EIGHTH ANNUAL CAPSTONE DAY

Department of Mathematics
Georgia College

November 23, 2019
8:15 a.m. – 1 p.m.
Maxwell Student Union

Department of Mathematics
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Earning a college degree is a significant achievement and requires dedication and tremendous effort by each student. Several programs have been developed to help students majoring in mathematics to succeed. The First Year Academic Seminar provides an introduction to department faculty, departmental and university expectations, policies, resources and opportunities following graduation. The department conducts informal social activities and presentations by faculty and guest speakers to encourage faculty and student interaction. The department webpage serves to inform, acknowledge and encourage student majors to become involved in activities related to the major such as mathematics competitions and professional meetings. The academic honor society Kappa Mu Epsilon has been organized to encourage and provide a supporting network for the student body.

Professional schools, businesses, government and industry recognize that mathematics majors are problem solvers and are highly skilled in the use of logic and reasoning. A degree in mathematics opens many careers that are closed to those without quantitative skills. Actuarial science stands as one major example. Moreover, the demand for mathematics in education-especially in secondary schools-is tremendous. In fact, the chronic nationwide shortage of mathematics teachers is due in part to the demand in so many other areas for talented mathematics majors.

2019 Capstone Day Schedule

8:15 – 8:55 a.m. Registration and Breakfast **Donahue Lounge**

8:55 – 9 a.m. Opening Remarks **Donahue Lounge**

9:00 – 10:00 a.m. Session I **Donahue Lounge**

Derivative Security Pricing with the Binomial Asset Pricing Model**,** Amy Beth Edwards

Deterministic Greedy Algorithm for Maximum Independent Set Problem in Graph Theory**,** Joshua Ballard-Myer

Reasoning with Fractions as Measures and Rational Expressions, Bayley Perkins

10 - 10:15 a.m. Break **Donahue Lounge**

10:15 - 11:15 a.m. Session II **Donahue Lounge**

The Entscheidungsproblem and Alan Turing**,** Laurel Brodkorb

Misconceptions of Trigonometry**,** Christopher Williams

Modeling FICO Score and Loan Amount**,** Ashleigh Romer

11:15 – 11:30 a.m. Closing Remarks **Donahue Lounge**

11:30 a.m. - 12:30 p.m. Lunch **University Banquet Room**

2019 Capstone Day Abstracts

Joshua Ballard-Myer

Deterministic Greedy Algorithm for Maximum Independent Set Problem in Graph Theory

The Maximum Independent Set (MIS) problem in graph theory is the task of finding the largest independent set in a graph, where an independent set is a set of vertices such that no two vertices are adjacent. There is currently no known efficient algorithm to find maximum independent sets. We will present a deterministic greedy algorithm that is an improvement on the general greedy algorithm for MIS. This algorithm is not valid for all graphs, but conditions where the algorithm fails will be discussed. We will also briefly discuss the extension of the algorithm to coloring and hypergraphs.

Laurel Brodkorb

The Entscheidungsproblem and Alan Turing

Computability Theory is a branch of mathematics that was developed by Alonzo Church, Kurt Godel, and Alan Turing during the 1930s. This talk explores their work to formally define what it means for something to be computable. Most importantly, this talk gives an in depth look at Turing's 1936 paper, "On Computable Numbers, with an Application to the Entscheidungsproblem". It further explores Turing's life and impact.

Amy Beth Edwards

Derivative Security Pricing with the Binomial Asset Pricing Model

A derivative security serves as a financial agreement in which a buyer is given the right to purchase assets at a predetermined price, which can be exercised at any point before the expiration of the security. In this paper, we explore the Binomial Asset Pricing Model and how it is used to price derivative securities for both stocks and bonds in the risk-neutral world. We look at how call options are regressively priced under risk-free probabilities that result in stock profit growth equal to that of the money market returns. Similarly, we examine interest rate discount processes and their effects on zero-coupon bonds prices, bond wealth portfolios, and derivative securities. We conclude by analyzing Apple Inc. stock data to price our own risk-neutral call option and consider the likelihood of the option being exercised over the period of our data set.

Bayley Perkins
Reasoning with Fractions as Measures and Rational Expressions

According to the literature, a common issue that students have with fractions is understanding that fractions have a magnitude. Students need fraction experiences with contexts involving length models and seeing fractions as measures. We designed and executed a teaching experiment to evaluate students' current understanding of fractions as measures. We also investigated whether there was a correlation between Preservice Teachers' (PSTs) fractional reasoning and procedural fluency with rational expressions. The participants involved were fourth graders, and elementary and special education PSTs. We administered pre-assessments and presented the students with tasks that required them to create and interpret length models and number lines. All data was collected, analyzed, and compared to answer questions such as how do students reason about fractions as measures and how can we develop students' conceptual understanding of measuring with fractions?

Ashleigh Romer
Modeling FICO Score and Loan Amount

In this research, we use Lending Club data from Kaggle to analyze FICO scores and loan amounts funded using multiple predictors. Lending Club is a US peer-to-peer lending company, headquartered in San Francisco, California. First, we will clean our big data with 1,048,575 rows and 97 columns and then perform exploratory data analysis. We will also use feature engineering and subset selection methods to build a linear model to predict FICO score and amount funded of customers loan requests.

Christopher Williams
Misconceptions of Trigonometry

Trigonometry plays a major role in our society. Trigonometry is the study of triangles and the relationship between the measures of its angles and sides. In this research, we will provide information concerning the misconceptions of basic concepts in trigonometry. The study will also identify whether students have a conceptual understanding of those concepts or just a surface level understanding. The study will provide information concerning the misconceptions of trigonometry in math courses that could help fellow educators.

Notes

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