

THE MATHEMATICS DEPARTMENT PRESENTS

A MATHEMATICS COLLOQUIUM

THURSDAY, November 8, 2007

BOND HALL 227

4:00 pm

Title: An Optimal Approach to Group Testing

Speaker: Seth Zimmerman

Abstract: The optimization of group testing has been a devilish challenge ever since it was publicly introduced in 1943. Much of its charm lies in its simple formulation. No one who hears the problem can resist offering an instant solution, and indeed, some of this guesswork turns out to be true, although difficult to prove. A further attraction is that this is a theoretical problem with immediate applicability in many areas. Here it is in its original, easily visualized form:

You are testing human blood samples to locate the members of a population who have a particular disease. The probability that any given person has the disease is minute (say $p = .0001$), and the population you are testing is large (say $N = 1,000,000$). If you test each sample individually you'll perform 1,000,000 tests, a number you'd like to reduce. Assume that if you combine several samples and test them all together, the test will register positive if at least one of the included samples has the disease. If it does register positive you will then have to continue testing within this combined group in order to find the diseased samples, but if the combined test registers negative you will have saved a great number of tests. For example, merely testing in pairs should save about 500,000 tests. Finally, any test whose outcome can be deduced from the results of previous tests need not be performed. The question then is: how do you go about testing so as to minimize the expected number of tests?

While I will present an outline of my optimal approach, (offering complete details of the proof by email to anyone interested) I do hope to engage the attendees at various stages. My approach is what would be called straightforward or constructive, in contrast with other analytical or purely empirical approaches. I'll attempt to make this interesting not only to faculty, but to alert math majors as well.

Refreshments will precede the talk at 3:30pm in Bond Hall 300
courtesy of Tilmann Glimm.