



A Statistical Verification of a Consiricy

Ian Jorquera

What makes someone back-in when they park in a parking spot? For me I simply could not be bothered to spend the time and mental energy to back-in when parking. So what drives those who do? And what type of person chooses to back-in given the chance?

I have personally noticed that one particular group of people who tend to back-in quite regularly are those who drive pickup trucks. Until recently, I had nothing more than my intuition and my keen sense of perception to justify this, which is what lead me to write this piece.

While writing and collecting data for this piece the authors become aware of a recent piece in the New York Times titled "Do You Back Into a Parking Spot or Back Out?" Much like this piece, they explore the often under-looked "ideological division" of backing-in or backing-out of a parking spot. The authors much like our selves speculate that a predominant reason for backing-in is for a quick escape: either from possible treats, from a grueling job, or just for the convenience of leaving more quickly. One interviewee believed that backing-in is "mostly men showing off ... and it seemed ... that a disproportionate number of them drove big American work trucks." Although the same NYT article claims that such a habit "didn't seem to be shaped by gender or car make," our research seems to agree more with this interviewee and disagrees with the conclusions of the NYT piece.

Research Methodology

In this study we have limited our data collection to only two section of one parking lot: the eastern most row of the Weber lot and and the eastern most row from

the adjacent engineering lot (data from the engineering lot was collected significantly less frequently). These include a few parking spots near the TILT building, handicap and non-handicap, but mostly those reserved for visiteres and students, in hopes of getting a greater diversity of parkers. We have picked these sections as there is no possibility of confusing pull-through parking, as back-in parking, as each section was on the edge of the lots. These spots were also chosen as they were not diagonal parking spots which we believe may have a smaller portion of drivers backing in. We also believed we would see a higher variety of vehicles from a wider range of places, parking for longer durations in the visitor area. To prevent any over counting, seeing the same vehicle on different days, we collected the date parked, the license plate number, whether a vehicle was a car or truck, and if they backed-in or not. The distinction between a car and truck is admitted vague, as some larger SUVs such as the Ford excursion, are in many ways indistinguishable from pick-up trucks, except they lack the open bed. Therefore a vehicle was to be considered a pick up truck if the frame had an open cargo bed, and so a topper, did no preclude a vehicle from being considered a truck.

Over the span of a month, between January 28th and February 26th we have collected 230 data points, with 173 distinct vehicles with license plates from a total of 24 states. Of these distinct vehicles, we noticed that the decision for a vehicle to back-in or not, was not always consistent. One car for example, which we saw a total of 7 times, backed in only 4 of those times. To attempt to account for this, we decided to log each vehicle once based on their more dominant

behavior. These indecisive vehicles were rare: only 2 vehicles were seen unable to make up their minds between different days.

Statistical Results

The following table highlights the overall results of the 173 distinct vehicles seen.

	Car	Truck	All
Backed-In	24	10	34
Forward Parked	134	5	139
Percent Backed-In	15.190%	66.667%	19.653%

To better understand our data we modeled our results with three binomial distributions, for cars backing-in, for trucks backing-in and for all vehicles backing-in based on the number of distinct vehicles of each type seen, and the observed probability of backing-in. To test our hypothesis H_A , that pick-up trucks back-in at a higher rate to cars, we compared it with a null hypothesis H_0 : that the probability that pick-up trucks back-in is equal to the probability that a car backs-in. In doing so we computed a z -score of

$$z = \frac{\hat{p}_t - \hat{p}_c}{\sqrt{\hat{p}(1 - \hat{p})\left(\frac{1}{n_t} + \frac{1}{n_c}\right)}} = 4.795$$

where \hat{p}_t and \hat{p}_c represent the proportion of observed back-ins for trucks and cars respectively, $\hat{p} = \frac{n_t\hat{p}_t + n_c\hat{p}_c}{n_t + n_c}$ and n_t and n_c the number of trucks and cars seen. Performing a right sided z -test, comparing the computed z -score with a critical value of $z_{0.99} = 2.33$, corresponding to testing this hypothesis at a confidence level of 99% we find that the z -score is large enough to reject the null hypothesis, meaning there is evidence to suggest that pick-up trucks back-in at a higher rate.

Conclusions

So do truck drivers back-in more often? Our results strongly suggest that they do, but more data should be collected to strengthen these results and to ascertain a more accurate estimate on the rate in which pick-up trucks back in. Equally as important is why? Why are pick-up

trucks more likely to back-in? Is it for the convenience of a quick departure? So that the bed doesn't stick out as far? A case of exhibitionism? Or to fit into the identity of a pick-up driver? We may never know for sure with out addition physiological studies. And is this trend just with trucks and their drivers? While collecting our data, we had noticed that a similar trend may exist amongst driver of muscle cars such as the Dodge challenger, or the Subaru WRX. These could also serve as directions of future research to better understand this behavior.

SIAM Students Visit NCAR in Boulder

Kristina Moen



On February 5th, student members of the Society for Industrial and Applied Mathematics (SIAM) stepped inside one of the nation's premier hubs for atmospheric science: the National Center for Atmospheric Research (NCAR) in Boulder. Organized by the SIAM student chapters of CSU and CU Boulder, the daylong visit brought together graduate students from both institutions to explore how mathematics informs contemporary atmospheric science and learn about the role of national research centers in sustaining long-term scientific infrastructure.

They met at NCAR's iconic Mesa Laboratory, which is set against the Boulder Flatirons. Designed in 1961 by architect I.M. Pei, the building seems to rise from the sandstone cliffs and is a testament to the interplay of science and environment. Inside, researchers work across fields ranging from meteorology and

atmospheric chemistry to solar and space weather.

The day began with a seminar on sea ice modeling led by Christopher Horvat of Brown University and joined by visiting researchers from the Polar Climate and Ocean Modeling Working Group. The discussion moved between mathematical theory, numerical computation, and real-world data, offering students a clear example of how mathematicians and atmospheric scientists collaborate to understand polar processes.

Following the seminar, students had lunch in NCAR's Mesa Cafe, which provided informal time for conversation with NCAR scientists about career paths, interdisciplinary collaboration, and the practical realities of working at a national research center.

In the afternoon, tropical weather researcher Quinton Lawton led a behind-the-scenes tour. In addition to serving at NCAR's primary research facility, the Mesa Laboratory also houses a public Visitor Center with hands-on exhibits on cloud physics, hurricane dynamics, Sun-Earth connections, and weather impacts on aviation and emergency

response. Students touched a cloud, stepped into a simulated tornado vortex, and explored how severe winds influence aircraft performance during takeoff and landing.

The timing of the visit was especially meaningful, as NCAR's funding has faced recent scrutiny, underscoring the importance of public understanding and support for foundational atmospheric research. Several students said that they hadn't realized how deeply mathematics shapes the tools used in disaster forecasting, policy decisions, and societal resilience to severe weather events.

Next up: A visit to CSU Energy Institute's Powerhouse Campus on March 5th (now passed). Following the tour, CSU and CU Boulder students are invited to a special IDA seminar on mathematical modeling of methane emissions with Energy Institute mathematician and CSU alum Michael Moy.

On March 7th (now passed), the SIAM chapters of Colorado will host the 22nd Front Range Applied Mathematics Student Conference in Denver. All are invited to register.

Things that happened to me and how I "solved" them

José Ignacio Rojas Rojas

I've seen some people run into issues that I've run into before. This prompted me to write about how I've overcome such situations, what I did, and some observations on the nature of such things.

The morning of February the 13th, a Friday of course, but a Friday morning after the common exams for Calculus 1, 2 and 3, I went in to teach my section of Differential Equations. I came to the long hallway of the Engineering E building and face all my students waiting, leaning against the wall, of course, none of them are talking to each other. I grin in confusion as I walk when one of my students who sits in the first row shouts at me from the other side of the hallway: *It's closed!* To which I reply

by stopping, and before even reaching the classroom, I just say: *I'll be back in a second!*

It was already past 8 a.m. basically 8:03. This was already too late! Alas, I went back to the math building and the first person I thought of to address my predicament was Hayden. Even if he couldn't help me open the room in Engineering, we went upstairs and checked 202. There was apparently no one there so we went through with the plan and I went back to Engineering to bring my kiddos to our home turf. Refreshing as it was to teach in our building, it was a bit stressful to do the back and forth with the uncertainty. But hey, we did it, even if the class started late that day.

In this case, this wasn't a huge problem. There was an easy solution at hand, but if I hadn't found an open classroom, I would've just looked for the nearest open classroom and hoped for the best. Also, can't forget sending an announcement on Canvas to let the stray kids know that we've moved classes.

Still related to the issues in teaching, most of the moments I get to teach, I feel confident! I've learned this material at a past moment in life and I'm ready to reproduce it in front of my kids. There's times however when a certain example may cross our paths or perhaps we thought ourselves better prepared than we actually were. Both of these situations happened to me this semester. For the first case let me tell you, coming from a place where we use the international system of units, I didn't know pounds were a unit of *weight* instead of *mass*. My cues for the latter were: the gym plates have pounds written on them, you can buy pounds of beef in the supermarket, and so on. Albeit, those cues could also correspond for weight, but who uses weight as a measurement instead of mass? Well I got the answer way too soon. Without regards to this, I was working on an example about a spring in front of my class. The problem read

Consider a spring of 4 lb...

So I wrote in my ODE $4\ddot{x}$...I eventually read the answer and apparently the coefficient is $1/8$ instead of 4. There was no indication whatsoever of what I did wrong, I reread the problem and was having issues with that for like 5 minutes in front of my class. Eventually kiddos realized what the issue is and gladly explain to me that it's $4/32$ where 32 is the acceleration due to gravity. There was no way I could've understood that, but I dismissed a comment on the example where it read something like w/g ... because I was already thinking about mass.

In a similar fashion I got lost with the *guesses* one has to do when creating the particular solution when using the method of undetermined coefficients. I must admit

to you, I didn't learn that topic well enough and tripped myself once again in front of my kids.

There are two key takeaways from this story: First that one should prepare oneself better so that such mistakes can be reduced to the minimum. And second, my kids did well enough on the exam so that I can appreciate that even if I make mistakes, it is my kids who should shine in the class (as in their work) and not me. Of course, me being a good teacher helps, but ultimately kids will find a way.

The last topic I mean to talk about was a question that assailed us at some point starting last year. I can still recall sitting down in one of the last rows in a small room in the student center when Dr. Soto was explaining to us the first changes to the budget and how things in the department might change. That was the first time I heard about the *tokens*. I always wondered what the business with the tokens was:

1. What was a token?
2. How did the lack of tokens affect us as graduate students? Who was losing the tokens?
3. What was the deal about token = 9 credits?
4. Were tokens a 3D printed green-plastic ram logo which human resources people handed out to each department?

As you can guess by my questions, I was severely uninstructed in the matter. After a couple of meetings with our department, I didn't feel as informed as I wished. I still wanted to know about the tokens.

My search started in the most obvious of places, the human resources building. It's a far removed building outside the main campus of the university. It's just a bit north of Mugs on the same Howes street. Inside the building you can go to the 3rd floor to the human resources office and greet a couple of secretaries who, to my luck, spoke Spanish. They kindly answered me that they also didn't know what a token was

and had no idea what I was talking about. So they pointed me to the next obvious step. Speaking with someone more local. They gave me the contact information of the HR liaison in the CNS and sent me off with the best of luck. I believe that information was valuable, but I thought of speaking with someone more locally.

It was after 3 p.m. so Krysta was to be found in the physics department. I bumped into her office and asked her a couple of questions about the tokens. Very kindly she answered to me that tokens were units of money used to pay tuition. This amount of money comes from the university's budget and not from the department and the situation is that fiscalization of such money wasn't done very meticulously before but now it is. The situation is not a lack or shortage of tokens, but rather increased monitoring of them. Then the potential loss of budget occurs in the following way: imagine that there's too many graduate students, so the budget coming from tokens can't pay for all of us. Then the department needs to use department funds in order to pay for tuition which, in essence, removes money from potential travel funds.

This indeed, doesn't answer all questions. But it's a start to the inquiries I had. I just had to go to places and ask people about the stuff I was interested in learning about. This information also doesn't contemplate the most recent meeting we had with the whole department.

In summary, I'd like to go through how I solved my situations:

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March Question of the Month

Please answer and cut out this question and drop it in locker #7 near the upstairs graduate offices. Check back next month to see the results!

(Q1) With 1 representing the eldest, 2 representing the second eldest, etc, what number eldest child are you?

_____ eldest

(Q2) With 1 representing the youngest, 2 representing the second youngest, etc, what number youngest child are you?

_____ youngest

1. Classroom was locked, so find another classroom. Hopefully empty.
2. Wasn't as prepared for teaching as I wanted, so prepare better next time!
3. Didn't know what a token was? Ask around to find out, some people might not know but they may point you in the right direction.

This and many more situations may assail our lives as grad students at times. I hope that with these small comments I may inspire you to do something central in all of my solutions, which is to take action. Because yes, there may be problems we identify, but if we don't do anything, then there won't be solutions.

Cheers, and any correspondence may be directed to me directly or through the editorial board.

Milestones

We want to congratulate the following people for their successful defenses and preliminary exams during February.

- Ashley Armbruster passed their preliminary exam on "Chatting with AI: Expert and novice communication to construct proofs."

A Fictitious Part B

Makenna Greenwalt

Mathematics faculty, graduate students, conspiracy theorists, and other interested parties are invited to attend the part B examination of Makenna Greenwalt.

Date: May 15, 2026

Time: 4:39pm

Location: Weber 17

Advisor: Jayan Nitzsche

Committee: Eden Heyen

External Committee: Hayden Hassebrock

Title: Mathematicians or Moles? A First Study in the Mesmerizing Psychology of Derek Moran and Enrique Mercado

Abstract: Since their arrival as part of the 2025 cohort, an overwhelming number of questions have arisen about the radical awesomeness—and sometimes strangeness—of Derek Moran and Enrique Mercado. Why doesn't Derek ever get cold, even in the winter? Is he stronger without shoes? What is he doing in the woods at night by himself? How is Enrique everywhere and nowhere at the same time? How does he know literally everyone? And how is it possible that these two seemingly opposite personalities have developed a ride-or-die brotherhood?

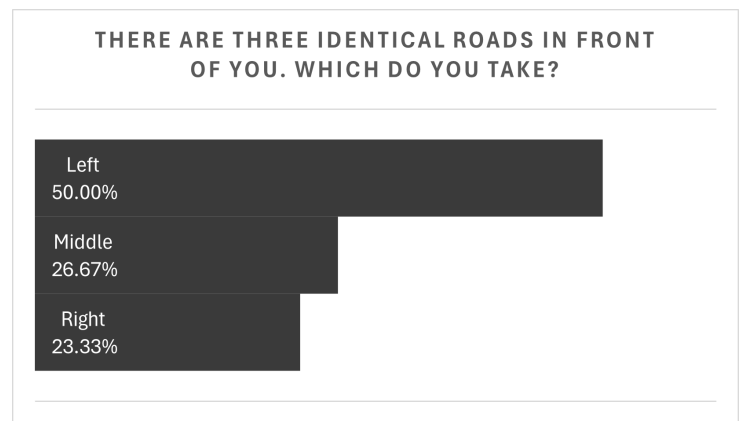
In this study, we propose a novel explanation for these qualities, as well as sufficient observational evidence to support the theory. We begin by considering the mutual background of the parties in question—namely, a history in the CSU math department—and follow this train of

thought to its natural conclusion: are these two actually graduate students, or are they something more?

February Question of the Month Results

Felix High

There are three identical roads in front of you: left, middle, and right. What roads did members of the CSU math department choose? Here are the results:



Since the roads are identical, you'd expect an even split of options. So it's interesting that most voters chose the left road! It makes one wonder if there's a reason for left being chosen more often.

If you have a question that you want polled, please reach out to either the Torus or to Felix High.

Remember, your opinion only matters if you vote! So remember to vote in every election!

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March Comic

Ignacio Rojas



March PotM

Provided by Ignacio Rojas

Consider the following statement:

Suppose A is a 2×2 matrix with eigenvalues λ_1, λ_2 (possibly equal). It is known that $\ker(A - \lambda_1 I)$ is the eigenspace corresponding to λ_1 . It surprisingly occurs that the *column space* of $A - \lambda_1 I$ coincides with the eigenspace corresponding to λ_2 .

For which family of 2×2 matrices does this statement *not* hold?

What: Free Dance Practice and Lesson!

When: After spring break, exact date TBD.

Where: Studio 1, CSU Rec Center

Cost: Your time, otherwise free :)

Come and try it out, I'll be there with my students from dance class having fun!

From the Editorial Board of the Torus

We hope you have enjoyed the Ninth edition of The Colorado State Torus! The success of the Torus requires article submissions from our readers; do you have an idea for an article or comic but just haven't had the time to write it? We hope you take the chance to do something creative over the next month, and spring break and submit a contribution: you can email your submission to our email address MATH_ColoradoStateTorus@mail.colostate.edu. The deadline to submit your work for the April addition is March 31st. We also want to remind our fellow graduate students that participation in the newsletter is required for graduation, this is a threat.

Love from your editors,
Ian, Joe and Page

ACROSS

- 1 Spat
- 5 Russia's ___
Mountains
- 9 Smoothie berry
- 10 Dad
- 11 Cutting edge
feature?
- 13 Quasimodo's
love
- 14 Like four-leaf
clovers,
supposedly
- 15 Trade places
- 19 X
- 20 Pasta sauce
eponym
- 21 Was ahead
- 22 Audio units:
Abbr.

DOWN

- 1 Shock, in a way
- 2 Chills
- 3 Most of
Nebraska
- 4 Energize
- 5 Absorption
- 6 Train storage
area
- 7 Like two peas in

- 8 Singer ___ Del
Rey
- 12 Inverse trig
function
- 15 Mo. town
- 16 Tiny
- 17 Bar bill
- 18 "Help!"

1	2	3	4		5	6	7	8
9					10			
11				12				
13								
		14						
15	16						17	18
19						20		
21						22		

February Solutions

1	2	3				4	5	6
S	S	W				C	C	S
7			8		9			
I	T	E	M		S	H	O	T
10				11				
T	R	I	P	L	E	I	P	A
12								
S	E	R	G	E	A	N	T	S
13						14		
O	E	D		D		R	E	I
15						16		
N	T	H				E	R	S
	17		18		19			
	S	U	M		U	S	S	
		20		21				
		H	E	A	R	T		
			22					
			S	I	N			