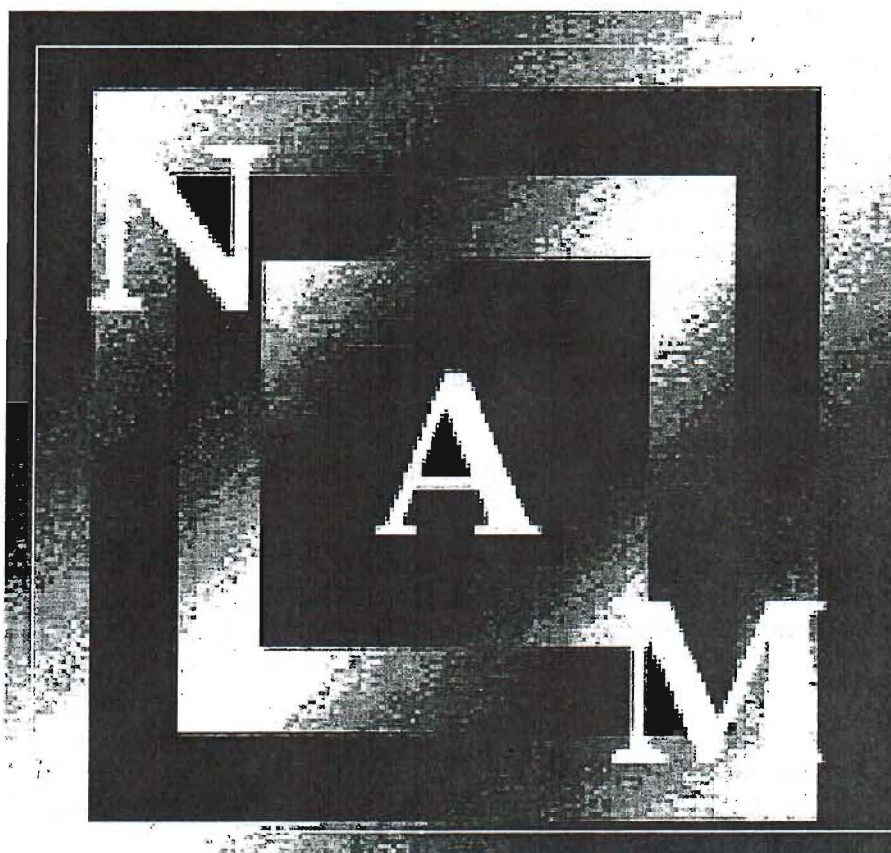# Undergraduate MATHFest XXI

A Conference for Undergraduates in Mathematics
Sponsored by the National Association of Mathematicians, Inc. (NAM)

Hosted by

The Department of Mathematics
School of Science, Technology, Engineering and Mathematics
Dillard University
New Orleans, Louisiana
Thursday, November 3 – Saturday, November 5, 2011

National Association of Mathematicians
Undergraduate MATHFest XXI

Thursday, November 3, 2011
Professional Schools Building (PSB)
Room 131, 135

12:00 noon	**Transportation from the Downtown Marriott New Orleans to Dillard University**
12:30 - 2:00	**Lunch** – Kearny Hall Cafeteria
12:00 - 2:00	**Registration** – PSB Atrium

2:15 – 2:30 **Opening Sessions**
Greetings: Dillard University
Dr. James Earl Lyons Sr., Interim President
Dr. Phyllis Dawkins, Provost and Senior Vice President
Dr. Abdalla Darwish, Chair, School of STEM

The National Association of Mathematicians
Dr. Nathaniel Dean, President

Conference Orientation:
Dr. Leon Woodson, Morgan State University
Executive Secretary – NAM

2:30 - 3:15 **Presentation:** "Fractional Calculus and some applications"
Gaston N'Guerekata, Morgan State University

3:15 - 3:30 Break

3:30 - 4:15 **Panel I:** *"How to Successfully Negotiate Graduate Study in the Mathematical Sciences, Graduate Faculty Perspectives"*

4:15 – 5:15 **Spotlight on Mathematicians**

5:15 – 6:00 *"The Generalized Trigonometric Sine Function and Its Applications"*,
Dr. Dongming Wei, *University of New Orleans (UNO)*

6:00 **Graduate School/Undergraduate Summer Research Reception** – PSB Atrium

7:15 **Transportation from PSB, Dillard University to the Marriott New Orleans**

Free Evening

Friday, November 4, 2011
Professional Schools Building (PSB)
Room 131, 135

7:15 / 7:30   Transportation from the Downtown Marriott New Orleans to Dillard University (2 buses)

8:00 – 9:00   **Breakfast** – Kearny Hall Cafeteria

9:00 – 9:50   **Student Presentations**

9:05   <u>**NAME**</u>
Dalesha Cartman
Elizabeth City State University

9:20   **Darius McDaniel & Rebecca Pettit**
Alabama Agricultural & Mechanical University & Notre Dame of Maryland University

9:35   **Cornelius Myles**
Mississippi Valley State University

9:50-- 10:00   Break

10:00 – 11:00   **Panel II**   *"How to Successfully Negotiate Graduate School",*
                            Graduate Students' View

                    Workshop I: Participating Graduate Students - PSB 131, 135

                    Workshop II: Participating Faculty – Facilitator: **Lt. Col. Donald Outing**
                                          PSB 261 - Mathematics Classroom I

11:00 - 12:00   **Student Presentations**

11:00   <u>**NAME**</u>
Jazzman Smith,
Dillard University

11:15   **Laura Gioco**
Fairfield University

11:30   **Marco Tapia & Prarthana Pandey**
University of Maryland, College Park &

11:45   **James Leslie**
Texas Southern University

12:00 - 12:15   **Group Photograph** – Front of PSB Building

12:15 - 1:30   **Lunch** – Kearny Hall Cafeteria

1:30 - 3:00	**Student Presentations**
	NAME
1:30	**Niraj Wagh** **Michigan State University, Lyman Briggs School of Science**
1:45	**Cyril Helbling** **United States Military Academy, West Point, NY**
2:00	**Anika Rounds** **Purdue University**
2:15	**Charles Elloie** **Southern University at New Orleans**
2:30	**Palpasa Manandhr & Kevin Mbakop** **Spelman College & University of District of Columbia**
2:45	**Shonte' Walton** **Dillard University**
3:00 –3:15	Break
3:15 - 4:15	**Panel III:** *"Research and Professional Careers in the Mathematical Sciences"* *"Characteristic of Highly Effective Mentors"*, **Dr. Joseph Omojola**, *Southern University of New Orleans (SUNO)* *"A Report of Enhancement on Undergraduate Actuarial Sciences for a Decade"*, **Dr. Hong Dai and Dr. Peter Frempong**, *Dillard University*
4:15 – 4:30	Break
4:30 – 5:30	**Student Presentations**
	NAME
4:30	**Dominique Rice** **Howard University**
4:45	**Jasmine Wallace & Sonia Mahop & Dotun Opasina** **Spelman College & Howard University & Morgan State University**
5:00	**Chartese Jones** **Mississippi Valley State University**
5:15	**Arielle Calloway** **Dillard University**
5:45-6:15	**J. Ernest Wilkins, Jr. Lecture** Title: "Analysis of Games and Social Interactions". **Invited address: Nathaniel Dean**
6:30	**Undergraduate MATHFest XXI Appreciation Dinner** – Kearny Hall West Wing
8:15	**Transportation from Dillard University to the Downtown Marriott – New Orleans**
	Free Evening

Saturday, November 5, 2011
Professional Schools Building (PSB)
Room 131, 135

8:00 / 8:15   **Transportation from the Downtown Marriott to Dillard University (2 buses)**

8:30 – 9:00   Breakfast (Continental) – PSB Atrium

9:00 – 9:45   *"Applications of the Mathematical Sciences to Global Issues of the 21th Century"*
                Roselyn Williams, Florida A&M

9:45-10:00   Break

10:00 -11:30   **Student Presentations**

                <u>NAME</u>

10:00   **Scott Leroy**
                Dillard University

10:15   **Sullen DaVonte**
                Dillard University

11.30 – 12:15   *"Existence and Uniqueness of Solution for Fractional-order Functional Integro-differential*

                Equations with Infinite Delay"

                Dr. Haewon Lee, *Dillard University*

12:15-12:30   **Closing Sessions**

                Dr. Nathaniel Dean
                President – National Association of Mathematicians
                Dr. Leon Woodson
                Executive Secretary – National Association of Mathematicians
                Dr. Robert Collins
                Senior Dean – College of Arts and Sciences

12:30 – 1:30   **Brunch** – Kearny Hall Cafeteria and **Departure** *

STUDENT PRESENTATIONS
Session I (Friday:9:00-9:50)

9:05-   Dalesha Cartman
         Elizabeth City State University

TITLE: The Use of the Math Sprint in a Tutorial Program for Sixth Grade Students to Improve End of Grade Test Scores

ABSTRACT: This project included sixth grade students from Elizabeth City Middle School who didn't pass their End Of Grade (EOG) exams. My partners and I used Math Sprint in a tutorials program to see if the tutoring could help enhance the students test scores. We followed a daily routine such as a class schedule in order to keep the students as close to a regular curriculum as possible.

9:20-   **Darius McDaniel & Rebecca Pettit**
         Alabama Agricultural & Mechanical University & Notre Dame of Maryland University

TITLE: A Geographical and Statistical Analysis of Leukemia Deaths Relating to Nuclear Power Plants

ABSTRACT: Due to an alarming increase in childhood leukemia rates, it has become a priority to learn what factors contribute to this disease. While no direct cause is known, it has been suggested that environmental factors such as the radiation emitted by nuclear power plants may be to blame. This study examines whether or not there is a geographical pattern in cancer rates based upon the locations of nuclear power plants throughout the United States. A spatial analysis was conducted to look for global and local clusters with an increased mortality rate due to childhood leukemia along with a statistical analysis to examine which factors contribute significantly to this rate. We found no evidence to prove that nuclear power plants are responsible for the recent increase in childhood leukemia rates. This leads us to believe that a different carcinogen is at fault.

9:45-   **Cornelius Myles**
         Mississippi Valley State University

TITLE: Identifying Uniqueness in High Dimensional Social Science Datasets

ABSTRACT: Social scientists at the Kinsey Institute for Research in Sex, Gender and Reproduction gather large amounts of sensitive data from individuals. These datasets are high dimensional, which presents many opportunities to characterize participants in unique ways. The primary purpose of this project is to identify unique characteristics in high dimensional datasets and determine whether uniqueness leads to re-identification. By using data collected from the surveys that the Kinsey Institute supplied, we combined certain answer choices to determine which make people uniquified in a dataset. Our results showed that an average of 98.72% of people could be re-identified in the datasets.

Session II (Friday:11:00-12:00)

11:00- Jazzman Smith
Dillard University

TITLE: Computer Security Using Linear Algebra-Cryptography

ABSTRACT: Cryptography is the science of writing in secret code; which come from the Ancient Greek words krytó meaning "hidden" and gráfo meaning "to write."
This research project will describe and perform cryptography to reveal a message in plaintext, an uncoded message, into ciphertext, a coded message, and vice versa. The message will be obscure and unintelligible to everyone except whom it is meant for. Cryptography is necessary when communicating over any none trusted medium, especially the internet. The objective of this research is to obtain computer security using linear algebra.

11:15- Laura Gioco
Fairfield University

TITLE: **Modular Representations of Graphs**

ABSTRACT: A graph G has a representation modulo r if there exists an injective map
$f : V(G) \rightarrow \{0, 1, ..., r-1\}$ such that vertices u and v are adjacent if and only if $f(u) - f(v)$ is relatively prime to r. The representation number of G, rep(G), is the smallest integer such that G has a representation modulo r. In this presentation we examine the representation numbers of various graphs, such as the complete ternary tree and Harary graphs. We also give a sharp upper bound for the representation number of a connected graph G.

11:30- Marco Tapia & Prarthana Pandey
University of Maryland, College Park

TITLE: **Vibrant Coloring**

ABSTRACT: A vibrantly colored matrix is an n by m matrix colored with k colors in such a way that no sub-rectangle of the matrix has the same color on all four corners. In this presentation I will present an algorithm for vibrantly coloring a k^2 by $k(k+1)$ matrix, where k=2,3,5 in such a way that no row or column can be added. This method does not work for k=4 or 6. It is known (Gasarch et al) that vibrant colorings exist for k being a power of a prime, so this method working for k=2,3,5 but not 4 or 6 is some evidence that it will work for primes but not otherwise.

11:45- James Leslie
Texas Southern University

TITLE: Using Mathematics As Means for Fingerprint Classification and Recognition

ABSTRACT: This paper presents a different approach in the field of biometrics by bringing different elements of mathematics to fingerprint recognition and classification. My research project was to develop an application that used mathematics to classify and recognize fingerprints. This research was based on a crime packet with different scenarios created by my mentor Dr. Fiorini.

This system classifies fingerprints based on ridge patterns called cores and delta's (c,d). A core is the termination of the inner-most ridge that appears in the interior of a concentric set of curved ridges. A delta is triangular-shaped ridge pattern that appears at the center of three intersecting ridge flows. The arch, loop, and whorl patterns would be the three main categories of classification used.

Session III(Friday:1:30-3:00)

1:30-

Niraj Wagh
Michigan State University, Lyman Briggs School of Science

TITLE: When the Quotient Rule Doesn't Follow the Status Quo

ABSTRACT: In this talk we present an infinite class of functions for which the wrong way of taking the derivative of a quotient gives correct results. In other words when does $\left(\dfrac{f}{g}\right)' = \left(\dfrac{f'}{g'}\right)$? Interestingly enough, there are a variety of functions that follow this method. For example we can use polynomial functions where $f(x)= \dfrac{x}{1-x}$ and g(x)= kx, and we can also use power functions where $f(x)=\left(\dfrac{x^k}{(k-x)^k}\right)$ and g(x)= x^k where k is defined as any positive integer to exemplify this. This project was motivated by the need to use students' misconception to enhance learning and understanding.

1:45-

Cyril Helbling
United States Military Academy, West Point, NY

TITLE: A Mathematical Analysis of Tuning in Western Music

ABSTRACT: The existence of patterns and rhythms in nature lends some insight into the relationships between mathematics and music. Mathematics can be used to analyze rhythm, frequency, tuning, composition, instruments, and more. This presentation will focus on tuning in Western music and how the method of tuning has changed with time. The three main types of tuning revolve around a twelve-note octave, and I will propose research in determining possible uses of a fourteen-note octave.

2:00-

Anika Rounds
Purdue University

TITLE: An Introduction to Dessins d'Enfants: The Intersection of Graph Theory, Group Theory, and Differential Geometry

ABSTRACT: Suppose there are three cottages, and each needs to be connected to the gas, water, and electric companies. Using a third dimension or sending any of the connections through another company or cottage are disallowed. Is there a way to make all nine connections without any of the lines crossing each other? To answer such a question, we explore the properties of planar graphs. It is natural to generalize to graphs which can be embedded into Riemann surfaces, such as the sphere and the torus. In this talk, we discuss how to draw such graphs using Grothendieck's concept of a Dessin d'Enfant.

2:15-   **Charles Elloie**
       Southern University at New Orleans

TITLE: The Lucas- Lehmer Test for Mersenne Primes

ABSTRACT: Fibonacci numbers and the related sequence of Lucas numbers have very interesting divisibility properties. This research is an investigation into those properties as they relate to prime numbers. In mathematics, the Lucas-Lehmer test (LLT) is a primality test for Mersenne numbers. Originally developed by Edouard Lucas in 1856 and subsequently modified by Derrick Lehmer, this test was used to show $2^{127}-1$ is a prime number and $2^{257}-1$ is composite. In this presentation I will apply these divisibility properties in an attempt to devise the LLT for primes of the form 3(mod 4). After this I will prove $2^{127}-1$ is a prime.

2:30-   **Palpasa Manandhr & Kevin Mbakop**
       Spelman College & University of District of Columbia

TITLE: Tug of War

ABSTRACT: Tug of War is a game with two players and it begins with each player having an equal amount of money. We demonstrate the game in a setting of a line segment with 'n' nodes on it and each player's destination is at the opposite ends. The game starts with a token in the middle and the goal of each player is to bring the token to their end. They negotiate on each move and one of the players will end up paying the other to be allowed to make the move. We assume that only the first player can make the first move and then we have several rules associated with the bidding and moving of the token accordingly. Our research was trying to find the strategies and possibilities of winning for each player under certain circumstances. We developed some hypothesis and used lemmas and theorems to prove them.

2:45-   **Shonte' Walton**
       Dillard University
TITLE: Simulation Methods and Their Applications in Disability Income Insurance"

ABSTRACT: In this research, three important simulation methods and algorithms including: Empirical Probability, Monte Carlo and Inverse Transform are probed.
The mathematic statistical principles of each method are explored with real examples, for instance, "How to find the value of the irrational number pi", "How to evaluate the area under any curve y = g(x) over interval [a, b], where g(x) has no anti-derivative" and "How to generate an independent random sample for a given accumulative distribution model" and so on.
Also, a simulation application in Disability Income Insurance is studied for different occupations, ages, gender, duration, amount of payment, and waiting period.
The simulation method presented can be useful tools to apply to all fields within STEM.

Session IV (Friday:4:30-5:30)

4:30- **Dominique Rice**
Howard University

TITLE: Character Table for the Binary PolyhedralGroup Corresponding to the Tetrahedron

ABSTRACT: We will determine the finite subgroups of $SO_3(R)$. Using the geometric interpretations of these groups we can connect them with the theory of linear representations of finite groups. There is a natural map between $SU_2(C)$ and $SO_3(R)$. The pre-images of the finite subgroups $SO_3(R)$ under this map give rise to all the finite subgroups of $SU_2(C)$. We will then compute the character table of the finite subgroup $\tilde{A}_4$ in $SU_2(C)$. We will create this character table for $\tilde{A}_4$ by describing generators and relations, and then we will compute the characters of this group. We will then set up a relation between this character table and the Dynkin diagram of an affine Kac-Moddy Algebra.

4:45- **Jasmine Wallace, Sonia Mahop & Dotun Opasina**
Spelman College, Howard University & Morgan State University

TITLE: Competitive color Graphing

ABSTRACT: Imagine your best friend is getting married to your ex. It's probably safe to say you are no longer best friends anymore. Your best friend decides to invite you to the wedding and asks for your help. Your job is to place everyone around the table in a girl/boy order. Since you are upset that your "best friend" is marrying your ex you don't do your job affectively so you may "accidently" place two girls or guys by each other.
In fact, Competitive Color Graphing is a way of coloring the vertices of a graph such that no two adjacent vertices share the same color; this is called a vertex coloring. Similarly, an edge coloring assigns a color to each edge so that no two adjacent edges share the same color, and a face coloring of a planar graph assigns a color to each face or region so that no two faces that share a boundary have the same color.

5:00- **Chartese Jones**
Mississippi Valley State University

TITLE: Analysis of Sequence Population in a High Performance Computing Environment

ABSTRACT: Modern pyro-sequencing techniques have made it possible to study complex bacterial populations, such as 16s rRNA, directly from environmental or clinical samples, and the resultant data sets contain many duplicate sequences leading to redundant calculations. Redundant Sequence Identification – In many large samples of bio-sequence that we have worked with, we have observed that many of the sequences are repeats. By identifying these repeats upfront and tracking them in some way, we can drastically reduce our overall computation time and achieve better analysis throughput. The 16S rRNA gene is used for phylogenetic studies as it is highly conserved between different species of bacteria and Achaea. Carl Woes pioneered this use of 16S rRNA. In addition to these, mitochondrial and chloroplast rRNA is also amplified.
Sequence analysis of the 16S rRNA sequence is done with the help of several primers, called universal

primers. These primers target the conserved region of 16S rRNA gene and amplify the target in parts. Finally the several amplified parts could be assembled together to have the entire sequence of amino acid. Some of the primers are listed below.

Universal PCR primers are used to amplify the 16S rRNA gene providing the phylogenetic information, the most common universal primer pair was devised by Weisberg and are currently referred to 27F and 1492R, however, for some applications shorter amplicons may be necessary for example for 454 sequencing with Titanium chemistry the primer pair 27F-534R covering V1 to V3.

5:15-	Arielle Calloway
	Dillard University
TITLE:	Study on Global Economic Growth and Its Impact Factors

ABSTRACT: I n this research, Global Economic Growth on GDP, Revenue, Cost and other Economic Indicators will be studied. A few of evaluation methods on Global Economic Growth will be investigated. A new evaluation method which combined the main economic indicators with indirect-economic indicators will be provided. Also, the increasing rates over 30 years of GDP of four groups, G1: Asia Pacific, G2: Europe Middle East and Africa (EMEA), G3: Latin America and G4: North America will be analyzed by new evaluation method.

In addition, this research is to find out the main Impact Factors to Global Economic Growth and to predict future trend and to give out advice to decision makers by decomposing the Economic Growth over 30 years into Trend, Cycling, Seasoning and Randomize components.

Third, this research is to consider non-traditional impact factors, such as Decision-makers' Mistakes, Average Level of Civics' Education, Individual's Ability to face Global Economic and Financial Crisis and so on.

Session V (Saturday: 10:00- 11:30)

10:00-	Scott Leroy
	Dillard University
TITLE:	Computation of the Law of Laminar Flow using Maple
ABSTRACT:	N/A
10:15-	Sullen DaVonte
	Dillard University
TITLE:	The Origins of L'hospital's Rules
ABSTRACT:	N/A