The Sum Times

Message from Dr. Frey

Welcome to the Spring 2020 edition of the Sum Times! I encourage you to read through this document to learn about our course offerings for Fall 2020 and the various events coming up this spring.

The department’s proposal for a new Statistics major has been approved, and I am pleased to notify you that the Statistics major will be available to students starting in Fall 2020. There will not be any incoming freshman Statistics majors until Fall 2021, but students will be able to declare the Statistics major as a primary or secondary major starting in Fall 2020.

Current Mathematics majors who are interested in the Statistics major are eligible to switch. The course requirements are listed on the next page. If you are interested in switching, I recommend talking with your faculty advisor about your plans before you register for Fall 2020 classes. I would also be happy to talk with you. If you are thinking about completing a Statistics major in Spring 2021 or earlier, please talk with me this semester, as accommodations may be needed to make your plan possible.

To make it easier to identify Statistics courses, the department has obtained permission to use the prefix STAT for Statistics courses, starting in Fall 2020. Courses numbered STAT 3000 or higher can count as Statistics major electives, while any course numbered 3000 or above, whether MAT or STAT, can count as a Mathematics major elective. For example, MAT 4310 (Statistical Methods) is now STAT 4310, which is required for the Statistics major and can count as a Mathematics major elective.

As part of implementing the new major, the department will need to choose a name for the Medallion award that is given each spring to the top graduating senior in Statistics. For the Mathematics major, the award is named after Professor Emil Amelotti, the founding chair of our department. If you have any suggestions for the name of the Statistics award, please send them my way.

Congratulations to all the seniors who are due to graduate in May! I hope to meet with each of you over the next month or two for a senior exit interview. I’m very interested in hearing about your Villanova experience and your plans for the future. I’d also like to get your thoughts on what our department is doing well and what we could be doing better.

Good luck in your classes this spring! Thanks for being a part of our department!

Sincerely,

Jesse Frey
Requirements for New Statistics Major

Course Requirements for the Statistics Major

- MAT 1500, 1505, and 2500 Calculus I, II, and III
- Either MAT 2705 Differential Equations w/ Linear Algebra or MAT 3100 Applied Linear Algebra
- STAT 4310 Statistical Methods
- STAT 4315 Applied Statistical Models
- STAT 4380 Data Science
- STAT 5700 Mathematical Statistics I
- STAT 5705 Mathematical Statistics II
- STAT 5905 Seminar in Statistics
- Three STAT electives numbered 3000 or above
- CSC 1051 Algorithms and Data Structures I
- Two natural science courses with laboratory at the major level. Possible choices include CHM (1151/03 & 1152/04), BIO (2105 & 2106), AST (AST2122/MSE2151 & AST2121/MSE2150), PHY (2410/11 & 2412/13 or 2414/15), PHY (1000/01 & 1002/03), and GEV (1050 & 1051).

If you are thinking about completing the Statistics major in Spring 2021 or earlier, please talk with Dr. Frey about your plans, as you will need a different course to substitute for STAT 5905.

Any Statistics major may count one approved Statistics course from outside the department as one of their three STAT electives. Double majors may count up to two approved outside courses.

MAT 1000: Mathematical Communities Seminar

MAT 1000: Mathematical Communities is a 1-credit professional and academic development course for mathematics majors that will run in Fall 2020 for new first-year math majors and in Spring 2021 for everyone else.

Communities is designed to help introduce you to your fellow math majors and also to help prepare you for finding internships, research opportunities, and careers. It’s very common to not know exactly what you can or want to do with your math degree; this course is designed to help you start looking for answers to these questions. Each week we talk about different aspects of being a math major, what you can do with a math degree, and what kinds of math you can expect to see in future classes.

If you are a current math major and this community experience sounds interesting, you should sign up to take MAT 1000 in Spring 2021!
**Fall 2020 Electives**

**MAT 3100 Applied Linear Algebra – Tim Feeman**

This new first course in Linear Algebra will introduce linear algebra and matrix theory to students in science, technology, engineering, statistics, computing science, and data science by focusing on modern applications in their fields of interest. Applications and matrix theory will be woven together, with the math flowing from the applications and, in turn, leading us to new, more sophisticated applications. Through this course, we will experience the power of mathematics to help us comprehend and actively participate in today’s information society.

Applications will include statistical correlation and regression, web information retrieval, matrix geometry for computer graphics, finding good connections and clusters within a network, least squares problems, ratings and rankings of web pages, and data compression. We will explore important linear algebra concepts, such as orthogonality, matrices as transformations, matrix factorization, and eigenvalues/eigenvectors.

Prerequisite: MAT 1312 or MAT 1320 or MAT 1400 or MAT 1500

**STAT 4210 Introduction to Bayesian Analysis – Al Marrero**

Generally, at present, Bayesian statistics is only taught at the graduate level. This course gives Villanova undergraduates the opportunity to learn about this important area of statistics. The course is an introduction to statistical data analysis from a Bayesian viewpoint. We assume no previous knowledge of Bayesian statistics. The course is intended to give students a taste of what it is like to work as a statistician, doing statistical analyses and writing statistical reports. It is meant to be a practical, hands-on learning experience. We will be using the software R. No previous knowledge of R is assumed.

Prerequisite: MAT 4310 - Counts as a math elective

**STAT 4310 Stats Methods – Yimin Zhang, Joe Pigeon, & Paul Bernhardt**

This course is an introduction to data summarization and various statistical methods that will allow students to begin to build up a toolbox of statistical techniques for handling data analysis. The class will study probability distributions that will serve as the foundation for these methods. The statistical methods that the class will study include point estimates, interval estimates and hypothesis tests for population means, variances and proportions, categorical data analysis, regression and correlation.

Prerequisite: MAT 1505 (concurrency allowed) - Counts as a math elective
STAT 4315 Applied Statistical Models – Paul Lupinacci

This course dives into regression models and analysis of variance (ANOVA). It is intended to be a follow-up course to MAT 4310 – Statistical Methods. The regression part of this course will cover simple and multiple linear regression, including prediction, correlation, model building, multicollinearity, influential observations, and model fit. The ANOVA part of this course will cover ANOVA for designed experiments, including completely randomized, randomized block, and factorial designs. The statistical programming language R will be used extensively in this course.
Pre-req: MAT 4310 - Counts as a math elective

STAT 4380 Data Science – Michael Posner & Jiangtao Gou

Data-savvy professionals are in high demand in business, public agencies, and nonprofits. The supply of professionals who can work effectively with data at scale is limited, and is reflected in rapidly rising demand and salaries for data scientists, rated as the #1 job in the US in 2016. This course explores how real-world data from a variety of disciplines are gathered, managed, and used for making decisions or predictions. Core topics will include data wrangling, visualization, multivariate thinking, text processing, data mining, ethics, and simulation-based inference. This course will introduce students to the statistical programming language R to accomplish these tasks. Prerequisite: any introductory statistics course (MAT 1230, MAT 1250, MAT 1430, MAT 4310, MAT 1313, or similar). - Counts as a math elective

MAT 4550 Financial Derivatives – Klaus Volpert

This course covers topics from Financial Mathematics, such as:

- mortgages and loans
- inflation and other interest rates
- What are stocks? Bonds? Options?
- A Random Walk on Wall Street
- volatility of stocks
- the concept of arbitrage
- put-call parity
- the Black-Scholes model for option pricing
- Monte Carlo methods for option pricing

The course is helpful in preparation for actuary exams FM and MFE.

“No winter lasts forever; no spring skips its turn”
-Hal Borland
MAT 5110 Geometry – Robert Styer

Euclidean geometry, non-Euclidean geometry, projective geometry, analytical geometry, differential geometry, finite geometry, solid geometry, affine geometry, tropical geometry, spherical geometry, hyperbolic geometry: how can there be so many kinds of geometries? We will begin with an overview of the classic Euclidean geometry and its influence on modern mathematics, then how a crisis emerged which led to new conceptions of physical space and mathematical reality, leading to the plethora of geometries we use today.

STAT 5700 Math Stats I – Elise Pasles (satisfies 2nd analysis requirement)

The course covers the basic principles of the theory of probability and statistics. Topics include: probability, random variables, discrete and continuous probability distributions, important families of distributions, multivariate probability distributions, and functions of random variables.

Prereq: MAT 2500 - Counts as a math elective

STAT 5910 TOP Design of Experiments—Paul Lupinacci

This class provides an introduction to the design and analysis of statistical experiments. Experimental design techniques are used in a wide variety of academic, industrial, and scientific areas. We will cover widely used designs, including but not limited to: Completely Randomized Designs, Random Block and Latin Squares Designs, full and fractional designs, nested and split-plot designs, and response surface methodologies. We will discuss practical and computational issues regarding their design and analysis. This course fulfills a math elective or an elective for the statistics minor.

Prereq: MAT 4310 - Counts as a math elective

MAT 5920 Graph Theory – Michael Tait

In this course we will define and prove some classical theorems about graphs. From there, we will begin our exploration into one of the most active research areas in graph theory: extremal graph theory. In this area, one tries to quantify what structures are guaranteed to appear once a graph is “large enough.” We will also discuss the connections between these problems and other areas in math, including number theory, geometry, and algebra.

Prerequisites: MAT 2600 or instructor approval
Fall 2020 Seminar

MAT 5900 Mathematics of Games – Alexander Diaz-Lopez

Can you always solve a Rubik’s cube? How many clues can you start with in a Sudoku puzzle and still get a unique solution? What board places are you most likely to land on when playing Monopoly? How many moves does it take to solve the Tower of Hanoi puzzle (with three or more towers)? In this capstone seminar, you will learn about different mathematical techniques to solve some of these questions. At the beginning of the semester, you will choose a project related to a game, which can be any of the following: SET, Hex, Rubik’s Cube, Spot It!, Bingo, Sudoku, Monopoly, Towers of Hanoi (and possibly others). We will work on the project throughout the semester and by the end of it, you will develop a written report and presentation. Depending on the project, you might find yourself learning and discussing one or more of the following topics: geometry, combinatorics, linear algebra, abstract algebra, number theory, algorithms, probability, Markov chains, and/or Monte Carlo simulations.

Prerequisite: MAT 2600 and one of the following three courses — MAT 3300, MAT 3400, or MAT 3500

“Spring is nature’s way of saying, ‘Let’s party!’”
- Robin Williams

Honorary faculty member, Will D. Cat, made a special appearance at the MLRC for the faculty meeting on February 14th, 2020.
Spring 2020 Semester Events To Remember

**π Day**

**When:** Friday March 13th from 11:00am-3:00pm

**Where:** Connelly Center

Find the Math Club and Association for Women in Math Club throughout the day selling baked goods in honor of Pi Day!

![π Day Pie](image)

**NOVAdance**

NOVAdance is a 12 hour dance marathon that raises money for pediatric cancer.

![NOVAdance](image)

It will be held on March 21st in Jake Nevin from 9am-9pm

**Pi Mu Epsilon Induction**

Friday May 1, 2020 (Reading Day)

Will be held from 10:00am-11:30am

in *Mendel 115*

**Guest Speaker:** Dr. Chris Rorres

Professor Emeritus of Mathematics at Drexel University

Topic: Olympic Starting Lines, Pistons, and Black Holes

**Annual Math Faculty vs. Student Softball Game and Picnic**

It will be held on *Austin Field* on Reading Day, Friday May 1 from 12:00 p.m. to 1:30 p.m.

![Softball](image)

*Come for a friendly game of softball, some food, and fun.*

If it rains the picnic will be held indoors in SAC 310.
John Urschel, former Penn State football player, later drafted by the Baltimore Ravens. Played 3 seasons before retiring to pursue his Ph.D in mathematics at MIT. Urschel received both his bachelor's and master's degrees in mathematics from Penn State University. In 2017, Urschel was named to Forbes' "30 under 30" list of outstanding young scientists. His research interests include numerical analysis, graph theory, and machine learning. He is expected to graduate from MIT in Spring 2021.

John Urschel made a visit to Villanova University to speak to the undergraduate students with a talk titled “Numerical Analysis in a Nutshell”. He later spoke at a colloquium titled “Iterative Methods for Matrices and Polynomial Optimization Problems”.

Please join us at the following Spring 2020 Colloquiums. All students and faculty are welcome to attend. The schedule is below:

**Friday, March 20:** Rebecca Everett (Haverford College); 2:30pm, Room: Mendel G90

**Friday, April 3:** Michael Czahor (Phillies); 2:30pm, Room: Mendel 154

**Friday, April 17:** Rebecca Hubbard (Penn Medicine; UPenn); 2:30pm, Room: Driscoll 248

**Thursday, April 23:** Glenn Hurlbert (VCU); 2:30pm, Room: Mendel G88
Got Data Skills?

Are you interested in participating in an event with data from leaders in the industry provided specifically for you as part of an internationally organized competition? Are you interested in creating a community of data-focused students from the Greater Philadelphia area? Do you want to share your resume with employers looking to hire data scientists and statistical analysts?

Then DataFest Philly 2020 is for you!

Get involved in the data deluge and explosive growth in demand for data-savvy professionals!

Join us for an opportunity to win prizes, meet students from local schools interested in data, present to judges from local companies (who could be your future employer), and learn more about data science and statistics than you thought possible in one weekend. Free food will be served throughout the weekend event.

April 17-19, 2020

This year’s event will start with an introduction and the reveal of the data at 4pm on Friday, April 17th. It will culminate around 5pm on Sunday, April 19th after judging of presentation and awards.

Register by Friday, April 3, 2020

**Senior Spotlight**

**Emma Bernhard**

I am currently student teaching at Harriton High School. I teach and co-teach Algebra 2H, IB Applications and Interpretations SL, and IB Math Studies. My responsibilities and duties consist of creating engaging and interactive lessons, fair tests/quizzes, and activities that encourage critical thinking within mathematics. I am fortunate enough to spend the semester combining both my interests of education and math by helping students. I get to know my students and have the challenge of individualizing lessons and practice to my students in order to best assist them in their learning. Something I really enjoy about student teaching is that every day is different and every day the students are growing.

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**Spring Calendar**

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Become a fan of the Department of Mathematics and Statistics at Villanova University page on [Facebook](#).

Join the Villanova Mathematics and Statistics Alumni and Students group on [LinkedIn](#).
Villanova Math Club

The officers of Math Club are excited to welcome returning and new Math Club members! This year, Math Club is under new leadership:
Co-Presidents—Kellen Short and Saurabh Verma
Everyone is welcome to join Math Club - Math Majors and Minors, Liberal Arts and Sciences students, Business students, Engineering students, graduate students. **If you love math, are interested in it, need help with it, or simply want to meet new people**, then Math Club is the club for you!
Meetings will take place approximately every three weeks in the MLRC and will include snacks, discussions about classes and professors, as well as fun activities such as math-themed competitions. This year the Math Club is planning on organizing several events, for instance, a **professional development night, Quizzo nights, Teacher talks, Math in Movies night, Board game night, a T-shirt design contest, and more!**

Association for Women in Mathematics

Open to anyone interested in math, supporting women in math, or wanting to meet new people! Meetings are held approximately every 2 weeks. We have field trips, guest speakers, a mentor program, service opportunities and host a breakfast on reading day.
For more information please contact: amille91@villanova.edu

Mathematics Learning And Resource Center (MLRC)

Phone: (610) 519-MLRC (6572)
Check out our web page at  www.villanova.edu/mlrc for more MLRC info regarding Villanova math course, tutoring schedules, math links, and MLRC email.

**Location:** 204 Falvey Library

**Hours:** Sunday 6:30-9:00pm
Mon-Thurs 11:00am-5:00pm & 6:30-9:00pm

**Dates:** Jan 22—Feb 28
Mar 11—Apr 16
Apr 23—May 2
If you’re interested in becoming a tutor, email mlrc@villanova.edu

**Resources:**
Free Walk-In Tutorial Service
Free Appointment Tutorial Service (Appointments can be made at: www.villanova.mywconline.com)
Course Software Access and Support
Free Review Materials for:
To learn more about the MLRC, visit www.villanova.edu/mlrc
Dr. Peter Chi

My primary research area is a subfield of statistical genetics, known as phylogenetics. Phylogenetics is the study of evolutionary relationships between different species. Coming from a public health background (I received my Ph.D. in Biostatistics), the “species” of interest could be bacterial or viral, thus being relevant to questions of disease transmission and viability.

For reasons generally unknown, there is an unusually high concentration of internationally renowned researchers in phylogenetics residing in the country of New Zealand. Since becoming aware of this during my graduate studies, it has been one of my aims to try and visit there to collaborate with them at the earliest opportunity. I am grateful to Villanova University for assisting me in this by granting me my Spring 2020 sabbatical.

Specifically, at some point last year I reached out to Dr. David Bryant, at the University of Otago in Dunedin, NZ. Though we had never met before, he agreed to host me during this sabbatical. Together, we are working on new methods to analyze trait data on a phylogeny. That is, once the phylogeny is established via molecular genetic information (e.g. DNA or amino acid sequences), what does this tell us about the traits (physical or otherwise) that each species is expected to have? The primary hurdle of this question is its computational complexity, so our aim is to reduce that complexity without losing too much information.

Due to personal reasons, my visit to New Zealand had to be shorter than originally planned. Specifically, my wife is pregnant! We are now back in the U.S., having been away for about a month. But my collaboration with Dr. Bryant will continue until we publish at least one paper on our work together, and I also plan to finish a couple of other older projects during this sabbatical.

Dr. Douglas Norton

“What I Did on my Summer Vacation (except I haven’t done it yet and it won’t be summer...)”

Rather than simply the usual sabbatical short-term release from teaching for progress in research, I see mine (perhaps a bit melodramatically) as a chance to redefine myself professionally. After 16 years of focus on administration and teaching one course per semester, teaching three courses last fall certainly provided a challenge! I expect an equally challenging task in regaining some momentum on the research side. I hope to catch up on advances in my original neighborhood of research in dynamical systems, find one or more specific topics on which to focus in the area of mathematics and the arts, and add to my toolbox in the area of mathematics and the life sciences. I also hope to update my facility with software packages such as Maple/Mathematica, TeX, various dynamical systems software tools, and Finale. I plan to remain here with various conference and short-term visits rather than taking a semester or more in residence elsewhere. I will also be on sabbatical in fall 2020.
Dr. Klaus Volpert

I am broadly interested in the intersection of mathematics with finance and economics. During the sabbatical I am hoping to finish—or at least make progress on—the following projects:

- A textbook with the title: Financial Mathematics with Option Pricing: A Gentle Introduction. This is a write-up of the notes from the course MAT 4550, which I have taught for some years now.
- A paper with the title: The QRI Index and its Relation to other Metrics of Income Inequality
- A paper with the title: Taking Mr. Piketty to the Poor Man’s Banquet: On the overlooked Inequality between the poor and the middle class
- A paper with the title: The Kelly Criterion in the presence of a Maximum Payout

Sabbatical Spotlight

Fall 2020

Dr. Alan Gluchoff

I plan to use my sabbatical to complete my book on the contributions to World War I era ballistics theory made by Gilbert Ames Bliss, a mathematician from the University of Chicago. I also plan to delve more deeply into research begun about a year and a half ago regarding Carl G. Barth, a mathematically-oriented mechanical engineer associated with the Philadelphia-based Scientific Management movement of Frederick Taylor, circa 1900-1920. He did some interesting mathematics related to the then prominent steel industry in Philadelphia, particularly for lathes and other tools used in the industry. While he was quite well-known at the time, his name has faded over the years, though some recent historians have picked up on his story.

Dr. Bruce Pollack-Johnson

I have been approved for a sabbatical in the Fall of 2020. I plan to go to Genoa, Italy, for the semester, where I have some contacts at the University of Genoa. My wife (who is an Italian interpreter) and I plan to start with a 6-week intensive Italian course (to beef up my Italian conversation skills) in a program for non-Italians in that area. The rest of the time I plan to be working on ongoing research projects: (1) on incorporating quality as a variable in project scheduling, especially under uncertainty, and (2) on why school districts in PA that are funded by the state at a level higher than the Fair Funding Formula level actually have fewer students who enroll in postsecondary education (university, college, community college, or trade school) than those who are funded at that level (this research came out of a project by Mary Frances Wenig in the last iteration of the Math & Social Justice Seminar, in 2018). I will also be following ideas and leads from a new book by the MAA about Math and Social Justice to see what I might add to my Math of Fairness class or to my Math and Social Justice Seminar, to be offered in the Spring of 2021. I will similarly be going through a document from the MAA about suggestions related to diversity, equity, and inclusion in mathematics classes and departments, in part because of my role as co-chair of our department’s Diversity, Equity, and Inclusion Committee.
To All Students: Set up an appointment to meet with your advisor to prepare for registration.

Preparing for Registration

Meet with your Academic Advisor:

Discuss your course options for next semester
Receive your Registration PIN (a.k.a. Alternate PIN)

Registration PIN:

Save it to your phone or email
Changes each semester

Spring Registration PINs begin: sp _ _ _ _ (four random numbers)
Fall Registration PINs begin: fa _ _ _ _ (four random numbers)
Take the time to test your PIN before your registration time begins

How to “Test” your PIN: Go to your Student tab -> My Schedule and Registration -> Login to Register --> Select the appropriate term --> type your PIN

If you enter the correct PIN, the system display your registration time appointment
If you enter an incorrect PIN, you will receive an error message: Authorization Failure – Invalid Alternate PIN
If you feel you have the incorrect PIN, contact your Advisor or your Advising Center

Note: The system is “case sensitive.” The letters are lower case.

Check your Registration Status link will display the following:

Date and time you can begin registering and the date and time online registration ends.
An alert if you have Holds on your account which will prevent registration
Link to View Holds is at the bottom of the screen
Your Academic Standing
Your Student Status
Your Class for registration (example: Sophomore class will not permit registration into courses restricted to Juniors and Seniors only)
In Memoriam — Dr. David Sprows

“Dr. David Sprows long aspired to live the line in the Villanova Alma Mater: “When the oldest pedagogue has had the final word.” As he retires this year, he has reached one version of that claim: he is not the oldest, but for a while, he is the pedagogue with the longest service: 57 years of teaching at Villanova! He did his undergraduate studies at West Chester University and then taught at Villanova while completing his master’s degree here and his Ph.D. at the University of Pennsylvania in topology. He learned at Penn what he has shared with his students for decades: that there is no topological distinction between a doughnut and a teacup. He was nominated many times for the Lindback Teaching Award over the years and was awarded the James P. Crawford Teaching Award by the Eastern Pennsylvania and Delaware section of the Mathematical Association of America in 1993. He was a serious participant in the student/faculty softball game and faculty tennis. On a Sunday morning when he and Fritz Hartmann were the only people on the tennis court, they finished play, got in their cars, and backed into each other. So much for probabilities! We celebrate his improbable status as the oldest pedagogue among us and await his final word to us.”

The words above were written by Dr. Fritz Hartmann & Dr. Douglas Norton as Dr. Dave Sprows prepared for his retirement in May 2019. Unfortunately, Dave’s pancreatic cancer returned shortly into his retirement. Dave passed away on November 19, 2019 at the age of 80. We have attached his obituary for you, [https://www.donohuefuneralhome.com/obituary/David-Sprows](https://www.donohuefuneralhome.com/obituary/David-Sprows). Dr. Sprows lived a wonderful life and Villanova University was such an instrumental part of it. The Department of Mathematics and Statistics is grateful for the life of Dr. David Joseph Sprows and for the years of service he gave Villanova. Rest in Peace, Dr. Sprows. You will be greatly missed.