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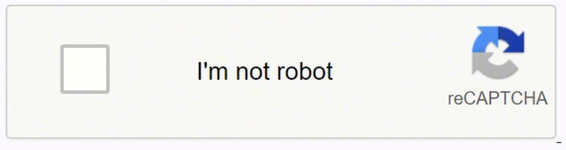

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By Alan Anderson Copyright © 2014 John Wiley & Sons, Ltd All rights reserved. ISBN: 978-118-63069-3 CHAPTER 1The art and science of business statistics In this chapter* Looking at key data properties* Understand the role of probability in sampling distributions* Drawing conclusions based on results This chapter provides a brief introduction to the concepts that are covered throughout the book. I introduce several important techniques that allow to measure and analyze the statistical properties of the real world variables, such as stock prices, interest rates, business profits, and so on. Statistical analysis is widely used in all business disciplines. For example, marketing researchers analyze consumer spending patterns in order to properly plan new advertising campaigns. Organizations use management advice to determine how efficient resources are used. Manufacturers use quality control methods to ensure the consistency of the products they are producing. These types of business applications and many others are strongly based on statistical analysis. Financial institutions use statistics for a wide range of applications. For example, a pension fund may use statistics to identify the types of securities it should contain in its investment portfolio. A cover fund can use statistics to identify profitable trading opportunities. An investment bank can predict the future state of the economy in order to determine which new assets must contain in its portfolio. Whereas statistics are a quantitative discipline, the ultimate goal of statistical analysis is to explain the events of the real world. This means that in addition to the rigorous application of statistical methods, there is always a lot of room for evaluation. As a result, one can think of statistical analysis as science and art; art derives from the choice of the appropriate statistical technique for a certain situation and correct interpretation of the results. Representing key data propertiesThe word data refers to a collection of quantitative (number) or qualitative (non-number) values. Quantitative data can be price, profit, sales or any variable that can be measured on a numerical scale. Quality data can be made up of colors, brands, geographic locations, and so on. Most of the data found in business applications are quantitative. STUFF TECHNICAL Word data is actually the plural of data; datum refers to a single value, while data refers to a collection of values. You can analyze data with graphical techniques or numerical measurements. I'll show both options in the following sections. Data analysisgraphs The graphics are a visual representation of a data set, which makes it easy to see models and other details. Deciding which type of chart to use depends on the type of data you are trying to analyze. Here are some of the most common types of graphics used in business statistics:[check] Istograms: An istogram shows theof data between different ranges or categories, using a series of vertical bars.[check] line charts: a line chart shows how a variable changes over time. [check] cake cards: a pie chart shows how the data is distributed between different categories, illustrated as a series of slices taken from a cake. Spreading plots (scatter diagrams:) a scattering plot shows the relationship between two variables as a set of points. the point model shows how closely the two variables are related. istograms you can use an istogram with quantitative or qualitative data. is designed to show how a variable is distributed between different categories. For example, suppose a marketing company surveys 100 consumers to determine their preferred color. the answers arered: 23 blue: 44 yellow: 12 green: 21 results can be illustrated with an istogram, with each color in a single category. the heights of the bars indicate the number of responses for each color, making it easy to see which colors are the most popular (see figure 1-1). based on the histogram, you can see at a glance that blue is the most popular choice, while yellow is the least popular choice. Line charts you can use a line chart with quantitative data. shows the values of a variable on a given time interval. For example, figure 1-2 shows the daily price of gold between April 14, 2013 and June 2, 2013:[GRAPHIC omitted] with a line chart, it is easy to see trends or patterns in a data set. in this example, the price of gold has steadily increased during the end of April to mid-May before falling in late May and then recovering a little at the end of the month. These types of charts can be used by investors to identify which assets can increase in the future according to their past performance. Cake cards use a pie chart with quantitative or qualitative data to show the distribution of data between different categories. For example, suppose a chain of coffee shops wants to analyze its sales by style of coffee. the styles that the chain sells are French roast, breakfast mixture, Brazilian rainforest, Jamaica blue mountain, and espresso. Figure 1-3 shows the percentage of sales for each style. The graph shows that expressed is the most sold style of the chain, while the Jamaica blue mountain represents the smallest percentage of the chain sales. Waste plots a shedding plot is designed to show the relationship between two quantitative variables. For example, figure 1-4 shows the relationship between sales and profits of a company over the last 20 years. each point on the shedding plot represents profit and sales for a single year. the point model shows that the highest levels of sales tend to be matchedhigher levels of profits, and vice versa. This is called a positive trend in data. Definition of properties and relationships with numerical measurements A numerical measure is a value that describes a key property of a data set. For example, to determine whether residents of a cityto be older than residents in another city, you can calculate and compare the average or average age of residents of each city. Some of the most important properties of interest in a dataset are the data center and the dissemination between observations. I describe these properties in the following sections. Find the data center To identify the center of a data set, measures are used that are known as central trend measures; the most important of these are the median, and the mode. The medium represents the average value in a data set, while the median represents the midpoint. Median is a value that separates data in two equal half; half of the elements in the dataset are lower than the median, and the remaining half is greater than the median. The mode is the most commonly present value in the data set. The medium is the most widely used measure of the central trend, but can give misleading results if the data contain unusually large or small values, known as outliers. In this case, the median provides a more representative measure of the data center. For example, median household income is usually reported by government agencies instead of average household income. This is because the average household income is inflated by the presence of a small number of extremely rich families. As a result, the median family income is thought to be a better measure of how life standards are changing over time. The mode can be used for quantitative or qualitative data. For example, it could be used to determine the most common number of years of education among employees of a company. It could also be used to determine the most popular flavor sold by a soft beverage manufacturer. Measuring data diffusionDispersion measures identify the spread of a data set, compared to the centre. This provides a way to determine whether members of a dataset tend to be very close to each other or whether they tend to be widely dispersed. Some of the most important dispersion measures are[control] Variance[control] Standard deviation[check] Percentages[control] Quarters[control] Interquartile range (IQR) Variance is a measure of the average square difference between the elements of a data set and the average. The larger the variance, the more "distribute" the data. The variation is often used as a risk measurement in business applications; For example, it can be used to show how much uncertainty there is over returns on a stock. The standard deviation is the square root of the variation, and is more commonly used than the variation (because the variation is expressed in square units). For example, the variation of a series of gas prices is measured in square dollars, which is difficult to interpret. The corresponding standard deviation is measured in dollars, which ismore intuitively clear. The percentages share a figure set in 100 equal parts, each consisting of 1 percent of the total. For example, if a student score on aThe exam is in 80 percent, then the student exceeded 80% of the other students who took the exam. A quartile is a special type of per centile; divides a data set into four equal parts, each consisting of 25 percent of the total. The first quartile is the 25th percentile of a set of data, the second quartile is the 50th percentile, and the third quartile is the 75th percentile. The interquartile range identifies 50 percent average of observations in a data set; is equal to the difference between the third and the first quarters. Determination of the relationship between two variables For some applications, you need to understand the relationship between two variables. For example, if an investor wants to understand the risk of a portfolio of shares, it is essential to correctly measure how much return on the stocks trace each other. It is possible to determine the relationship between two variables with two association measures: covariance and correlation. Covariance is used to measure the tendency of two variables to rise above their means or fall under their means at the same time. For example, we assume that a bioengineering company finds that the increase in research and development costs generally leads to an increase in the development of new patents. In this case, R&D spending and new patents would have a positive covariance. If the same company finds that the increase in labor costs generally reduces business profits, then labor costs and profits would have a negative covariance. If the company finds that profits are not linked to the average daily temperature, these two variables will have a covariance that is very close to zero. Correlation is a closely related measure. It is defined as value between -1 and 1, so interpreting correlation is easier than covariance. For example, a correlation of 0.9 between two variables would indicate a very strong positive relationship, while a correlation of 0.2 will indicate a fairly weak but positive relationship. A correlation of -0.8 would indicate a very strong negative relationship; a correlation of -0.3 would indicate a weak negative relationship. A correlation of 0 shows that two variables are independent (i.e. not related). Probability: The probability theory of statistical analysis provides a mathematical framework for measuring uncertainty. This area is important for business applications, since all statistics field results are ultimately based on probability theory. Understanding probability theory provides basic information about all statistical methods used in this book. The probability is strongly based on the notion of set. A set is a collection of objects. These objects can be numbers, colors, flavors and so on. This chapter focuses on series of numbers that can represent prices, yield rates, and so on. Variousmathematicians can be applied to sets — union, intersection and complement, for example. The union of two sets seta new set that contains all the elements in the original two sets. The intersection of two sets is a set that contains only the elements contained in both original sets (if any). The complement of a set is a set containing elements that are not in the original set. For example, the complement to the black card set in a standard deck is the set containing all the red cards. Probability theory is based on a model of how random results are generated, known as a random experiment. The results are generated in such a way that all possible results are known in advance, but the actual result is not known. The following rules help determine the probability of specific results occurring:[check] The addition rule[check] The multiplication rule[check] The complement rule The addition rule is used to determine the probability of a union of two sets. The multiplication rule is used to determine the probability of a crossing of two sets. The complement rule is used to identify the probability that the result of a random experiment is not an element in a specified set. Random Variations A random variable assigns numerical values to the results of a random experiment. For example, when you flip a coin twice, you are running a random experiment, since:[check] All possible results are known in advance[check] The actual result is not known in advanceThe experiment consists of two tests. On each test, the result shall be a "head" or a "size." " Suppose a random variable X is defined as the number of "texts" that occur during the course of this experiment. X assigns values to the results of this experiment as follows: OutcomeX {TT} 0 {HT, TH} 1 {HH} 2 T represents a tail on a single head H represents a head on a single head TT flip represents two consecutive queues HT represents a head followed by a TH queue HH represents two consecutive heads X assigns a value of 0 to the TT result because no head has risen. X assigns a value of 1 to HT and TH because a head came up anyway. Similarly, X assigns a value of 2 to HH because two heads have risen. Probable Distributions A probability distribution is a formula or table used to assign probabilities to any possible value of a random variable X. A probability distribution can be discrete, meaning that X can assume one of a finite (accountable) number of values, or continuous, in which case X can assume one of a number infinite (uncountable) of different values. For the coin fluctuation experiment from the previous section, the probability distribution of X could be a simple table showing the probability of each value by X, written as P(X):X P(X) 0 0.25 1 0.50 2 0.25 The probability that X = 0 (no head shows up) is 0.25 because this experiment has four similarly probable results: HH, HT, TH and TT and in one of those cases there will be no heads. You do the other odds similarly. Discreet probabilityspecialized discrete probability distributions are useful for specific applications. For business applications, three discrete distributions used are:[check] Binomial[check] Geometric[check] Poisson Binomial distribution is used to calculate probability for a process where only one of the two possible results can occur on each test. Geometric distribution is linked to binomial distribution; you use geometric distribution to determine the probability that a specified number of tests will take place before the first success occurs. You can use the Poisson distribution to measure the probability that a given number of events occur during a given period of time. (continue...) Excluded from the company statistics for the mannequins of Alan Anderson.

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