

# Math Department Open House

The Wall Street Journal\* says “Mathematician” is the best occupation in the United States, and we want to show you why. On

Tuesday, February 17, 2009, from 1900-2100

you are invited to the **Math Department Open House**, which takes place

on the third deck of Chauvenet

All are welcome! Come learn about

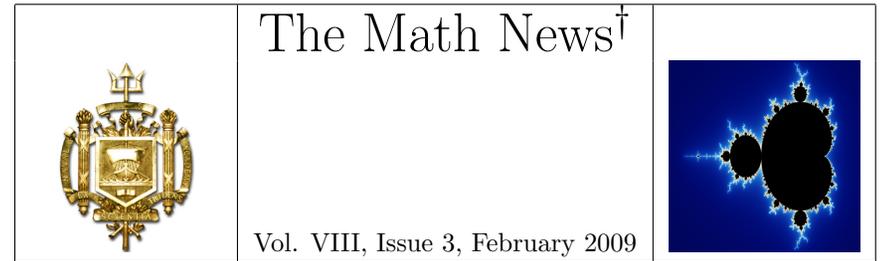
- Careers in mathematics
- Graduate school opportunities in mathematics
- the Mathematics (SMA) and Applied Mathematics (SMP) Tracks
- Operations Analysis, and the sub-specialty codes (3211E and 8051 MOS)
- Capstone and honors projects in mathematics
- SASMC (the Service Academy Student Mathematics Conference)
- Modeling, simulation, and internships in mathematics
- Completing language minors within mathematics
- Completing premedical/predental programs within mathematics
- the USNA Math Team and problem-solving competitions

You can also play “A Sudoku Flip”, match your chess prowess against Assoc. Prof. Will Traves (who will take on all comers), or just watch the math of YouTube on our medium-sized screen. We’ll supply the popcorn, ice cream, and drinks!

## Problem of the Month

Consider a simplified version of football in which the only scoring plays are 3-point field goals and 7-point touchdowns. Then a team can achieve any score except 1, 2, 4, 5, 8, and 11. Now imagine a sport in which scoring plays count either  $p$  or  $q$  points (where  $p$  and  $q$  are distinct positive integers). Find a necessary and sufficient condition on  $p$  and  $q$  so that a team can achieve all but finitely many scores. Mids who submit a correct solution to Asst. Prof. Vrej Zarikian ([zarikian@usna.edu](mailto:zarikian@usna.edu)) will be entered in a random prize drawing. (There were no correct solutions to the January problem!)

\*<http://online.wsj.com/article/SB123119236117055127.html>



## A Baseball Paradox: Reversal of Averages

by Assoc. Prof. T. S. Michael ([tsm@usna.edu](mailto:tsm@usna.edu))

The role of mathematics, statistics, and operations analysis in sports has grown in recent years. For instance, some football coaching staffs now use statistics to detect trends in opponents’ strategies. Fair schedules for professional sports leagues require a balance of home-and-away games, allowances for travel time, and respect for traditional rivalries. Intricate models are needed to account for these factors. But even the simplest of sports situations can give rise to interesting mathematics.

**Example 1.** Consider the following batting average data for two teammates on the Baltimore Orioles. In 1991 Brady Anderson had 59 hits in 256 at-bats, giving him a batting average of  $59/256 = 0.230$ . As usual, the batting average is rounded to the nearest 0.001. Chris Hoiles was a little better, batting 0.243 that same season. The next season both players improved; Anderson batted 0.271, while Hoiles was again better at 0.274. Question: Who was the better batter over both seasons combined? Note that we cannot simply “average the averages.” We must use the total hits and total at-bats to compute the batting average over both seasons combined. The table shows all the data. We see that even though Hoiles was

	BRADY ANDERSON			CHRIS HOILES		
year	hits	at-bats	ave.	hits	at-bats	ave.
1991	59	256	.230	83	341	.243
1992	169	623	.271	85	310	.274
total	228	879	.259	168	651	.258

better over each season separately, Anderson (0.259) had a higher batting average than Hoiles (0.258) over the two seasons combined! Notice that

†On the cover: The USNA seal (left) and the Mandelbrot set (right).

Anderson had a whopping 623 at-bats in 1992, making that season count a lot more toward his overall batting average.

We have encountered an instance of the so-called *Reversal of Averages Paradox*. The same perplexing state of affairs occurs in many non-sporting contexts, too. All we need is fractions that satisfy

$$\frac{a}{b} < \frac{A}{B} \quad \text{and} \quad \frac{c}{d} < \frac{C}{D}, \quad \text{but} \quad \frac{a+c}{b+d} > \frac{A+C}{B+D}.$$

Although these inequalities are contrary to most people's intuition about fractions, there is no actual contradiction. Thus the Reversal of Averages is not a genuine mathematical paradox.

**Example 2.** The second table shows a hypothetical situation involving the QPRs of two midshipmen. In both the Fall and the Spring semesters Midn Door has a higher QPR. However, Midn Gish has a higher QPR for the whole year. This happens because Midn Gish's strong QPR of 3.9 in the Spring is achieved with a heavy load of 21 credits, and therefore carries more weight than her 16-credit Fall semester.

DOOR				GISH		
semester	qual. pts.	credits	QPR	qual. pts.	credits	QPR
Fall	54	18	3.00	46.4	16	2.90
Spring	60	15	4.00	81.9	21	3.90
year	115	33	3.45	128.3	37	3.47

Midshipmen majoring in Mathematics (SMA, SMP) and Quantitative Economics (SQE) at the Naval Academy hone their critical thinking skills and learn to analyze conflicting quantitative information, as we have done in our two examples. See if you can make up your own example of the Reversal of Averages Paradox. One scenario might involve the average heights of the male and female midshipmen in two different majors. Can you find an example involving real-world data, like Example 1?

## Faculty Profile: CDR Dan Schindler, USNR

CDR Dan Schindler was born in 1965 in Detroit, MI, and grew up in nearby Livonia. Inspired by the example of his uncle, who served as a Marine in Vietnam, and by his AP World History class, CDR Schindler decided that he would spend at least two years in the service of his country. Having grown up during the space race, he also had aspirations of becoming an astronaut.

In 1983, CDR Schindler became the first person in his family to attend college when he was admitted to the US Naval Academy. He graduated in 1987 with a BS in Mathematics (Operations Analysis Track). A self-described "intramural warrior", he also earned an N-Star Letter with the Bowling Club, back when there was a bowling alley on the Yard, in what is now the Mid Store. Three days after graduation, CDR Schindler married his high school sweetheart, Sally Ellen, in the Naval Academy Chapel.



Upon graduation, CDR Schindler went to flight school in Pensacola, FL, earning his wings in Feb. 1989. His first tour was flying the P-3C Orion with VP-23 in Brunswick, ME, from 1989-1992. After that, he served as a flight instructor in Corpus Christi, TX, from 1992-1995. During this time, CDR Schindler began preparing for a future career in academics by taking graduate classes at Texas A&M Corpus Christi, completing the bulk of the requirements for an MS in Mathematics with a concentration in Operations Analysis/Management Science. From 1995-1998 he did a tour as a full-time reservist, flying the DC-9 with VR-52 in Willow Grove, PA. Says

Schindler, "I got to see the world in this plane." Between 1999 and 2005, CDR Schindler lived in Denver, CO, where he worked for United Airlines in several capacities (727 pilot, instructor, and safety/security manager). Meanwhile, he continued to serve as a reservist. Following 9/11, CDR Schindler spent substantial time (including most of 2003) back in Corpus Christi, standing up the VT-35 Squadron Augment Unit.

In Nov. 2004, CDR Schindler came across an ad in the *Naval Reserve Association Magazine* for math instructors at USNA. He was recalled and joined the USNA faculty in July 2005. In addition to teaching calculus (SM121, 122, 221, and 223) and probability (SM230), CDR Schindler has been involved with activities throughout the Yard. He is the O-Rep for the Cycling Club and has facilitated numerous 1/C Capstone Seminars. During summers he has helped mids obtain their sailing qualifications and has traveled with them to China. Recently CDR Schindler became the Associate Chair of the Math Department. He will be at USNA through 2011, after which he intends to resume working for United Airlines in Denver and, possibly, to teach in the Aviation Department at Metropolitan State College.

CDR Schindler lives in Cape St. Clair with his wife and their three children Andrew (13), Samantha (10), and Hannah (5).