

Program

2011 Governor's Institute in Mathematical Sciences

June 19 - 24, 2011

Approximately 30 top Vermont mathematics students from grades 9-12 will participate in the **2011 UVM / GIV Mathematical Sciences Institute, June 19 - 24, 2011**. Participants will explore topics such as, robotics, mathematical games and mathematical problem solving. Students will visit NRG to investigate production, research and development at the company.

Games of Perfect Information

You know tic-tac-toe, checkers, chess, reversi, and mancala. All are two-player games of perfect information in that no moves are governed by chance, and every element of the game is exposed to both players. This weeklong course will explore the history of these games and will introduce combinatorial game theory: the mathematics that lies behind them. We will also study and play similar games that might be new to you, such as go, hex, nim, bao, kayles, and hackenbush. We will seek optimal strategies, and discuss how computers such as IBM's Deep Blue can be programmed to play these games. Students will also have an opportunity to study and play new games of perfect information of their own creation. This course is taught by Robert Snapp of the UVM Computer Science Department.

Robots: Subjects, or Masters?

Why don't we have robots at home doing our dishes or shoveling our snow? I will discuss some of the challenges in designing robots, and, if we can eventually build complex robots, what might they tell us about ourselves? This course is taught by Josh Bongard of the UVM Computer Science Department.

A tale of crayons and their consequences: why four colors suffice

Consider a map of the US. Your goal is to color the states so that any two adjacent states (say VT and NH) are colored differently. Moreover, you are stingy and want to use the fewest number of colors. How many do you need? How can you color the map, and how do you show that you can't do so with any fewer colors? And why would anyone care? This course is taught by Dan Archdeacon of the UVM Department of Mathematics.

One Happy Bird: Using Mathematics to Measure Happiness (and other Social Phenomena)

Online interactions have recently enabled social scientists to ask very interesting questions. For example, how does the fabric of a social network influence the way we communicate? How does our well-being vary as a function of time, geographical location, age, sex, weather, ... As a nation, how happy are we? In this set of talks, we will explore how mathematics is being used to describe, model, and even understand human behavior. This course is taught by Chris Danforth of the UVM Department of Mathematics.

Analog to Digital: The Mathematics of Modern Communications

Students will explore the importance of mathematics as utilized in digital communication systems. Mathematical tools such as trigonometric functions, series representation, probability and matrix multiplication will be utilized. Hands on activities will be incorporated. This course will be taught by Dr. Jeff Frolik of UVM's School of Engineering.

Applied Mathematics and Human Intelligence

Just what is it that makes humans intelligent? Some have suggested pattern recognition -- the ability to see order in a chaotic environment -- is not only necessary for life, but is a skill at which we excel. This talk will explore artificial neural networks, in particular pattern recognition algorithms. This course will be taught by Donna Rizzo of UVM's School of Engineering.

The Stable Marriage Problem

Imagine you are a matchmaker with 20 female clients and 20 male clients. Each of the women has given you a complete list of the men ordered by her preference of whom she would like to marry. Similarly, each of the men has given you a complete list of the women ordered by his preference of whom he would like to marry. Your job is to find a "stable marriage". This would be a total of 20 marriages (between all the men and all the women) such that there is no pair of a man and a woman who both prefer each other to their partner in the marriage? Can you do it??? This course is taught by Jeff Dinitz of the UVM Department of Mathematics.

Problem Solving Strategies, I, II, and III

Session I is taught by Jack Lawlor of the UVM Department of Mathematics.

Session II is taught by Tony Trono, Director of GIV Math for many years and award-winning math team coach.

Session III is taught by Mike Kling, sophomore at MIT, and past high school mathematics contest national champion.

Mortgage Economics and Time Series Analysis:

We will explore the mathematics behind planning for your financial future..... How will the mortgage to finance the purchase of your first home work? How will you predict the returns from your investments? Is anything predictable? This course is taught by Doug Dickey of the UVM Department of Mathematics.

Slip Sliding Away – When Slide Rules Ruled

What does the Empire State Building, the Golden Gate Bridge, and the Apollo Moon Landing all have in common? Their designers all used slide rules for their mathematical calculations. Up until 1970, Slide rules, not hand held calculators or computers, were the workhorses of mathematicians, engineers, physicists and economists. Learn what amazing feats these remarkable devices could do, and make and use a simple slide rule in class. This course is taught by Bill Gottesman.

Numbers in Our Lives

Social Security numbers, ISBN numbers, zip codes, UPC numbers – we see numbers every day and probably don't give them a second thought. But there is a system behind the seeming randomness of the numbers. See how modular arithmetic plays a role in creating the numbers we see and use almost every day.

Tour of IBM

What does a large company do to help the environment, while optimizing their own operations? We'll meet with IBM's site operations team, who use analytics to monitor the site and reduce the use of energy and water. We'll tour several of the areas, including the DI water plant and the waste water treatment facility.