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Juliet Popper Shaffer and Yung-Pin Chen, ["A Novel Method of Proof With an Application to Regression"](#) (66K)

A useful way of approaching a statistical problem is to consider whether the addition of some missing information would transform the problem into a standard form with a known solution. The EM algorithm (Dempster, Laird, and Rubin 1977), for example, makes use of this approach to simplify computation. Occasionally it turns out that knowledge of the missing values is not necessary to apply the standard approach. In such cases the following simple logical argument shows that any optimality properties of the standard approach in the full-information situation generalize immediately to the approach in the original limited-information situation: If any better estimate were available in the limited-information situation, it would also be available in the full-information situation, which would contradict the optimality of the original estimator. This approach then provides a simple proof of optimality, and often leads directly to a simple derivation of other properties of the solution. The approach can be taught to graduate students and theoretically-inclined undergraduates. Its application to the elementary proof of a result in linear regression, and some extensions, are described in this paper. The resulting derivations provide more insight into some equivalences among models as well as proofs simpler than the standard ones. -- JPS

Key Words: Best linear unbiased estimation; Least squares estimation; Unbiased estimation; Variance estimation.

Christine M. Anderson-Cook, ["An In-Class Demonstration to Help Students Understand Confidence Intervals"](#) (39K)

This article discusses an active learning technique that can be easily incorporated into a variety of introductory statistics classes to demonstrate purely subjective and statistical confidence intervals. The concepts of confidence intervals, confidence levels, and the fixed, but unknown, population parameter are frequently misunderstood by a significant proportion of students. This class activity demonstrates these concepts by stressing the objective nature of statistical confidence intervals. It also emphasizes that the precision of the interval depends on the quality of the data used in its construction. The proposed exercise takes less than 50 minutes of lecture time and helps to solidify these essential statistical concepts in a visual and memorable way. Student reaction to the exercise has been positive as measured anecdotally by both improved student understanding of the concepts and increased interest in the activity. --CMA-C

Key Words: Active learning; Introductory statistics courses; Purely subjective intervals.

Philip J. Boland and Yudi Pawitan, "Trying To Be Random in Selecting Numbers for Lotto" (65K)

In the lottery game Lotto n/N, the winning n numbers are selected randomly and without replacement from $\{1, 2, 3, ..., N\}$. The selection of the winning numbers is normally done with a highly sophisticated mechanical device, and one of the appealing aspects of Lotto is that this procedure is seen to be fair and unbiased. An important perceived consequence is that no one (for a given amount of money) is seen to have a better chance of winning than anyone else. Few people would be willing to let an individual perform this task because of possible bias, but do we really know how difficult it is for an individual to be random in selecting numbers? In an experiment to observe the types and degrees of bias an individual might possess, data were collected from students who were asked to perform as 'random' number generators for the Lotto 6/42 game. Data consisting of the winning numbers from the Irish National Lottery game Lotto 6/42 were obtained from previous years, and a statistical package (in this case, S-Plus) was used to generate other simulated data. A comparison of the three sets of data using many of the basic tools in descriptive statistics together with some goodness of fit tests provides a useful exercise for students to test their intuition about randomness and to discover some of the inherent (and sometimes subtle) biases individuals possess when they attempt to be random. --PJB

Key Words: Bias; Boxplots; Chi-squared tests; Lottery; Minimum gap; QQ plots.

Robert C. delMas, Joan Garfield, and Beth L. Chance, "A Model of Classroom Research in Action: Developing Simulation Activities to Improve Students' Statistical Reasoning" (80K)

Researchers and educators have found that statistical ideas are often misunderstood by students and professionals. In order to develop better statistical reasoning, students need to first construct a deeper understanding of fundamental concepts. The *Sampling Distributions* program and ancillary instructional materials were developed to guide student exploration and discovery. The program allows students to specify and change the shape of a population, choose different sample sizes, and simulate sampling distributions by randomly drawing large numbers of samples. The program provides graphical, visual feedback that allows students to construct their own understanding of sampling distribution behavior. To capture changes in students' conceptual understanding we developed diagnostic, graphics-based test items that were administered before and after students used the program. An activity that asked students to test their predictions and confront their misconceptions was found to be more effective than one based on guided discovery. Our findings demonstrate that while software can provide the means for a rich classroom experience, computer simulations alone do not guarantee conceptual change. --RCD

Key Words: Assessment; Computer microworlds; Conceptual change; Diagnostic testing; Sampling distributions; Statistical instruction.

"Teaching Bits: A Resource for Teachers of Statistics" (43K)

This column features "bits" of information sampled from a variety of sources that may be of interest to teachers of statistics. Bob delMas abstracts information from the literature on teaching and learning statistics, while Bill Peterson summarizes articles from the news and other media that may be used with students to provoke discussions or serve as a basis for classroom activities or student projects. --JG

Peter K. Dunn, "A Simple Dataset for Demonstrating Common Distributions" (19K)

The baby boom dataset contains the time of birth, sex, and birth weight for 44 babies born in one 24-hour period at a hospital in Brisbane, Australia. The data can be used to demonstrate that some common distributions -- the normal, binomial, geometric, Poisson, and exponential -- can be used to model real situations. Because the dataset is small and easily understood, it provides a useful classroom example for discussing these distributions. --PKD

Key Words: Binomial; Births; Classroom data; Exponential; Geometric; Normal; Poisson.

Christopher H. Morrell, "Simpson's Paradox: An Example From a Longitudinal Study in South Africa" (11K)

Real world examples of the reversal of the direction of an association when an additional explanatory variable is taken into account are unusual and hard to find. This article presents an example of Simpson's paradox from a South African longitudinal study of growth of children. The example demonstrates the importance race plays in every aspect of South African life. --CHM

Key Words: Categorical data; Comparing proportions.

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