Modeling Fungal Growth **Dr. Jim Caristi, Valparaiso University**

Branching that occurs in the growth of fungi can be studied at many differenct levels. Our approach will be to combine theory of how the underlying transportation phenomenon works with mathematical and statistical modeling, and we will implement these models in a simulation language. Participants do not have to have a background in biology, but must be willing to learn how the biology works. Prerequisites: Differential Equations and Statistics.

Cryptographic Protocols Dr. Andrea Huszti, University of Debrecen

Cryptography is one of the most beautiful research areas of number theory. During the course we will deal with cryptographic protocols including the basic protocols like secret sharing, authentication, and also the advanced ones, especially zero knowledge proofs and blind signatures. Our goal is to gain deep knowledge of the building blocks in order to design complex, esoteric protocols for secure election schemes. Prerequisites: Elementary Number Theory

Inflow Rates on Horizontal Wells Dr. Ken Luther, Valparaiso University

Horizontal wells are often used to collect drinking water, as their ability to withdraw large amounts of water can be larger than similarly sized vertical wells. Typically, horizontal wells are drilled near surface water bodies, such as lakes or rivers, and are often placed in networks of multiple wells - also known as a radial collector well. In modeling horizontal wells, we usually assume the wells are truly horizontal. However, these wells can also be installed at an angle from the horizontal. One possible modeling project is to determine, given a well of certain length and radius near a given water body, what influence the angle from horizontal has on the total amount of water than can be removed by the well. Prequisites: Differential Equations

Diophantine Solution Methods Dr. Akos Pinter, University of Debrecen

In this project we present some elementary and non-elementary methods for solving certain diophantine problems. Using these techniques we solve several new research problems concerning diophantine equations with combinatorial background. Prerequisites: Elementary Number Theory, experience in MAPLE is a plus.