

Rice University Summer Institute of Statistics (RUSIS) ¹

Today, the need for professionals with high-level quantitative training is increasing in all areas, from medicine to engineering to communications. For work in such areas, a doctorate in statistics opens doors to a broad variety of excellent professional opportunities, and yet, many students with an aptitude for studying statistics are unaware of the great opportunities the field offers.

The Rice University Summer Institute of Statistics (RUSIS) stimulates students' interest in statistics by exposing them to actual research problems in the field and by providing guidance and encouragement to pursue a Ph.D. in the mathematical sciences. Established in 2003 by Javier Rojo



at Rice University, the program has now moved to the University of Nevada at Reno, where Rojo has taken a position as chair of the mathematics and statistics department. The program has been renamed Research for Undergraduates Summer Institute of Statistics at the University of Nevada at Reno, RUSIS@UNR.

Rojo spent seventeen years at the University of Texas at El Paso, where he founded a math club for undergraduates and worked hard to

recruit students from underrepresented groups. In 2001, he moved to Rice University, and two years later he launched RUSIS, with funding from the National Science Foundation and the National Security Agency. As the country's first Research Experiences for Undergraduates program focusing on the field of statistics, RUSIS has been phenomenally successful: Among the RUSIS participants who have now graduated from college, 83 percent have gone on to graduate school. This high percentage is especially remarkable because questionnaires filled out by students at the start of the program indicate that, before participating in RUSIS, only a few had considered graduate school.

Initially, RUSIS had seventeen to nineteen participants each year, and for the past three years it has had twelve students. The program runs for ten intense weeks over the summer. To be admitted to RUSIS, students must typically have done well in a set of prerequisite courses in mathematics. But the program also keeps the door open to accepting students who do not quite meet the academic requirements but who exhibit the kind of perseverance and creativity that signal potential for success in graduate school.

Because the students typically come to RUSIS with varied backgrounds, the mornings of the first three weeks of the program are devoted to an intensive course in probability, stochastic processes, statistical inference, and survival analysis. In the afternoon, students are given a course in

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computation, which takes place in a computer lab. Here the students gain a working knowledge of computer software needed for their later work in the program. Throughout this period, students are closely supervised and mentored by faculty, who provide intellectual challenges and encouragement, as well as practical information about how to apply to and succeed in graduate school.

During the last six weeks of the program, students form groups and participate in at least one research project in which they analyze data, run computer simulations, develop algorithms, and, when appropriate, engage in theoretical work. With help from postdoctoral associates and graduate students, RUSIS mentors work closely with the students to provide background material specific to the projects, as well as research direction necessary as the projects evolve.

Most of the projects focus on understanding, developing, and assessing the merit of new methodologies in the areas of multivariate survival analysis, multivariate extreme value theory, analysis of microarray data, analysis of massive data sets, and other biomedical and statistical problems. These areas present a wealth of interesting questions, many of which are accessible to undergraduates. Problems of current interest are used to motivate the students and serve as a point of departure for the research projects. Students are expected to prepare presentations about their work, for delivery in the final week of RUSIS and sometimes in national meetings. When the work is of sufficient merit, students have written research papers for submission to professional journals.

Throughout the program, RUSIS draws on centers of research and engineering in the Houston area—such as the MD Anderson Cancer Center, the Michael E. DeBakey Department of Surgery at the Baylor College of Medicine, and the University of Texas Health Sciences Center at Houston—to put students in contact with individuals who are doing exciting work. Researchers from these centers come to RUSIS to discuss with the students such topics as survival analysis applications in cancer research, liver transplant, and other health-related and environmental applications. Students pay a visit to the Anderson Cancer Center, and they also spend a day touring NASA's Johnson Space Center, where they can operate the flight simulators and visit Mission Control.

In the tenth week, the six-person RUSIS advisory committee, consisting of mathematical scientists from a variety of colleges and universities, visits the program. Students present their work to the committee and interact with the committee members. In addition, the committee members deliver short lectures highlighting how statistics plays a role in their disciplines and providing new perspectives on science and engineering and on career opportunities. Students often comment that these lectures are inspirational. In addition, the students meet with the advisory committee, without RUSIS personnel in attendance, to provide feedback on ways to improve the program.

While open to all students, RUSIS places special emphasis on recruiting students from groups traditionally underrepresented in mathematics and statistics. In this regard, RUSIS has been very successful: Of the 177 RUSIS participants to date, 61 percent are from underrepresented minorities, and 53 percent are female. Of the minority RUSIS alumni, three have obtained Ph.D. degrees and ten have obtained M.S. degrees. Twenty-five minority RUSIS alumni are currently in Ph.D. programs, and many of these are within one or two years of completing their doctorates.

RUSIS has also had a positive impact on the statistics department at Rice University. Before 2001, when RUSIS started, only one student from an underrepresented group had received a Ph.D. in the

department. Since 2001, the department has awarded the Ph.D. to eleven individuals who are from underrepresented groups. The success, energy, and excitement engendered by RUSIS has created a change in the departmental culture.

Of course, the real success of RUSIS lies in the way it has transformed the individual lives of the participants. Several RUSIS alumni wrote letters in support of the nomination of RUSIS to receive the Mathematics Programs That Make a Difference award. One of them is Raymundo Navarrette, a RUSIS alumnus who is now a graduate student at the University of Michigan. Navarrette is a U.S. citizen who grew up with working class parents in Mexico. Within his family background, his obtaining a bachelor's degree at the University of Arizona was already a huge accomplishment. Graduate school had not occurred to him until he attended RUSIS. "Through brilliant and very sincere talks given by the RUSIS director Dr. Javier Rojo and other invited speakers, I was convinced that a doctorate degree would benefit me intellectually and economically and would allow me to do more for my community," Navarrette wrote. "Additionally, the RUSIS program never failed to increase my appetite for more advanced knowledge and to inspire me to dream big."

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