

1: An Introduction to Statistical Methods and Data Analysis by R. Lyman Ott

Ott and Longnecker's AN INTRODUCTION TO STATISTICAL METHODS AND DATA ANALYSIS, Seventh Edition, provides a broad overview of statistical methods for advanced undergraduate and graduate students from a variety of disciplines who have little or no prior course work in statistics.

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Quality and Process Improvement 13 addressed how a corporation could achieve radical improvement in quality, efficiency, and effectiveness by completely rethinking their business processes that have been maintained in a rapidly changing business and technology environment. If we define a task as a unit of work, and a process as a sequence of related tasks that create value for the customer, Hammer and Champy were offering corporations a way to refocus their change efforts in value-creating activities. The case for change is compelling. Within almost every major business—apparel e. In many cases the industry leader has not kept pace with the dizzying changes occurring in the marketplace. Mergers proliferate with high expectations from management and shareholders for increased market share, cost synergies reductions, and increased profitability. Unfortunately, the list of successful mergers as defined by those meeting the initial case for action driving the merger is pitifully small. Something else is needed. A company that can do this well over time, as needs and the competitive environment change, will win. Whether a company focuses on business process improvement or fast cycle time, the foundation for change will be the underlying data about customer needs, current internal cycle time, and comparable benchmark data in the industry. These four points, which are very similar to the four steps in learning from data discussed earlier in the chapter, drive home the relevance of statistics learning from data to the business environment. A number of statistical tools and techniques that can help in these business improvement efforts are shown here. Statistical Tools, Techniques, and Methods Used in Quality Improvement and Reengineering r Histograms r Numerical descriptive measures means, standard deviations, proportions, etc. As you encounter these tools and concepts in various parts of this text, keep in mind where you think they may have application in business improvement efforts. Quality improvement, process redesign, and fast cycle time are clearly the focus of American industry for the s in world markets characterized by increased competition, more consolidation, and increased specialization. These shifts will have impacts on us all, either as consumers or business participants, and it will be useful to know some of the statistical tools that are part of this revolution. Finally, in recent years the ideas and principles of quality control have been applied in areas outside of manufacturing. Service industries such as hotels, restaurants, and department stores have successfully applied the principles of quality control in their businesses. Many federal agencies—for example, the IRS, the Department of Defense, and the USDA—have adapted the principles of quality control to improve the performance of their agencies. A study of the discipline of statistics requires us to memorize new terms and concepts as does the study of a foreign language. Commit these definitions, theorems, and concepts to memory. Also, focus on the broader concept of making sense of data. Do not let details obscure these broader characteristics of the subject. The teaching objective of this text is to identify and amplify these broader concepts of statistics. Medical researchers, social scientists, accountants, agronomists, consumers, government leaders, and professional statisticians are all involved with data collection, data summarization, data analysis, and the effective communication of the results of data analysis. Supplementary Exercises Basic Techniques Bio. A researcher wishes to estimate the mean weight of shrimp maintained on a specific diet for a period of 6 months. One hundred shrimp are randomly selected from an artificial pond and each is weighed. Identify the population of measurements that is of interest to the researcher. What characteristics of the population are of interest to the researcher? If the sample measurements are used to make inferences about certain characteristics of the population, why is a measure of the reliability of the inferences important? State health officials have decided to investigate the radioactivity levels in one suspect area. Two hundred points in the area are randomly selected and the level of radioactivity is measured at each point. Answer questions a, b, c, and d in Exercise 1. Supplementary

Exercises 15 Soc. A random sample of households is selected from the city welfare rolls. A check on welfare recipient data provides the number of children in each household. Answer questions a , b , c , and d of Exercise 1. Identify the items that were observed in order to obtain the sample measurements. Identify the measurement made on each item. Clearly identify the population associated with the survey. What characteristics of the population were of interest to the pollster? Does the article explain how the sample was selected? Does the article include the number of measurements in the sample? What type of inference was made concerning the population characteristics? Does the article tell you how much faith you can place in the inference about the population characteristic? A total of helmets were collected from the five companies that currently produce helmets. The agency then sent the helmets to an independent testing agency to evaluate the impact cushioning of the helmet and the amount of shock transmitted to the neck when the face mask was twisted. What is the population of interest? What is the sample? What variables should be measured? What are some of the major limitations of this study in regard to the safety of helmets worn by high school players? For example, is the neck strength of the player related to the amount of shock transmitted to the neck and whether the player will be injured? How could the sample be selected? What type of questions should be included in the questionnaire? Preparing Data for Summarization and Analysis 2. The design of the data collection process is the crucial step in intelligent data gathering. The process takes a conscious, concerted effort focused on the following steps: Thus, the department needs to determine what aspects of the bus system determine whether or not a person will ride the bus. The objective of the study is to identify factors that the transportation department can alter to increase the number of people using the bus system. To identify the variables of interest, you must examine the objective of the study. For the bus system, some major factors can be identified by reviewing studies conducted in other cities and by brainstorming with the bus system employees. The measurements to be obtained in the study would consist of importance ratings very important, important, no opinion, somewhat unimportant, very unimportant of the identified factors. Demographic information, such as age, sex, income, and place of residence, would also be measured. Finally, the measurement of variables related to how frequently a person currently rides the buses would be of importance. Once the objectives are determined and the variables of interest are specified, you must select the most 18 2. Data collection processes include surveys, experiments, and the examination of existing data from business records, censuses, government records, and previous studies. The theory of sample surveys and the theory of experimental designs provide excellent methodology for data collection. Usually surveys are passive. The goal of the survey is to gather data on existing conditions, attitudes, or behaviors. Thus, the transportation department would need to construct a questionnaire and then sample current riders of the buses and persons who use other forms of transportation within the city. Scientific studies, on the other hand, tend to be more active: The person conducting the study varies the experimental conditions to study the effect of the conditions on the outcome of the experiment. For example, the transportation department could decrease the bus fares on a few selected routes and assess whether the usage of its buses increased. Thus, an increase in bus usage may have taken place because of a strike of subway workers or an increase in gasoline prices. In most scientific experiments, as many as possible of the factors that affect the measurements are under the control of the experimenter. A floriculturist wants to determine the effect of a new plant stimulator on the growth of a commercially produced flower. The floriculturist would run the experiments in a greenhouse, where temperature, humidity, moisture levels, and sunlight are controlled. An equal number of plants would be treated with each of the selected quantities of the growth stimulator, including a control—that is, no stimulator applied. At the conclusion of the experiment, the size and health of the plants would be measured. The optimal level of the plant could then be determined, because ideally all other factors affecting the size and health of the plants would be the same for all plants in the experiment. In this chapter, we will consider some of the survey methods and designs for scientific studies. We will also make a distinction between a scientific study and an observational study. These surveys determine such government policies as the control of the economy and the promotion of social programs. Opinion polls are the basis of much of the news reported by the various news media. Ratings of

television shows determine which shows will be available for viewing in the future. We are all familiar with public opinion polls: However, the vast majority of surveys are conducted for a specific industrial, governmental, administrative, or scientific purpose. For example, auto manufacturers use surveys to find out how satisfied customers are with their cars. Frequently we are asked to complete a survey as part of the warranty registration process following the purchase of a new product. Many important studies involving health issues are determined using surveys—for example, amount of fat in the diet, exposure to secondhand smoke, condom use and the prevention of AIDS, and the prevalence of adolescent depression. Bureau of the Census is required by the U. With the growing involvement of the government in the lives of its citizens, the Census Bureau has expanded its role beyond just counting the population. An attempt is made to send a census questionnaire in the mail to every household in the United States. Since the census, in addition to the complete count information, further information has been obtained from representative samples of the population. In the census, variable sampling rates were employed. For most of the country, approximately five of six households were asked to answer the 14 questions on the short version of the form. The remaining households responded to a longer version of the form containing an additional 45 questions. Many agencies and individuals use the resulting information for many purposes.

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An Introduction to Statistical Methods presents the mathematics of probability theory (including numerous probability distributions) and the foundations of statistical inference (via hypothesis testing).

Alle productspecificaties Samenvatting Statistics is a thought process. In this comprehensive introduction to statistical methods and data analysis, the process is presented utilizing a four-step approach: Recensie s Part 1: Statistics and the Scientific Method. Some Current Applications of Statistics. A Note to the Student. Introduction and Abstract of Research Study. Sampling Designs for Surveys. Designs for Experimental Studies. Exit Polls versus Election Results. Calculators, Computers, and Software Systems. Describing Data on a Single Variable: Measures of Central Tendency. Controlling for Student Background in the Assessment of Teaching. Summary and Key Formulas. Probability And Probability Distributions. Finding the Probability of an Event. Basic Event Relations and Probability Laws. Conditional Probability and Independence. Probability Distributions for Discrete Random Variables. Two Discrete Random Variables: The Binomial and the Poisson. Probability Distributions for Continuous Random Variables. A Continuous Probability Distribution: Normal Approximation to the Binomial. Inferences about Performance Enhancing Drugs among Athletes. Inferences about Population Central Values. Introduction and Abstract of a Research Study. Choosing the Sample Size for Estimating?. A Statistical Test for?. Choosing the Sample Size for?. The Level of Significance of a Statistical Test. Inferences about the Median. Percent Calories from Fat. The Wilcoxon Rank Sum Test. The Wilcoxon Signed-Rank Test. Choosing Sample Sizes for Inferences about? Effects of Oil Spill on Plant Growth. Inferences about Population Variances. Estimation and Tests for a Population Variance. Evaluation of Methods for Detecting E. An Analysis of Variance. Checking on the AOV Conditions. Transformations of the Data. Which Error Rate Is Controlled? Comparison of Treatments to a Control. A Nonparametric Multiple-Comparison Procedure. Inferences about a Population Proportion?. Inferences about the Difference between Two Population Proportions,? Inferences about Several Proportions: Tests for Independence and Homogeneity. Measuring Strength of Relaxation. Odds and Odd Ratios. Combining Sets of 2 X 2 Contingency Tables optional. Linear Regression and Correlation. Inferences about Regression Parameters. Predicting New y Values Using Regression. Examining Lack of Fit in Linear Regression. The Inverse Regression Problem Calibration. Two Methods for Detecting E. Multiple Regression and the General Linear Model. The General Linear Model. Estimating Multiple Regression Coefficients. Inferences in Multiple Regression. Testing a Subset of Regression Coefficients. Forecasting Using Multiple Regression. Comparing the Slopes of Several Regression Lines. Some Multiple Regression Theory Optional. Designing an Electric Drill. Selecting the Variables Step 1. Formulating the Model Step 2. Checking Model Assumptions Step 3. Construction Costs for Nuclear Power Plants. Analysis of Variance for Completely Randomized Designs. Completely Randomized Design with Single Factor. Determining the Number of Replications. Development of a Low-Fat Processed Meat. Analysis of Variance for Blocked Designs. Randomized Complete Block Design. Multiple Covariates and More Complicated Designs. Extensions of Random-Effects Models. Rules for Obtaining Expecting Mean Squares. Analysis of Variance for Some Unbalanced Designs. Evaluation of the Consistency of Property Assessment. Communicating and Documenting the Results of a Study or Experiment. The Difficulty of Good Communication. Documentation and Storage of Results.

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