Mathematical Sciences

UNIVERSITY OF MONTANA
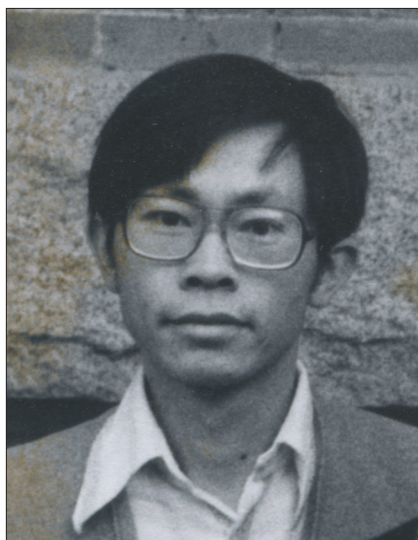**COLLEGE OF HUMANITIES & SCIENCES**

SPRING 2024

An Incredible Journey

By John Bardsley

Fat Lam as a TA at UM in 1980

Fat Lam, PhD '87, began his life in China, spending his school years and youth in Hong Kong, where his family had moved when he was a child to escape the communist government in China. Fat was an exceptional student, graduating at the top of his elementary school class. However, tragedy struck him and his family, when Fat began to go deaf at the age of 10, then his father died one year later. Despite his disability and his father's death, Fat finished grade school at the age of 13 at the top of his class, but he had to then quit school in order to work – first as a tailor and then as a carpenter – to support his family.

During his teen years, Fat studied at night, eventually working his way through a collection of high school books given to him by a friend, while also reading such novels as War and Peace. After six years as a carpenter, he was looking through a catalog of American Universities at the U.S. Embassy in Hong Kong when he discovered Gallaudet University in Washington, DC, which is entirely devoted to educating deaf students. Fat passed the entrance exam at Gallaudet, was accepted, and received financial support to attend from the Lutheran World Federation.

Professor Lam left for the U.S. when he was 21 years old, beginning at Gallaudet University in the fall of 1968.

A Tale of Two Students

By Jon Graham

Last summer, one of our stellar undergraduate math majors, **Mary Catlett**, participated in an internship with Neptune and Company, an environmental consulting and decision-making company using statistics and data science to conduct environmental modelling and risk assessment. Discussing Mary's work at Neptune, updating a probabilistic

Mary Catlett

performance assessment model for contaminant transfer through the environment, would be an interesting article on its own, but there is more to this internship experience that requires a look back about 25 years.

When I came to the University of Montana in 1995, the first course I taught was a mathematical statistics course with a handful of upper level undergraduate and beginning graduate students. One of those students was one of the most eternally happy people I have ever met who always had a big smile on his face, **Paul Duffy**, my first master's student in the department. A Bertha Morton Scholarship recipient, Paul earned his master's degree in statistics in the spring of 1998 and began working for Neptune in Los Alamos, NM. He was fortunate enough to have a joint fire science program proposal funded and transitioned this into his PhD work under Dr. Scott Rupp at the University of Alaska Fairbanks through an interdisciplinary statistics and forest ecology program. He used a spatially

Notes from the Chair

By John Bardsley

Another academic year has come to a close. It feels like it has been an extraordinary year, yet when I look back on it now, it looks like just another year in the Math Department. If both are true (and I think they are), then I guess every year in the Math Department at UM is extraordinary!

First, Professor Jon Graham received the Tom Boone Town and Gown Award from UM in May. The award recognizes UM faculty who foster a deeper understanding between UM and Missoula, and it was given for Jon's 17 years as a MATHCOUNTS coach.

One thing that marks most years is the absence of our colleagues who are on sabbatical. We miss interacting with them. Last year there were four who were away: Eric Chesebro, Kelly McKinney, Fred Peck, and Emily Stone. All four of them traveled widely, and we look forward to having them back in the department, refreshed from their sabbatical year.

Three of our faculty will be away on sabbatical next year: Elizabeth Gillaspy, Javier Pérez-Álvaro, and Ke Wu. Elizabeth and Javier welcomed a baby into their family in December and have been on family leave this spring. Congratulations to them! They will spend their sabbatical year in Spain, near Madrid, where Javier is from. They will both collaborate with colleagues at the University Carlos III Madrid, where Javier got his PhD. Ke Wu will be busy with her collaborative work with tribal colleges throughout Montana and the region, and she will visit several southeast Asian countries (including her home country, China) in Spring 2025.

We have had a very productive year in terms of PhD student production. Van Magnan will graduate in May with his PhD in discrete mathematics under the direction of Cory Palmer. Ryan Wood will graduate with his PhD in discrete mathematics under the direction of Mark Kayll and Cory Palmer. Both Van and Ryan appear in Cory's article (see the last page) on the second annual Pi Day Math Marathon Lecture. Additionally, José Martinez will graduate with his PhD in topology under the direction of Eric Chesebro.

We received some good news about coming renovations in the Math Building. Facilities Services plans to renovate several of our rooms: the Math Learning Center, the Student Lounge, and our two computer labs in Rooms 206 and 306. It's looking likely that Room 206 will be turned into graduate student offices/cubicles, which will allow us to move the remainder of our graduate students from Corbin Hall into the Math Building.

We will lose, to retirement, one of our long-time faculty members, Dr. Regina Souza. Her expert stewardship of our College Algebra/Trigonometry/Pre-Calculus courses over the course of many years will be missed, but we wish her well in her retirement. Regina plans to travel extensively, to visit her children here in the U.S., her family in her home country of Brazil, and beyond.

Two of our emeritus faculty passed away during the past year, both were born in 1939. First, we lost Don Loftsgaarden in October. He was Chair of our department for many years. We then lost Keith Yale last January. Both were giants of our department.

These transitions remind me that we faculty are only stewards of the department, passing it eventually on to the next generation, hopefully in as good a shape as we got it.

Finally, I would like to thank those of you who have donated to our department over the past year. In an era of increasing budgetary restrictions, we depend more and more on your donations. One thing we have been able to maintain – unlike most departments on campus and thanks to our donors – is a travel allotment for faculty, so that we are able to attend conferences and visit collaborators, keeping our research programs going. For a more exhaustive list of what we do with your donations, see page 6.

Best wishes to you all. Have a great summer, and please don't hesitate to reach out if you are so inclined.

Tale of Two Students **(continued from page 1)**
explicit simulation model called the Alaska Frame Based Ecosystem Code (ALFRESCO) and drove it with different projections of future climate change from the Intergovernmental Panel on Climate Change (IPCC) and with different representative concentration pathways that reflect human development out to 2100. Upon completion of his PhD, he moved to Fort Collins, CO, and began working for Neptune again, transitioning to full-time around 2006.

Math Teachers' Circles in Montana

By Ke Wu

Math Teachers' Circles (MTCs) bring K-12 math teachers and mathematicians together for mathematical discovery and fun around mathematics. Initially founded in California by the American Institute of Mathematics in 2006, MTCs have gained popularity rapidly in the United States. Through regular meetings they build, connect, and support local communities for the enjoyment of mathematics.

Starting in 2011, math department faculty members Fred Peck, Matt Roscoe, and Ke Wu together with now-retired College of Education faculty member David Erickson have worked closely with math teachers such as Nick Grener (former math teacher at Hellgate High School in Missoula), Jennifer Hudson (math teacher at Billings High School), and Polly Dupuis (math faculty from Salish Kootenai College) to initiate and support local MTCs in Montana.

Montana MTCs have had meetings at 9 locations – Anaconda/Butte, Billings, Bozeman, Great Falls, Harve/Hi Line, Helena, Lame Deer, Missoula Valley, and Missoula. Fred Peck is leading the organization and communication of MTCs in Montana. Below is a picture of the Missoula gathering at Imagine Nation Brewing, where participants gather, grab a drink and do math together!

Some MTCs work on traditional math problems. For example: *Find all the ways to arrange four points so that only two distances occur between any two points*.

In recently years, our team has developed a unique and novel way to run a math circle where problems are developed by participants based on mathematizing an object or activity. An example is math discovery through playing the game of Tenzi. Here is one way how the game can be played: In a small group of players, everyone gets ten dice. One person says, "Go." Then everyone rolls and rolls as fast as they can until someone gets all their dice on the same number and shouts "TENZI." This game is so fast and a frenzy! At our MTC, participants played the game and then developed a bunch of questions, including this super interesting one, and spent the rest of the meeting time investigating the questions:

Say you roll 2 sets of three. Is it better to set both aside and make a decision after the next role, or just set one aside and go with it, or roll all 10 dice again? What about 2 sets of two, or 3 sets of 2?

In addition to the regular local MTC meetings, annual statewide summer retreats for MTC participants have been held since 2016. Above is a picture of participants playing "Building the City of Numbers" to collectively find the prime factorizations of each whole number 1-100 as a tower of blocks on a 10-by-10 grid with each block representing a prime. This game was created by our faculty member Matt Roscoe and earned him a national Rosenthal Prize for Innovation and Inspiration in Math Teaching! ❖
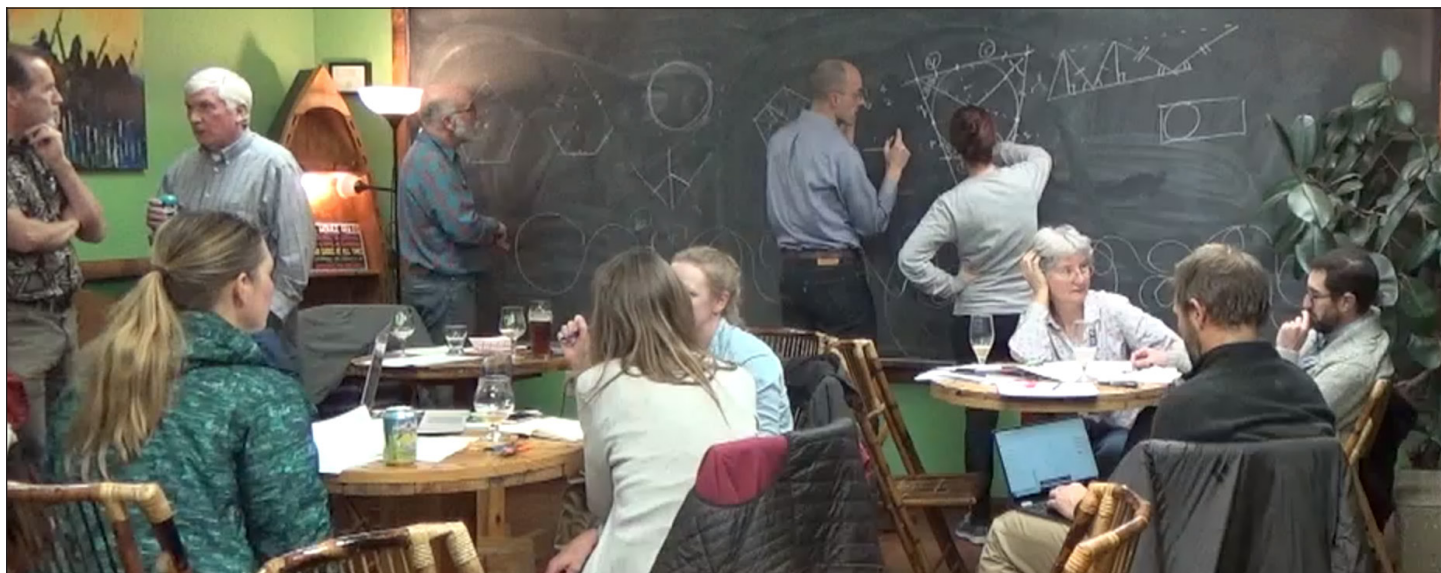
Don Loftsgaarden 1939–2023

We are sad to report that Emeritus Professor Don Loftsgaarden passed away on October 29, 2023. Professor Loftsgaarden earned his Ph.D. in 1964 at Montana State College (the year before it was renamed Montana State University). He then taught for a year at MSU and two years at Western Michigan University before joining the mathematics department at the University of Montana in 1967. He served on our faculty for 32 years until his retirement in 1999. During this time he served twice as chair, 1977-1978 and 1991-1995. He received the university's Academic Administrator Award in 1995 for his hard work and effective leadership. Throughout his career, he collaborated and consulted with students and faculty from numerous departments at UM, as well as with regional and national organizations. You can learn more about Professor Loftsgaarden from his obituary and from an article in the Fall 1999 newsletter.

Fat Lam (continued from page 1)

He took 21 credits per semester while working 20+ hours per week in order to continue to help his mother in Hong Kong. He finished his Bachelor's degree in 1971 after only three years and was then asked to teach in the Mathematics Department which he did while working on his Master's degree at George Washington University.

A recent Photo of Fat Lam

After receiving his Master's degree in 1974, he entered the PhD program in Mathematics at the University of Montana (UM). He chose to pursue his PhD in our department because we offered him a teaching assistantship, and because at the time he had a Japanese friend living in Missoula. Upon arriving, he was struck by the fact that the Math Department had its own building, which was not the case at Gallaudet or George Washington Universities. Fat's PhD advisor at UM was Prof. Hien Nguyen, who he said, "had the greatest impact on me." He noted that Prof. Nguyen was very unpretentious, despite the fact that he had a consulting business that eventually became Edulog, a company which continues to thrive and for which he remains the CEO. Fat also said that "the most striking professor, with a lasting impression on me was Professor William Myers." As for his five years in Missoula and at UM, Fat said, "Ah, my experience there! Unforgettable! The campus is at a foothills, beautiful! During summer, flowers bloom, almost everywhere. No wonder it is called the Garden City."

Also of note is Professor Lam's experience as a deaf student in the 1970s at UM: "Nowadays, deaf students attending colleges are provided with sign language interpreters, courtesy of Americans with Disabilities Act (ADA), enacted into law by President Bush in 1990. Back in my time, there was no such thing. When lectures were delivered by talking, I just read my book. When fellow classmates asked questions, I missed the fine points. Students learn more by listening to answers to questions raised in classes. What could I do, complain? Unheard of. Probably blame myself."

Prof. Lam returned to Gallaudet University in 1981 to teach full time and write his dissertation part time, eventually receiving his PhD from UM in Mathematics in 1987, when he also obtained tenure at Gallaudet University. Particularly noteworthy is that Professor Lam was the first deaf person from China (and the third from Asia) to obtain a PhD, according to the Gallaudet University Library Guide to Deaf Biographies.

At this point, Professor Lam moved rapidly up the ranks of faculty at Gallaudet University, becoming a Full Professor in 1994 and then Chairman of the Mathematics and Computer Science Department from 2001 until 2007. He retired from Gallaudet University in 2014 and is now a Professor Emeritus. In his retirement, he is raising his two children, a seventeen-year-old son Ching-Wah and an eleven-year-old daughter Ching-Lin.

Professor Fat Lam's story is incredible and inspiring, from poverty in Hong Kong, to facing a disability, to obtaining a PhD in Mathematics, and finally, becoming the Chairman of the Mathematics and Computer Science Department at Gallaudet University.   ❖

Tale of Two Students (continued from page 2)

Paul worked as the lead statistician on a number of projects funded through competitive grants from NSF and NASA and did a fair amount of consulting work for the National Ecological Observatory Network (NEON). Due to his integration into virtually all components of the company, Paul moved into the role of Vice-President at Neptune about 5 years ago, and is now the Practice Area Lead for the Statistics and Decision Analysis Practice Area. In this

Keith Yale 1939–2024

We are sad to report that Emeritus Professor Keith Yale passed away on January 16, 2024. Professor Yale had been an undergraduate student at UM, taking classes from former math faculty such as Joe Hashisaki, Fred Young, Wayne Cowell, Bill Meyers, Bill Ballard, Howard Reinhardt, and Harold Chatland. After his graduation in 1960, he went on to earn his Ph.D. at the University of California at Berkely in 1966. He returned to UM in 1967 as an assistant professor, and retired in 2001, after 34 years of service. Over his career, he had three Ph.D. students, one of whom, Greg St. George, also became a faculty member in the math department. Professor Yale chaired the math department from 1984 to 1987. During this time, he led a successful fight to save the Ph.D. program from proposed elimination by the Board of Regents. You can learn more about Professor Yale from his obituary and from an article in the Spring 2001 newsletter.

Tale of Two Students **(continued from page 4)**

role, he manages workflow for a group of 18 statisticians and helps align appropriate expertise with project needs. When I asked him to tell me about his work at Neptune, he replied: "One of the things that Neptune has built our reputation on is radiological probabilistic performance assessment (PPA). There are radioactive waste disposal facilities at various locations across the country. We build models that depict the transport of those radionuclides through space and time. We couple the output from those models to a dose assessment which makes assumptions about how people will be using the land in the future."

Fast forward about 25 years to the present, I found myself teaching that same mathematical statistics course with a number of very strong students including Mary Catlett. Mary is from Bozeman, is a Presidential Scholar in the Honors College and is currently a junior double-majoring in mathematics and physics. When asked why she came to UM and why she decided to study math, she credited one of the astronomers in the physics department for visiting her high school and opening her eyes to opportunities in physics, and commented that "Math is just something that I've always loved. My mom has 2 math degrees; when Becky [Mary's twin sister] and I were young, it was just a lot of math problems sitting at the kitchen table." Well done, Mom! Having taken a lot of math and physics at UM, Mary has indicated a preference for statistics and data science.

During Mary's internship experience at Neptune in Fort Collins, she began by learning about some specialized modelling software called GoldSim, a probabilistic difference equation solver used to develop probabilistic performance assessment models used for contaminant transport. Her mom, Katie, is the senior GoldSim modeler at Neptune. Mary initially did a lot of model checking and updating for a PPA model to give an overview on a generic radioactive waste disposal site. Specifically, she updated the model radionuclide list and dose conversion factors in

Paul Duffy, MA 1998

Python, and used updated solubilities as inputs for the stochastic modeling element of GoldSim. The PPA model used is a dynamical advection-diffusion model and Mary mentioned how she had gained a familiar understanding of how they worked from Dr. Emily Stone's differential equations class. In talking to her mom about modeling, her mom mentioned that while some of the people she worked with said they didn't like their math classes, "it's so important to understand the math behind the modeling." In addition to updating the PPA model, Mary communicated to others how radionuclide contaminants move through the environment in the model, and how these contaminants will likely impact someone living on a site with radioactive waste thousands of years from now.

Upon graduation from UM in the spring of 2025, Mary plans either to begin her graduate studies or perhaps take a year to work in a national lab. She is very interested in a career centered around climate modeling and has looked into programs such as the Atmospheric and Oceanic Sciences program at UC-Boulder. With her dual background in physics and math, her interest in climate science, and her clear mathematics abilities, I have no doubt that she will be successful in whatever path she takes, perhaps following in the footsteps of Paul, that first student I encountered in my first class I taught back in 1995. ❖

Pi Day Marathon (continued from back cover)

Larry Shaw in 1988 in San Francisco. Pi Day has been recognized by the US House of Representatives and UNESCO. The International Mathematical Union—the organization that awards the Fields Medal—pegs the day as the *International Day of Mathematics*.

This year in the Math Department, I decided to run a little event of our own. Starting at 10 AM on March 14 we began a nonstop 24-hour lecture of an entire introductory discrete math course. This math marathon took place in the Math Building and was broadcast live online.

The 24 hours of lecture were split between me, my two current PhD students Van Magnan and Ryan Wood and former PhD student (and current Iowa State postdoc) Anna Halfpap who flew back to Missoula during her spring break to participate.

Our lecture followed a 250-slide Beamer deck—the mathematician's PowerPoint—that we constructed for the event. We broke the course material into eight 3-hour blocks: pigeonhole principle, counting, binomial coefficients, graph theory, (extremal) set theory, induction, recurrence relations, and probability.

We decided to cover discrete math since it is the introductory content to our own research discipline of extremal combinatorics. Moreover, the subject is less familiar but particularly accessible to a non-mathematician audience. Finally, discrete math is often more problem-based than theory-based which we felt was especially suitable in this format.

In order to create a quality hybrid lecture we checked out most of the necessary AV and lighting equipment from UM's well-stocked library. Our experience teaching over Zoom during the pandemic taught us the importance of quality audio and video for producing mathematical content. In order to test all the equipment and make all the tech work correctly we ran two mini practice lectures in the days leading up to the event. We broadcast the event on the live-streaming service Twitch.tv. This platform is focused mostly on video game content, but today it hosts all manner of live content. We decided that the only thing it was missing was mathematics!

This was the second year we ran this event. This year we decided to include some more sophisticated material and feature some of the classic theorems from our discipline. Some highlights from the event included: Ryan's presentation of the Katona cycle method proof of the Erdős-Ko-Rado theorem, Zykov's symmetrization proof of Turán's theorem by Van, an analysis of several probabilistic "paradoxes" by Anna, and my delirious and sleep-deprived proof of Van der Waerden's theorem to close out the marathon.

We had two main inspirations for this event. The first were charity telethon events. The second was the natural extension of shortened summer and winter sessions where an entire semester might be delivered in a 6-week period. How compact could you make an entire semester? When you strip away exams, recaps, in-class discussion, etc, a semester of 50-minute lectures nearly fits into a 24-hour block. This isn't to say this is an ideal mode of course delivery, but it is an interesting thought experiment and fun challenge.

The online broadcast was viewed (voluntarily!) live by 340 people. I know of at least one instance where it was shown in a high school classroom and several parents who watched with their kids. Over 30 people visited in-person over the course of the event. Including some very loyal students of mine during the late late hours of the night from 3 to 7 AM!

Next year Pi Day falls on a Friday. This means we'll celebrate all Friday into Saturday morning. We hope you'll join us!   ❖

Donations to the Math Department

We always enjoyed acknowledging your donations in the Honor Roll of Donors, which had been a regular feature in this newsletter for decades. But last spring, the University of Montana Foundation advised us against including it in future newsletters, to protect the privacy of donors who have not given explicit permission to recognize them.

While we can no longer list you by name, we still thank you for your generous support!

In addition to funding scholarships and awards for our students, donations have made many other important things possible over the past year: undergraduate summer research, research-related travel by faculty, graduate students, and visiting speakers, occasional community-building lunches for graduate students and faculty, Colloquium talks, our Department Picnics at the beginning and end of the academic year, publishing and mailing this newsletter, a 24-hour marathon lecture on Pi Day, and more! We are grateful for your support – we couldn't have done it without you!

To donate online, please visit https://supportum.org/give/. Please specify in the Comments box that the donation is for the Dept. of Mathematical Sciences. For information on other ways to give, please contact our new Development Director, Kristiana Nelsen, at 406-243-2646 (she starts at UM on May 20).

Degree Recipients 2023-2024

Bachelor Degrees

Rebecca Elise Bryan	Jelisa Jean Holmquist	Luke Mathias McShane
Cooper J. Craig	Kasidy Love	Aspen J. Morgan
Vivian Cummins	Ethan Alexander Lowe	Erin Szalda-Petree
Nathan O. Hanlon	Megan Maggard	Amy Weatherbee

MA in Mathematics

Breille Duncan · Jethro Thorne

MA in Teaching School Mathematics

Dorcella Eastman · Nicole Kelly

MS in Data Science

Jackson Nakae

PhD in Mathematics

Van Magnan — Advisor: Cory Palmer
Forbidden Substructure Problems in Graphs and Hypergraphs

José Martinez — Advisor: Eric Chesebro
Farey Recursion and Hyperbolic Dehn Filling

Ryan Wood — Advisors: Mark Kayll and Cory Palmer
The Flower Base in Full Bloom: Intersecting Families and a Generalization of Diversity

Spring 2024 Scholarships & Awards

Made possible by our generous donors - Thank you very much!

Joseph Hashisaki Memorial Scholarship

William Myers Mathematics Scholarships (2)

The Adams Scholarships (2)

Anderson Mathematics Scholarship

Gloria C. Hewitt Graduate Scholarship in Mathematical Sciences

William R. Derrick Mathematical Sciences Endowed Scholarship

Graduate Student Distinguished Teaching Awards** (3)

Mac Johnson Family Scholarships (3)

Graduate Student Summer Research Awards** (3)

Carolyn and Johnny Lott Elementary Education Scholarship

N. J. Lennes Competition Awards (3)

Merle Manis Award

John A. Peterson Mathematics Education Award

George F. Votruba Memorial Scholarship

Undergraduate Teaching Scholar Award*

President's Outstanding Student Awards (2)
(from the President's Office)

Undergraduate Tutorial Scholar Awards* (2)

Starred awards are funded primarily (*) or completely (**) by the George and Dorothy Bryan Endowment.
Because of privacy considerations, we no longer publish the names of the scholarship and award winners.

Pi Day Math Marathon Lecture
By Cory Palmer

The famous irrational number π has fascinated mathematicians for thousands of years. The ancient Egyptians and Babylonians approximated it within 1% of its actual value. In the 1760s, Swiss polymath Johann Heinrich Lambert first proved that π is irrational (i.e., it cannot be written as a fraction of integers). Even today π maintains its mystery—is π *normal*? That is, do all digits 0-9 appear with the same density 1/10 among the decimal expansion of π?

March 14th has become known as Pi Day as its date notation 3/14 includes, in order, the first three significant digits of π. The origins of this celebration are folklore, but the first known Pi Day event was organized by physicist

Pi Day speakers Cory Palmer, Anna Halfpap, Ryan Wood and Van Magnan

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