Multiple Monte Carlo Methods for Making Sense of Statistical Matters

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Computer Programs and Presentation by

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Abstract

While Monte Carlo methods are valuable research techniques, they also can be useful instructional tools. Instructors can generate data to explore sampling distributions, Central Limit Theorem, Type I error, and power. This presentation will demonstrate several free Windows Monte Carlo programs (created by the presenter) that instructors can use.

Software and Auxiliary Materials are available for download at:
http://oak.cats.ohiou.edu/~brooksg/software.htm

Multiple Monte Carlo Methods for Making Sense of Statistical Matters

Monte Carlo computer simulation methods are valuable research methods in applied statistics. They help to provide understanding of problems that cannot be solved mathematically, such as when a statistic's sampling distribution is unknown or when a null hypothesis is not true. Using simulation, the values of a statistic are observed in many pseudorandom samples generated from a population with known characteristics. For example, we may want to test the robustness of a statistic when the null hypothesis is true but the underlying mathematical assumptions of the statistic are violated; knowing that any statistically significant result is a Type I error under a true null hypothesis, a researcher can use Monte Carlo simulation to determine the impact of the violation on actual Type I error.

Monte Carlo methods also have great promise as useful instructional tools -- if made easy to use. For example, it is very important for students in introductory statistics courses to comprehend complex concepts like sampling distributions, the Central Limit Theorem, mathematical assumptions, inflated Type I errors, and statistical power. Computer simulation is an ideal way to present such abstract ideas in a more concrete way. Unfortunately, Monte Carlo techniques have typically been the exclusive territory of statistician-researchers with computer programming skills and have not been used much for instruction.

We are hopeful that this free computer software and the associated guided learning activities will be useful to instructors in all circumstances, but particularly as more and more statistics courses are made available online.

FISH: Friendly Introductory Statistics Help (version 4.60)

Version 3.0.8 presented at the Joint Statistical Meetings, August 2004, Toronto, Canada

Statisfaction Guaranteed (with 95% Confidence)

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Web Site URL: http://oak.cats.ohiou.edu/~brooksg/software.htm

MC4G

MC4G: Monte Carlo Analyses for up to 4 Groups (version 4.20)

Version 3.4 was presented at the annual meeting of the American Psychological Society (2004, May), Chicago, IL

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$(MC)^2$

$(MC)^2$: Monte Carlo Multiple Correlations (version 1.30)

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MC2G

Monte Carlo Analyses for 1 or 2 Groups (Version 5.03)

Version 2.2.3 Presented at AERA 2002, New Orleans, LA

A description of version 3.0.7 of the program has been published:
Brooks, G. P. (2003). Using Monte Carlo methods to teach statistics: The MC2G computer program. Understanding Statistics, 2, 137-150.

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