	$z = \frac{x - \bar{x}}{s}$ to find the area under the normal distribution	measures the distance from the mean in terms of standard deviation	



## Synopsis

Statistics problems can make the best students shudder as they near the classroom, but they need not worry any longer! QuickStudy is here to help! A comprehensive, up-to-date collection of tips and tricks for understanding statistics/probability is contained in this 3-panel (6-page) guide, which is designed with easy-to-use icons to help students go right to the equations and problems they most need to learn, and also call out helpful tips to use and common pitfalls to avoid.

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## Customer Reviews

I got this for my wife because she was just beginning statistics. I tried to read it off the pictures, but didn't have much luck. When it arrived I was surprised with how advanced it was and how the information beginners could use was spread throughout. It probably works well for people that have a firm foundation, but I wouldn't recommend it for a beginner.

Statistics Equations & Answers (Quick study: Academic) is great for Statistic students in college. It has been years since I went to college, and being Older in my 40's I loved the quick reference guide. It came in some sort of hard plastic laminated which I love best for quality.

I like these laminated quick memory jogger sheets. paired with a good reference for the topic they are a great help. This is an almost perfect formula cheat sheet. It has the equations, a quick explanation and even some quick notes (warnings?) for usage/application. I truly love this sheet. pair

this sheet with a good Statistics text for a great reference combo. A great study helper for a Intro stats course test. Go section by section through the sheet and read the section title and look away and write down the formula on a different sheet, explain to yourself why the formula is that way component by component and then return to the sheet to see if your answer matches the sheets. Make notes on what you didn't get correct and review that section of the sheet or your course text...sometimes google can find a different source that explains the concept in a manner that makes sense to you so don't forget to use google when studying. Many times a topic is introduced to us and we are confused by the topic and the presentation of it doesn't help our understanding. I find googling the topic and finding alternate sources for information allows me to have the topic presented in a different manner that does make sense to MY brain and then returning to the original explanation it now all makes sense.

I gave it three stars because it is not well organized, although it is way better than the Triola TI- 84 Plus Reference ISBN 0-321-39967-6 (which I have too). The booklet is laminated, that is very useful when you go through the pages. I wish it had more formulas and especially TI-84 instructions for step-by-step. I bought it to help me in my STAT class because the Triola 4th-Edition "Essentials of Statistics" is just a waste of money and it will not teach you, most likely will confuse you even more.

VERY convenient study or reference aide .... brief but concise information/equation/etc. on a broad range of Statistical Materials/Concepts... a great reference for students, teachers or tutors... minimizes digging through the tomes to find the stuff you need to remember better...

Nice laminated guide for easy reference. Serves the purpose of providing a handy quick "tip and technique" sheet. Reduces amount of time you would need to do Google searches and researching information in print material appendixes and glossaries.

The chart was beneficial in my statistics class. Included was vocabulary and definitions omitted in the class book. Would highly recommend it.

This contained more than I expected so I am happy with it. It's a tri-fold, laminated 8.5" x 11" laminated card (6 pages) containing info on basic definitions, frequency distributions, central tendency, dispersion, graphing techniques, probability, confidence intervals, hypothesis testing, ANOVA, correlation, regression and more. I would have given it 5 stars if the text was written more

plainly (11th grade level or below). Well worth the price. I bought one for my son taking Statistics in college and one for myself (Six Sigma Master Black Belt).

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