What is statistics?

Statistics is becoming increasingly important in modern society. We are constantly being bombarded with charts, graphs, and numbers of various types in an attempt to provide us with compressed information to make decisions. Sometimes this information is presented in a manner so as to sway us toward a particular view. As consumers and decision makers we must be aware of this. Which drug prescriptions have the lower risks? Which car is the best buy? Where will the economy go? Who is more likely to be infected with a particular deadly disease? These are all examples of questions which are usually given to the statistician for analysis and distribution.

In order to understand the subject of statistics, it is important to appreciate the justification behind why and how statistics are used by the world at large. Although the answer may be slightly complex, it cannot be overemphasized the need for thinking "statistically." Without a proper quantitative perspective of our environment, numbers we read become a mere mental exercise, diverging from the true nature of mathematics: scientific literacy

To begin our analysis as to why statistics is a necessary type of reasoning, we must start by addressing the nature of science and experimentation.

Because it is physically impossible to study everything and everyone, a characteristic method used by scientists is to study a relatively small sample, say 2,500 people, and a variable, say, longevity, and through experimentation or observation of only 2,500 people, draw a conclusion appropriate for the entire population. For example, suppose a study published results suggesting people who own pets live longer. Would this mean that *all* people who own pets are likely to live long lives? Does owning a pet cause longevity? Suppose the people in the study were, by chance and on the whole, very healthy people, and therefore lived long lives: Would this invalidate the researcher's assertion that people who own pets live longer? The obvious problem with this type of reasoning is that these issues can never be proved absolutely. This is exactly why statistics is needed: To tell us how close we come to proving it, if at all.

In contrast to the lack of certainty associated with statistics, the type of logic used in Mathematics in general, and in operations in particular, is absolutely certain. For example, $2 + 3 = 5$ and $3 + 2 = 5$, always. However, statistics are chancy, but always with some percentage of confidence that the results are true. In other words, we may say predictions are risky, but through careful statistical study, we reduce our chances of failure and always err on the side of caution learned.

Statistics is, therefore, the mathematical method by which the doubt built-in in the scientific method is rigorously quantified.