St. Olaf Mathematics Department

Math Mess

Department of Mathematics
St. Olaf College
Northfield, MN 55057

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This Week's Mathematics Colloquium

Title: A Fish Story: How Different Forms of Harvesting Affects Population Dynamics
Speaker: Urmila Malvadkar
Time: Tuesday, February 17th, 1:00 pm
Place: SC 182

This Week's Colloquium

Mathematics can help us understand issues in biology which cannot be analyzed by other means. In this seminar, I will introduce the field of mathematical biology and two fundamental equations for modeling population dynamics. We will also explore some methods of analyzing these equations. Finally we will look at different assumptions about the harvest rate (focusing on fish, but applicable to other species, as well) to see how these affect the population. This seminar is based on work by Colin Clark.

Growing up in Oklahoma, Urmila Malvadkar was always interested in both mathematics and environmental issues. She was fortunate to be able to combine her interests both in college at Vanderbilt (BS, mathematics and environmental science) and in graduate school at Princeton (PhD, applied and computational mathematics, emphasis: mathematical biology). She studied zooplankton behavior and taught both undergraduates and elementary school student. The latter took significantly more energy. Currently she is working on an NSF biocomplexity project involving optimal marine reserve placement in the Bahamas.

More Math-Bio Stuff!

Urmila Malvadkar will give a second talk entitled "How Dispersal Affects the Success of Marine Reserves: Insights from Diffusion Models and Optimal Control" on Tuesday at 4:00 pm in SC 182.

The success of marine protected areas depends on the species life history characteristics and movement patterns. I examine two different models with different metrics for measuring success, focusing on fish dispersal. The first is an age-structured diffusion model for a one-species system in one spatial dimension. A set of persistence conditions that depend on the fecundity schedule, diffusion coefficient, and mortality in space is derived. Persistence conditions, however, can be reduced to a simple relationship based on relative magnitude of mortality. The second model examines two different types of dispersal, density dependent and density independent. An optimal control model is derived, seeking to maximize discounted net profits. Although a marine reserve is not optimal under any conditions under finite time constraints, long-term analyses indicate that density independent dispersal more strongly affects conditions under which a reserve is optimal.

Summer Research Opportunities

If any of these capture your interest, you'd better get moving – the application deadline for all of the programs is Friday, February 20th!

CPET, a general-purpose web-based tool

This summer, we aim to create the first prototype *CPET (Co-Process Extension Tool)*, a loadable software module (e.g., a plug-in) that is capable of extending the capabilities of a web browser by connecting it to another running program (the "co-process") that may be located elsewhere on a computer network. The CPET concept might be applied to arbitrary software having a network interface; our first application will use CPET to extend the capabilities of ordinary course-management software (e.g., WebCT) so that online quiz questions may involve the evaluation of programming language expressions, using a language interpreter or compiler as the "co-process." The project will involve web technology, computer security, network programming, and software design as well as programming. CS background must include at least CS 251 (Software Design and Implementation); preference to students with core-level CS courses and network and/or web programming experience. Contact Dick Brown, rab@stolaf.edu, x3860.

The Bioinformatics of Tuberculosis Latency

Approximately a third of the human population (~2 billion persons worldwide) have viable, but nonreplicating tubercle bacilli in their lungs. Together with HIV, it is the worlds number one killer. Using a combination of computer science and statistical thinking we build a "whole genome" view of the causative bacterium M. tuberculosis. Over the past few years, we have provided bioinformatic support for several major labs, helping them store and manage the data on the expression all of this bacterium's genes under several hundred different growth conditions, helping discover the roles of each gene. We also build and distribute new open source software to help biologists discover new things. Knowledge of Biology is not necessary: this can be learned on the job. Lovers of UNIX/Linux and/or Statistics are especially encouraged to apply. For more information see orb.public.stolaf.edu or drop by to meet Dr. Rutherford in SC226.

Algorithms and the Hilbert Polynomial

Ever wondered if your strong computer science and programming skills could be put to good use in pure mathematics? Do you have a desire to explore mathematics and implement algorithms? Then you are the student I am looking for. I have a research project that studies algorithms for computing the Hilbert Polynomial, a key invariant used in commutative algebra. The main motivation is decreasing the space complexity of this computation, but the road to get there has ended up being interesting in itself. The project has combinatorics, commutative algebra, simplicial complexes AND computer science. Minimum requirements: By June 2003, interested students must have successfully completed Abstract Algebra (Math 252) and Software Design and Implementation (CS 272). Students with core courses in CS with an enthusiasm for learning mathematics or with core courses in mathematics who know some C++ programming will be considered. Interested students should contact Amelia Taylor (OMH 205) for more information or go to http://www.stolaf.edu/people/ceumb/research.html and fill in the application.

Problem of the Week

A carnival worker offers you the opportunity to play the following game. Laid out in front of you are nine tiles, bearing the digits 1 through 9. The two of you will take turns selecting a tile. If either player collects exactly three tiles whose digits add to 15, that player wins immediately. You are offered the choice of going first or second, just because the carny likes your face. Is there a strategy you can employ to be sure of winning the giant plush Gorilla?

Please submit all solutions by Thursday at noon to David Molnar at molnar@stolaf.edu or by dropping them off at OMH 201.

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