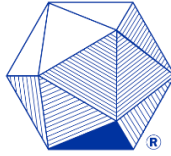


The Mathematical Association of America
Louisiana/Mississippi Section



99th Annual Meeting hosted by
Northwestern State University of Louisiana
Natchitoches, Louisiana
March 03 – 05, 2022



MAA

NSU Wi-Fi Guest Access:

Wi-Fi Network: nsulaguest
Username: MAAGuest
Password: Demons1884

Institutional Partners:

Northwestern State University

McNeese State University

Mississippi College

Mississippi State University

Rust College

Southeastern Louisiana University

University of Louisiana at Lafayette

Xavier University of Louisiana

Institutional Partners' Membership Fees help fund student activities. Thank you for your support!



Schedule of Events

Thursday March 3rd

Registration	5:30 – 8:00	1 st Floor Lobby
Integration Bee	6:30 – 9:00	Hendrick Room
Food and ESports	6:00 – 9:00	Esports Room

Friday March 4th

Registration	8:00 – 4:30	2 nd Floor Lobby
Exhibits & Hospitality	9:00 – 4:30	Presidents Room
Committee Meetings	9:00 – 4:30	Room 221
Student Team Competition	8:30 – 10:30	Hendrick Room
Section NEXt	8:30 – 11:30	Cane River Room
Student Address	10:45 – 11:45	Hendrick Room

Allen Butler

1st Plenary Session:	1:00 – 2:15	Ballroom
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Anderson Lecture

Judy Walker

Student Paper Presentations	2:30 – 3:30	Hendrick Room
Faculty Presentations I	2:30 – 4:15	Cane River Room

2nd Plenary Session:	4:30 – 5:30	Ballroom
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Pólya Lecture

Talithia Williams

Anderson Banquet	6:00	Chateau St. Denis
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Saturday March 5th

Faculty Presentations II	9:00 – 10:30	Ballroom
3rd Plenary Session:	10:45 – 12:00	Ballroom

Outstanding Teacher

Leigh Ann Myers

Business Meeting

Executive Committee	12:00 – 1:00	Room 221
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Invited Speakers:



Dr. Butler holds a B.A. in Mathematics from Texas Tech University and a PhD in Mathematics from the University of Illinois, Champaign-Urbana (1987). He has been employed at Daniel H. Wagner Associates, Inc. (www.wagner.com) since 1987 and is currently a Vice-President and Chair of the Board of Directors. Throughout his career, Dr. Butler has served as the principal investigator for Department of Defense R&D projects involving a variety of mathematical disciplines as applied to areas such as tracking, track correlation, data fusion, and search optimization. He has been involved in the development and implementation of optimal search techniques for a number of projects, including a research effort whose goal was the interdiction of narcotics smugglers in the Caribbean. He recently served as VP of Practice on the Board of Directors of the Institute for Operations Research and Management Science (INFORMS), currently serves on the Board of the Institute for Mathematical and Statistical Innovation, is a Visiting Lecturer for the Society for Industrial and Applied Mathematics (SIAM), and most importantly is the Treasurer of the Mathematical Association of America (MAA).



Judy Walker joined the faculty at the University of Nebraska–Lincoln in 1996 and has remained there, except for the fall 2011 semester when she was a visiting professor at École Polytechnique Fédérale de Lausanne in Switzerland. She was named Aaron Douglas Professor of Mathematics in 2012. Professor Walker is an algebraic coding theorist, with a concentration on connections between coding theory and algebraic geometry, number theory, and graph theory. She is a co-founder of both the All Girls/All Math program for high school girls and the Nebraska Conference for Undergraduate Women in Mathematics. She served as the MAA's Pólya Lecturer for 2009–2011 and has given lecture series at the Institute for Advanced Study and at the Sophus Lie Conference Center in Norway. In 2006, she received the MAA's Haimo Award for Distinguished Teaching, in 2021 she was named an AMS Fellow, in 2019 she was named an AWM Fellow and in 2021 she received the outstanding Alumni Achievement Award from the Department of Mathematics at the University of Illinois at Urbana-Champaign.



Statistician **Talithia Williams** is an innovative, award-winning Harvey Mudd College professor, a co-host of the PBS NOVA series “NOVA Wonders” and a speaker whose popular TED Talk, “Own Your Body’s Data”, extols the value of statistics in quantifying personal health

information. She demystifies the mathematical process in amusing and insightful ways to excite students, parents, educators and the larger community about STEM education and its possibilities. In 2015, she won the Mathematical Association of America’s Henry L. Alder Award for Distinguished Teaching by a Beginning College or University Mathematics Faculty Member, which honors faculty members whose teaching is effective and extraordinary, and extends its influence beyond the classroom. It is this excellence that attracted the attention of online educational company The Great Courses, which selected Williams to produce “Learning Statistics: Concepts and Applications in R,” a series of lectures in which she provides tools to evaluate statistical data and determine if it’s used appropriately. She is the author of “Power in Numbers: The Rebel Women of Mathematics”, a full-color book highlighting the influence of women in the mathematical sciences in the last two millennia and has narrated several science documentary films including NOVA’s “Secrets in our DNA” and NOVA’s “Hindenburg: The New Evidence”. Williams is a proud graduate of Spelman College (B.A., mathematics), Howard University (M.S., mathematics) and Rice University (M.A., Ph.D., statistics). Her research focus involves developing statistical models that emphasize the spatial and temporal structure of data and applies them to problems in the environment. She’s worked at NASA, the Jet Propulsion Laboratory and the National Security Agency and has partnered with the World Health Organization on research regarding cataract surgical rates in African countries. Faith and family round out a busy life that she shares with her husband and three amazing boys. Through her research and work in the community at large, she is helping change the collective mindset regarding STEM in general and math in particular, rebranding the field of mathematics as anything but dry, technical or male-dominated but, instead, a logical, productive career path that is crucial to the future of the country.

Section Next Workshop
Friday March 4, 8:30 – 11:30
Cane River Room

8:30 **(Not) All about MAA**

Michael Pearson, MAA Executive Director

Michael will share his thoughts on the ways MAA has been central to his professional life, and how you can find ways you can engage with MAA resources and participate in the MAA community to advance your career. For those long-time members, he will also share some of the recent and ongoing changes as we look towards a changing landscape in higher education. Bring your ideas and help the MAA set an agenda for the future!

9:30 **Teaching Lessons Learned from the Pandemic**

In this session members of the Section NExT Committee will share teaching techniques they have found helpful in the last two years.

Judith Covington, Northwestern State University,
Hwamog Kim, Mississippi University for Women,
Catherine Putnam, Delta State University,
Carmen Wright, Jackson State University,

10:30 **Ask Us Anything**

Judy Walker, University of Nebraska

Talithia Williams, Harvey Mudd College

This will be a Q&A session with Anderson Lecturer Judy Walker and Pólya Lecturer Talithia Williams. Potential topics might include involvement in professional societies, pros and cons of being in leadership, early career advice, communicating mathematics to the general public, issues around diversity, equity, and inclusion in mathematics, or anything else you would like to ask these mathematicians. Come prepared with your questions!

Student Address
Friday March 4, 10:45 – 11:45
Hendrick Room



Allen Butler (UICC, 1987) is Vice-President and Chair of the Board of Directors of Daniel H. Wagner Associates, Inc., a small consulting firm focusing on mathematics and scientific software development (www.wagner.com). A former member of MAA's Board of Governors, he currently serves as the Treasurer of the MAA and is an active member of a number of other Professional Organizations (e.g., AMS, SIAM, IMSI, CNU's PCSE Industrial Advisory Board). Reading, International travel, Texas Holdem, Blackjack, and golf comprise his primary interests outside work.

**Bayes' Theorem – Making Rational Decisions in the
Face of Uncertainty**

Allen Butler, Daniel H. Wagner Associates
Friday March 4, 10:45 – 11:45
Hendrick Room

A statement of Bayes' Theorem (aka Bayes' Rule) can be written very succinctly, but this belies its far-reaching consequences. In this talk, I will provide a little of the history behind Bayes' Theorem, a derivation of the mathematical basis in probabilistic terms, and a description of the less formal basis where it is viewed as a form of evidential or inferential reasoning. I will illustrate the utility of Bayes' Theorem by describing applications from the work of my former company, Daniel H. Wagner Associates, Inc. One of these resulted in the location and recovery of the "Ship of Gold", the SS Central America, a side-wheel steamer carrying nearly six hundred passengers returning from the California Gold Rush, which sank in a hurricane two hundred miles off the Carolina coast in September 1857.

**First Plenary Session
Anderson Lecture
Friday March 4, 1:00 – 2:15
Student Union Ballroom**

Announcements

Leigh Ann Myers
Program Chair

Welcome

Marcus Jones, President
Northwestern State University of Louisiana

Introduction of Anderson Lecturer

Judith Covington
Section Chair

Coding Theory: A cornucopia of mathematics

Judy Walker, University of Nebraska – Lincoln

Whenever information is transmitted or stored, errors are bound to occur. It is the goal of coding theory to find efficient ways of adding redundancy to the information so that these errors can be corrected. The mathematical study of error-correcting codes began with Claude Shannon's groundbreaking 1948 paper, in which he proved probabilistically that good codes exist. The subsequent challenge has been to actually find or design these good codes; this problem has occupied the minds of many mathematicians, computer scientists and electrical engineers ever since. In addressing Shannon's challenge, many areas of mathematics have been drawn upon, including several that are not typically thought of as "applied math". This talk will give a mathematical tour through coding theory, focusing especially on the wide range of areas such as algebraic geometry, number theory, and graph theory that have played a crucial role in the development of this field.

Presentations Overview

Student Presentations March 4 2:30 – 3:30, Hendrick Room

- | | | |
|------|---|--|
| 2:30 | Andrew Lott
(Millsaps College) | Schur's Theorem in Integer Lattices |
| 2:50 | Saima Arif
(Mississippi College) | An Exploration of Higher-Order Derivatives |
| 3:10 | Megan Sickinger
(University of Southern Mississippi) | Analysis of COVID-19 and Vaccination Administration in Mississippi |

Faculty Presentations I March 4 2:30 – 4:15, Cane River Room

- | | | |
|------|--|--|
| 2:30 | Alex Rice
(Millsaps) | A precise probability related to Simpson's paradox |
| 2:50 | Edgar Reyes
(SELU) | w-Polar Decomposition for $O(p,q)$ |
| 3:10 | Zachary P. Bradshaw
(Tulane University) | Cycle Index Polynomials and Separability Algorithms in Quantum Computing |
| 3:30 | Jessica Bass
(NSU) | Preparing for Praxis Problems |
| 3:50 | Carrie Maggio
(NSU) | A Successful Approach to Teaching Co-requisite Math Courses |

Faculty Presentations II March 5 9:00 – 10:30, Ballroom

- | | | |
|-------|---|--|
| 9:00 | Arindam Sutradhar
(ULL) | K_1 injectivity of the Paschke Dual algebra |
| 9:20 | Taylor A Poe
(Mississippi College) | Poncelet Quadrilaterals Four Ways |
| 9:40 | Corwin Stanford
(Jackson State University) | Anomaly Detection Using Principal Component Analysis for Identification of Cyber-Physical Attacks in the Hardware-in-the-Loop-Based Augmented Industrial Control System (HAI) Dataset. |
| 10:00 | Randall Gordon Wills
(SELU) | Squares of Repunits and their Associated Identities |

Student Presentations
Friday March 4, 2:30 – 3:30
Hendrick Room

2:30

Schur's Theorem in Integer Lattices

Andrew Lott, lottal@millsaps.edu

Millsaps College

A standard proof of Schur's Theorem yields that any r -coloring of $\{1, 2, \dots, R_r - 1\}$ yields a monochromatic solution to $x + y = z$, where R_r is the classical r -color Ramsey number, the minimum N such that any r -coloring of a complete graph on N vertices yields a monochromatic triangle. We explore generalizations and modifications of this result in higher dimensional integer lattices, showing in particular that if $k \geq d + 1$, then any r -coloring of $\{1, 2, \dots, R_r(C_k)^d - 1\}^d$ yields a monochromatic solution to $x_1 + \dots + x_{k-1} = x_k$ with $\{x_1, \dots, x_d\}$ linearly independent, where $R_r(C_k)$ is the analogous Ramsey number in which triangles are replaced by k -cycles. We also obtain computational results and examples in the case $d = 2$, $k = 3$, and $r \in \{2, 3, 4\}$.

2:50

An Exploration of Higher-Order Derivatives

Saima Arif, snarif@mc.edu

Mississippi College

This paper presents the concept of Fractional Derivatives, the history behind them and how they were developed. In addition to that, two different approaches to calculating fractional derivatives are considered: a modification of the integer order derivative using the Gamma Function as well as the Riemann-Liouville Integral. We explore one application of the fractional derivative in the field of image processing.

3:10

Analysis of COVID-19 and Vaccination Administration in Mississippi

Megan Sickinger, Megan.Sickinger@usm.edu

University of Southern Mississippi

In this work, we develop a mathematical model to observe the spread of COVID-19 and vaccine administration in Mississippi. How simplistic can a model be to accurately measure the spread of COVID-19 in short term observations with a vaccine control measure? From this question arose an eight compartment ASIRD-V model, where asymptomatic cases and recovered population are split between unvaccinated and vaccinated. We investigate the stability and equilibrium points of this model, and simulations optimize the model's parameters over short periods of time using both death data and vaccine data given by the Centers for Disease Control. This model observes the impact of policy changes as well as the vaccine rollout in Mississippi to combat the spread of COVID-19. This work is an extension of the summer research on the ASIRD model in the 2020 undergraduate Cross Scholar summer research program at the University of Southern Mississippi.



<https://xkcd.com/1856>

Faculty Presentations I
Friday March 4, 2:30 – 4:15
Cane River Room

2:30

A precise probability related to Simpson's paradox

Alex Rice, riceaj@millsaps.edu

Millsaps College

Suppose two friends are about to participate in a two-day contest in which they repeatedly attempt a task with a clear success/failure outcome (such as shooting free throws on a basketball court). We have no specific prior knowledge of the participants' skills, or of how many attempts they will take each day, so we suppose that each participant's success rate for day 1, success rate for day 2, and proportion of attempts that take place on day 1 are all chosen uniformly at random between 0 and 1. What is the probability that the same person has a higher success rate each of the two individual days, but the other person has a higher success rate for the two-day period? This can be thought of as a prior probability of a simple case of *Simpson's Paradox*, and we show that this probability is $\frac{\pi^2-9}{36} = .0241556778 \dots$

2:50

w-Polar Decomposition for $O(p,q)$

Edgar Reyes, edgar.reyes@selu.edu,

Southeastern Louisiana University

The polar decomposition of a nonsingular real matrix is the product of a positive-definite real matrix and an orthogonal matrix. In this talk, we generalize the polar decomposition to the indefinite orthogonal group $O(p, q)$.

3:10

Cycle Index Polynomials and Separability Algorithms in Quantum Computing

Zachary P. Bradshaw, zbradshaw@tulane.edu

Tulane University

The cycle index polynomial of a group is an important object in Pólya theory. It is interesting that this combinatorial device makes an appearance in the acceptance probability of certain quantum algorithms that test for the entanglement of a pure bipartite quantum state, an important resource in the field of quantum computing. In this talk we discuss this property and answer a conjecture about the behavior of the cycle index polynomial for the symmetric groups in this context, showing that the algorithm proposed by LaBorde and Wilde becomes more stringent as the order of the symmetric group increases. This result follows from the relationship between the cycle index polynomial and the complete Bell polynomials, which satisfy a desirable recurrence relation. Finally, we conjecture that a similar behavior holds for the cycle index polynomial of any finite group.

3:30

Preparing for Praxis Problems

Jessica Bass, bassj@nsula.edu

Northwestern State University

To help our mathematics education students prepare for the Praxis exam, I created a course to meet the needs of these students. Students in this course review material covered by the Praxis exam and test taking strategies. This talk will discuss the changes regarding the new mathematics content exam and how we are preparing our students for the exam and the classroom.

Faculty Presentations I

Friday March 4, 2:30 – 4:15

Cane River Room

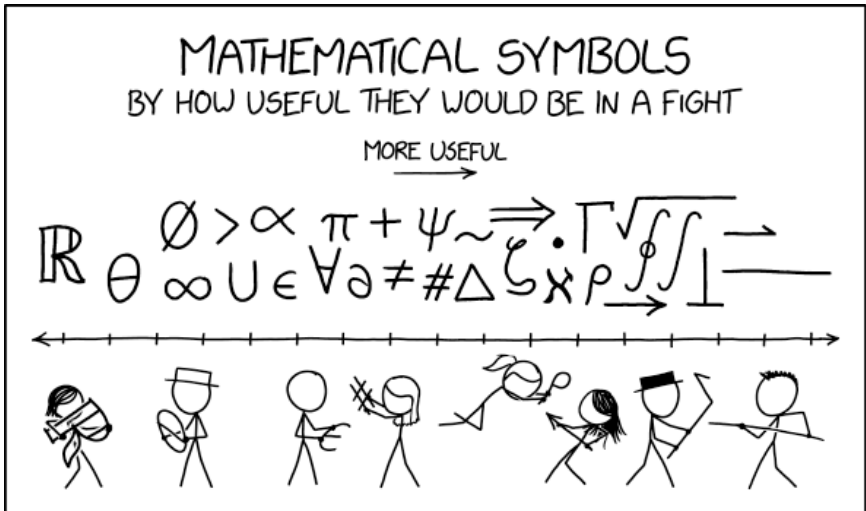
3:50

A Successful Approach to Teaching Co-requisite Math Courses

Carrie Maggio, maggioca@nsula.edu

Northwestern State University

For the last several years NSU has offered corequisite courses to students meeting the criteria. Many different approaches have been implemented. Finding the right balance to help students succeed in their first math course and beyond has been a challenge. We have developed a course framework that has allowed students to receive the extra instruction needed to succeed and gain confidence in their ability to solve problems.



<https://xkcd.com/2343/>

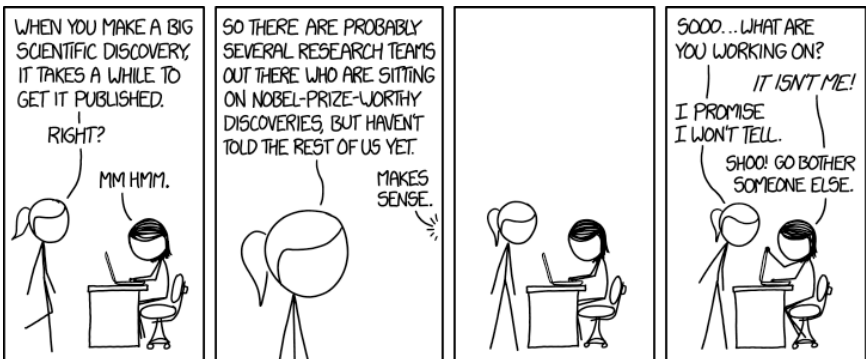
Second Plenary Session
Pólya Lecturer
Friday March 4, 4:30 – 5:30
Student Union Ballroom

Introduction of Anderson Lecturer

Judith Covington
Section Chair

Power in Numbers: Unveiling Hidden Figures
Talithia Williams, Harvey Mudd College

The movie “Hidden Figures” brought visibility to the lives of African American women who served as NASA “human computers” in the 1960s, women who dreamed the impossible in a field where their presence was lacking. Meeting the demands of a 21st century STEM workforce requires that we look beyond traditional talent pools to recruit and train individuals typically underrepresented in math. During this talk, I'll discuss my personal journey as a woman of color in statistics and share ways in which we can excite public interest in data science, building upon the rich legacy of diverse mathematical scientists that have come before us.



<https://xkcd.com/1805/>

Faculty Presentations II
Saturday March 5, 9:00 – 10:30
Student Union Ballroom

9:00

K_1 injectivity of the Paschke Dual algebra
Arindam Sutradhar, arindam1050@gmail.com
University of Louisiana at Lafayette

Let B be a nonunital separable simple stable C^* -algebra with strict comparison of positive elements and $T(B)$ having finite extreme boundary, and let A be a simple unital nuclear C^* -algebra. We prove that the Paschke dual A_D^B algebra is K_1 injective. As a consequence, we obtain interesting KK -uniqueness theorems which generalize the Brown–Douglas–Fillmore essential codimension property.

9:20

Poncelet Quadrilaterals Four Ways
Taylor A Poe, tpoe@mc.edu
Mississippi College

A consequence of Poncelet's theorem states that given any two points in the unit disk, one can find an ellipse with these points as foci circumscribed by infinitely many quadrilaterals, each of which is inscribed in the unit circle. We will connect this beautiful geometric fact with finite Blaschke products, orthogonal polynomials on the unit circle, numerical ranges of matrices, and Mirman's iterations.

9:40

Anomaly Detection Using Principal Component Analysis for Identification of Cyber-Physical Attacks in the Hardware-in-the-Loop-Based Augmented Industrial Control System (HAI) Dataset.

Corwin Stanford, j00928757@students.jsums.edu
Jackson State University

Principal component analysis (PCA) is a common dimension reduction technique in which the eigenvectors of a dataset's covariance matrix that capture the maximum variance within the data are used to transform said data. The eigenvectors which capture the least variance within the data are discarded. However, these latter components have been shown to be a valuable tool for detecting cyber-physical attacks in industrial control systems (ICS). When ICS data is transformed using these components, normal operating data shows little variance, but data collected during attacks can vary greatly, resulting in identifiable anomalies. Unlike supervised machine learning techniques, this does not require information from prior attacks in order to build a detection model. Here, we examine a collection of attacks contained within the HAI dataset, a HIL (hardware-in-the-loop) augmented ICS. A variety of methods for selecting PCA components and identifying anomalies are used, and the results compared.

10:00

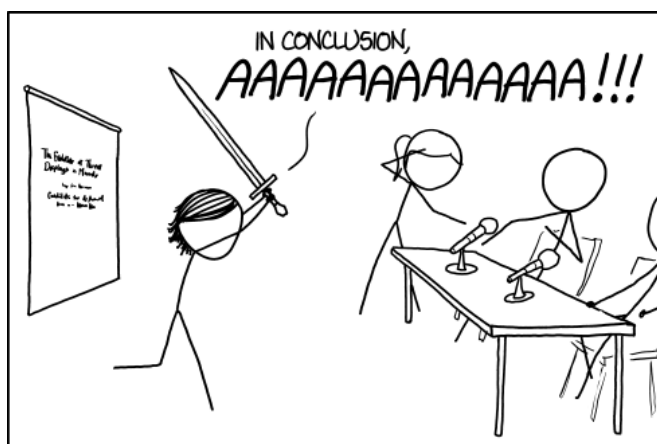
Squares of Repunits and their Associated Identities

Randall Gordon Wills, rwills@selu.edu
Southeastern Louisiana University

Define a repunit R_n to be an n digit positive integer whose digits are all 1s. That is $R_n=111\dots111$. In this talk we will develop various identities which express the squares of repunits in terms of repunits. This talk is accessible to undergraduates.

**Third Plenary Session
Business Meeting
Saturday March 5, 10:45 – 12:00
Student Union Ballroom**

Welcome	Frank Serio NSU Department of Mathematics
Outstanding Teacher Address	Leigh Ann Myers
Opening of Business Meeting	Judith Covington
Representative's Report	Laura Shepherdson
Treasurer's Report	Christy Sue Langley
Competitions Results / Committee Reports	
Invitation to 100 th Annual Meeting	Catherine Putnam
Closing Remarks	Judith Covington



THE BEST THESIS DEFENSE IS A GOOD THESIS OFFENSE.

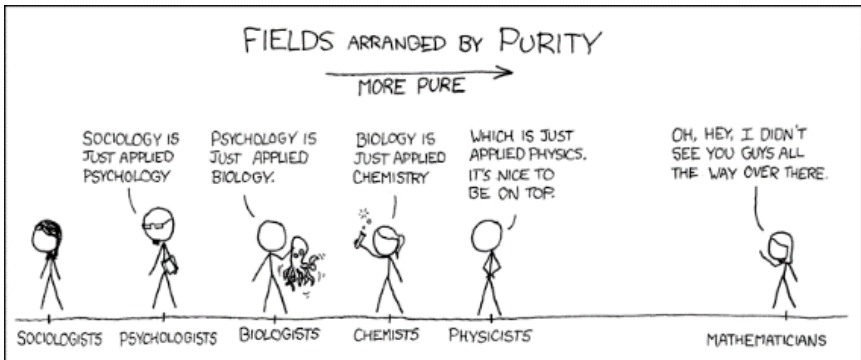
<https://xkcd.com/1403/>

Math Word Search

Words can be found going up, down, left, right, and diagonal.

A Q R Q X U I G Z W N E Q A V Q
 I F Y A F S L W B I A B L V K R
 Z S A M E D T J P L Z O E C L T
 N Y O X N F O Q K X B H R E W H
 P I X M D E R I V A T I V E S A
 R I N A O J U I R G P S E H E N
 V E C T O R S A B V R S U G T H
 M C S R E T P J F H G U F X E D
 S Y L I T G A H V A T L E D S U
 E S W X U E R O I C H U E H E L
 U Q P E R D A A P C N C U A R D
 D U A T E B L O L B W L O G I C
 J A L R C O L L N R V A I S E N
 Z R X E S S E Q U E N C E E S K
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 I Y O F D R T G P F F L E L M M
 L I N E A R E G R E S S I O N I

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| Logic | Vertex | Vector | Calculus | Linear |
| Sequence | Torus | Matrix | Regression | Delta |
| Series | Slope | Square | Derivative | Pi |
| Integral | Parallel | Isomorphic | Parabola | Tau |





NORTHWESTERN STATE
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Special Thanks



Music provided by Armadillo Jackal Band





Conference Hotels:



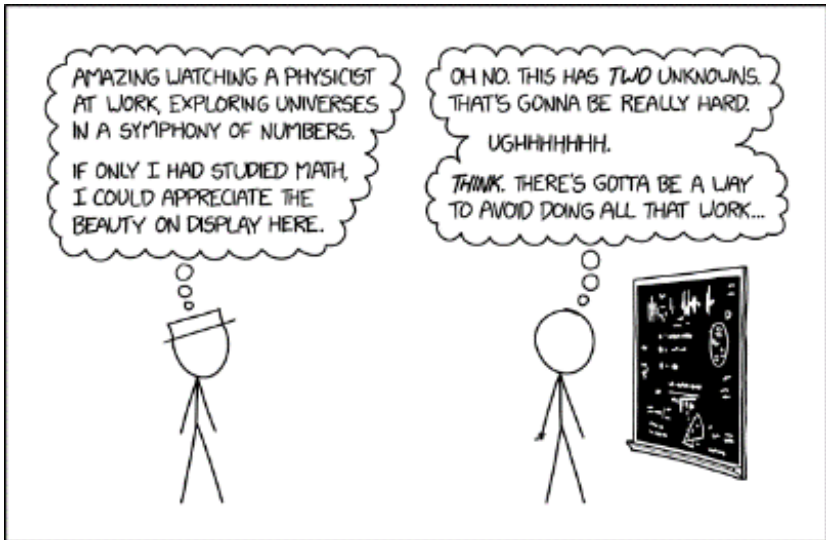
Chateau St. Denis
751 2nd Street
Natchitoches, LA 71457
(318) 951-4105



Church Street Inn
120 Church Street
Natchitoches, LA 71457
(318) 238-8888

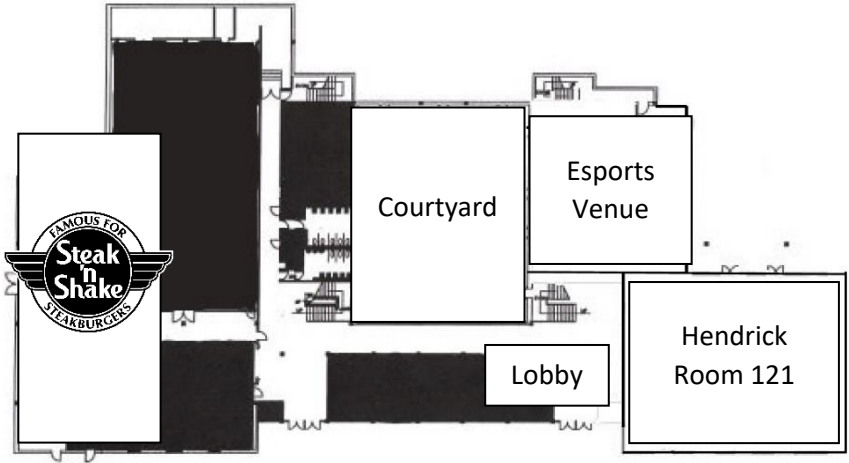


Fairfield Inn & Suites
150 Hayes Ave.
Natchitoches, LA 71063
(318) 354-8007

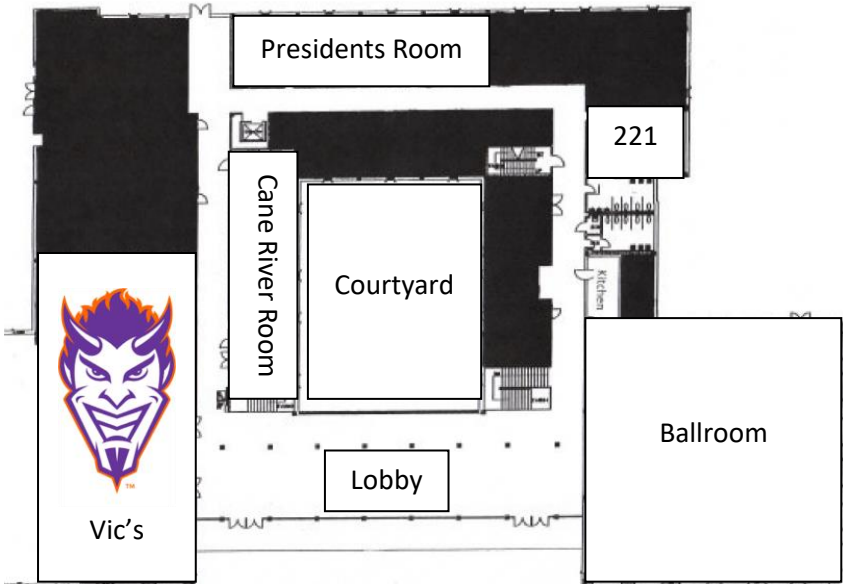


Friedman Student Union

1st Floor

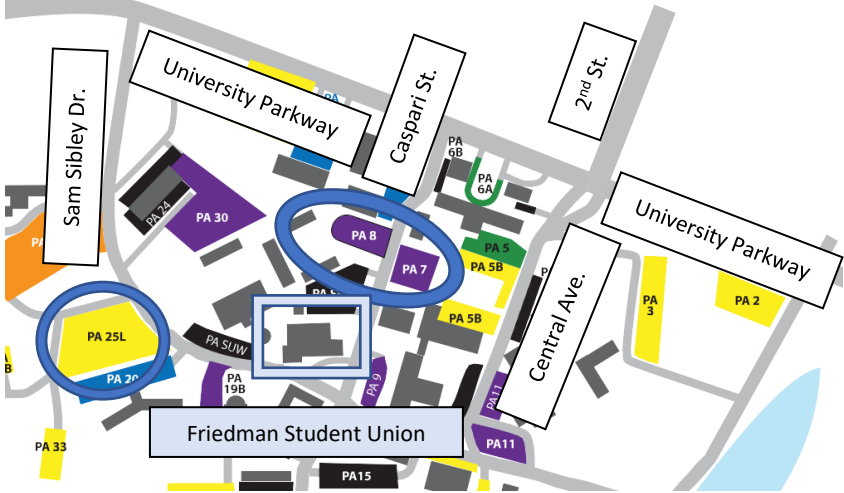


2nd Floor





NORTHWESTERN STATE
UNIVERSITY OF LOUISIANA



Parking: Parking will be in the large parking lot on Sam Sibley Dr. across the street from the flagpole and the 2 commuter lots located on Caspari St.

Banquet: The banquet will be at Chateau St. Denis hotel on 2nd Street. Leaving campus from Sam Sibley Dr. or Caspari St., take a right onto University Parkway. Take a left onto 2nd Street, the train tracks pass through this intersection. Proceed down until 751 2nd Street. The hotel will be on your right shortly after Horn St.

THE AXIOM OF CHOICE ALLOWS
YOU TO SELECT ONE ELEMENT
FROM EACH SET IN A COLLECTION
AND HAVE IT EXECUTED AS
AN EXAMPLE TO THE OTHERS.



MY MATH TEACHER WAS A BIG
BELIEVER IN PROOF BY INTIMIDATION.

<https://xkcd.com/982/>

