## MATH RESEARCH AT UNC CHARLOTTE 2024

**Project 7:** Reconstruction of random family trees.

**Mentor:** Dr. Kevin McGoff

**Project description**. Description: The central task in the study of phylogenetics is to reconstruct the evolutionary history of a collection of related individuals from their genomes. Mathematical models of this problem typically assume that the genome of their most recent common ancestor is drawn at random, and then genomes are sequentially passed down from ancestors to their direct descendents with random mutations. Some existing results describe conditions under which the family tree can be successfully reconstructed with high probability, but there are also impossibility results describing conditions under which any reconstruction method will fail with high probability. While there are many results describing algorithms for reconstruction and their probability of success, there remain many approachable open questions.

In this project students will study probabilistic models of random family trees, investigate possible reconstruction algorithms, and attempt to quantify their probability of success. Students may choose to study these questions from either an analytical or a computational point of view. The project will be suitable for students with an interest in probability, statistics, and/or mathematical biology.