Math and Stat Colloquium

Thursday, April 26

3:30pm LIB 405

Refreshments will be served in the Lund Hall Foyer at 3 p.m.

Speaker:

Dan Ralescu

University of Cincinnati

"Mixed Models of Uncertainty"

Abstract: Management of uncertainty plays an important role in what has become to be known as intelligent information processing. Depending on what causes uncertainty - randomness, lack of definition of a concept, imprecision - various approaches to capture and compute with uncertain information have been devised.

This tutorial lecture describes issues that arise when two such approaches are considered together. In particular, we emphasize the synergy between probability - based approaches and fuzzy sets theory for the treatment of uncertain and/or imprecise information. Primarily, we study the applications of the concept of *fuzzy random variable* to standard problems of decision-making, the possibility of *estimating an imprecise probability*, as well as the *statistical testing of inexact hypotheses* and *regression analysis with fuzzy data*. More specifically, we discuss the following models: (1) data are sets or fuzzy sets, but the probabilities are numbers; (2) data are numbers (or vectors), but the probabilities are sets, or fuzzy sets; (3) vague prior information incorporated into a statistical model; (4) distributions with fuzzy parameters.

Fuzzy sets theory and the associated fuzzy logic originated from problems in systems science; mathematical theory of evidence originated from the need to develop alternative representations for probabilities (e.g. interval valued) and to traditional (including Bayesian) probabilistic approaches. The unifying mathematical concepts and techniques that we explore in this specific setting are *integrals* with respect to *non-additive measures* (i.e. Choquet integrals), *set-valued probabilities*, and *optimization with inexact constraints*, as well as *nonparametric tests*. Some of these techniques were also found useful in other fields, such as mathematical economics, and Bayesian robustness.