

Abstracts of Student Presentations given at the 2008
Math Student Appreciation Day event held at
3:00 p.m. in OWS 150

Molly A. Leonard

Faculty Collaborator: Cheri Shakiban

The Incan Abacus: A Curious Counting Device

La yupana was the ancient calculating device of the Incans. In the indigenous Andean language quechua "yupar" means "to count." There are numerous historical accounts that mention the existence of such a calculating device, but the way they worked is left very unclear. What we do know for sure is that the Incans used some sort of tablet upon which the stones or beans were placed. These markers were moved about in such a fashion as in order to perform the various calculations needed to make the quipu records. It is easily seen that some sort of calculating device was used, but much more difficult to identify exactly how la yupana was used. This research explores and proposes a possible explanation of such a counting device.

Justin J. Falzone and Patrick J. Persons

Faculty Collaborators: Dr. Heekyung Youn and Dr. Arkady Shemyakin

Crop Insurance

For this research project, our main goal was to develop a crop insurance plan to insure maize farmers in Kakamega, Kenya. Because of the various degrees of moral hazard, it was discovered that weather-indexed crop insurance would be the most efficient type of insurance. We had received data containing daily rainfall amount in Kakamega for each day from 1970-2007 and we wanted to use that data to find the probability of crop failure due to lack of rain. The first planting season normally starts during the first week of March. Although this is the standard range, we wondered if farmers would benefit from a delayed start date. The ultimate goal was to find expected payout for various start times of the first planting season and to develop an affordable insurance plan that provides a safety net for farmers in seasons of total crop failure due to inadequate rainfall. We researched the amount of rainfall needed for successful maize growth and also stress and failure levels of rain fall amount for the crop. After finding this information, we needed to determine what type of crop insurance plan best fit the needs of the Kenyan farmers.

After the rainfall data was organized into a manageable set, it was analyzed using the different growth periods as the possible payout periods. The results showed high expected payouts that would result in an insurance premium unfeasible for the client. In order that one may find a lower expected payout, future endeavors should be targeted at a moving start date, rather than a fixed date. For instance, start the planting of maize after there has been 30mm of rain in a 10-day period.

Mark J. Jadin

Faculty Collaborator: Dr. Arkady Shemyakin

Method of Quantifying Risk for Loan Portfolios

The Commercial Lending industry specializes in giving financing to small businesses that typically sell large ticket items (i.e. a commercial lender is the financier between a boat manufacturer and a boat dealership). During the recent economic recession, small businesses have had a much greater tendency to default on their loans, which makes it crucial for Commercial Lenders to be able to quantify the risk of their loan portfolios. My presentation will cover my experience in helping develop an effective risk model for a Textron Financial by using binary logistic regression.

Ryne A. Smith

Faculty Collaborator: Dr. Magdalena Stolarska

Mathematical Modeling of Cell Motility

One-celled organisms move in a variety of different ways. One type of movement is known as chemotaxis, the process by which cells are attracted to a chemical in the cell's surroundings and move towards that chemical. The process of chemotaxis involves various complex biochemical pathways. In this research, the biological pathway of focus is that which leads to extension of the leading edge and the contraction of the rear of our cell of study, *Dictyostelium Discoideum*. The specific purpose of this research project is to model the biological process of extension and contraction in a mathematical way, concentrating more heavily on the contraction phase and the "C-to-spot" formation of the biological species inside the cell known as *myosin*. This species *myosin* works with a number of other intracellular species, which were also modeled. This mathematical model was programmed into the computer program *Mathematica* in order to process calculations more quickly.