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The math club

Intro

Welcome to the (much delayed) first issue of the Math Club newsletter. As this is my first publishing/editing job, you might notice certain quirks in this issue, such as: missspellings, tasteless font selection (see below), improper capitalizatioN, bad grammar, page layout indicating an obvious lack of skill, and really bad humor. BUT NOT TO WORRY!! All of these will disappear with a few years of experience.. Except the bad humor, of course. But I digress — in this first issue, we have: an interview with Professor Doyle, an article about the Golden Ratio, a careers section, a "Rad Math Internet Link" section, and last but not least a "Stuff We Did" section. We will try to stick somewhat to this layout for the up-coming issues, but we are always open to suggestions, compliments, complaints, Love/Hate mail, and large donations. On a final note, WE NEED MORE WRITERS AND ARTISTS! It's sort of embarrassing to have all your articles printed in 14 point font with standard clip-art (or lack thereof) filling out the white-space. So contribute your creativity! Anyway, that's it for the intro, enjoy the news-letter!

later-
Steve Young - Editor

Contents

Stuff we Did

Many words could describe the math club.. Could… But only one comes to mind in describing our first quarter: FREEFORM! We've done our best to establish our presence as a club as well as think up.. well.. things that a math club would do. One might think that the organizers of a club would consider the latter as prerequisite to the former, but that just shows how novel, experimen-tal, creative, and FREEFORM we are!! Right, so this is what we thought up and did this past quarter:

We put up a web page which will (eventually) include a brainteaser, a calendar of events, a list of careers and internships, a bank of on-line tests from previous years' courses, articles of interest, an alumni link, and a question and answer forum.

We ran a booth at the Sungod festival where we sold drinks and homemade baked goods. We made an UNBELIEVABLE amount of money…

We hosted a number of career seminars regarding jobs available to math majors.

We gave away a load of free food at most of these seminars… In fact we gave away a load of free food at just about ALL our events (join math club!).

We held a number of seminars by prominent professors in the department, dealing with topics such as the recent proof of Fermat's last theorem, and the magnetic fields of neutron stars.

We aired the Nova special — "The Proof", which also dealt with the recent proof of Fermat's last theorem. We gave away free food there too…

We had (approximately) weekly meetings, at which we discussed various math-related topics, and occasionally had professors come in and talk on interesting math topics.

And finally, of course, we put out a newsletter.

Interview with Professor Doyle

-Tina Hu

When I first entered Professor Doyle's office, my attention was immediately drawn towards the many geometric contraptions decorating his office. I found him comfortably seated in a large bean bag extending a warm welcome as I walked through the door.

Here (in paraphrase) is part of my interview with Professor Doyle.

TH: What first sparked your interest in math?

PD: Well, it definitely wasn't my parents. Even though my father was a physicist and my mother a scientist, my dream was to become a baseball player—admittedly kind of a stretch for a kid with eyesight as bad as mine!

TH: So what changed your mind?

PD: When I was in grade school, my teacher showed the cartoon movie Donald Duck in MathMagicLand. I was really fascinated by the spiral with the golden ratio.

TH: How do you feel about math?

PD: It's the most exciting thing in the universe. However, most people never get to actually understand math and see the interesting part of it. They just hate the word "math."

TH: So do you think that anybody can do math?

PD: Definitely. I believe that people get the wrong impression about math in grade school and the dislike just continues on. We need better math teachers in the early stages of schooling.

TH: Where in math does your interest lie?

PD: Geometry and probability.

TH: What are you up to now?

PD: I am teaching MATH 169 (Chance) this quarter. As for research, I am currently working on four or five different projects in geometry, probability, and combinatorics. One project is to prove the Riemann Hypothesis using techniques of electrical engineering—only you mustn't tell anybody I'm working on this, or they'll think I'm nuts!

TH: Are there any research projects that students can get involved in?

PD: Sure. I can think of a number of research and computer projects that students could work on, for example the Four-Peg Tower of Hanoi problem. I'm sure other faculty members could also think of projects. Maybe when you invite faculty to talk to the math club, you could ask them to suggest some projects that students (or groups of students) could work on if they're interested.

The Golden Ratio

-Barry Smith

The ancient Greeks in their study of geometrical figures were interested in the question "For what value of x does x/1 = 1/(x-1)?" When this is considered as an equation relating ratios of lengths, then the form of a rectangle constructed with the common value of these ratios as the ratio of the lengths of its sides was believed to be especially aesthetically pleasing.
Solving for x is equivalent to finding the roots of the equation x^2-x-1=0, which are

$$\frac{1\pm\sqrt{5}}{2}$$

Considering that the Greeks needed this to be a length, the positive root was used and has a value of approximately 1.61803. This quantity, denoted as j, is called the golden ratio. The negative root will be denoted throughout as j*. It turns out that the golden mean is intimately connected to the Fibonacci sequence, which is the sequence

0,1,1,2,3,5,8,13…

If F_n denotes the nth term in this sequence, then F_0=0, F_1=1, and for each successive term,

$$F_n + F_{n+1} = F_{n+2}$$

The limit of the ratio of successive Fibonacci numbers is, in fact, j.To show this, one needs to know a few more properties of j.

Theorem: For any positive integer n,

$$j^n = F_n j + F_{n-1}$$

For n=1, this equation is trivial. It is also true for n=2 since j is a root of $x^2-x-1=0$, and so $j^2 = j + 1$. Now suppose that the assertion is true for some k, then

$$j^{k+1} = j(j^k) = j(F_k j + F_{k-1}) = F_k j^2 + F_{k-1} j = F_k(1+j) + F_{k-1} j = (F_k + F_{k-1}) j + F_k = F_{k+1} j + F_k$$

Thus, the assertion is true for all positive integers n where the facts that $j^2 = j + 1$ and $F + F_{n+1} = F_{n+2}$ were used in the proof. Also, since j* is a root of the same equation as j, the assertion is also true for j*.

Now defining the Fibonacci sequence recursively by relating a term to previous terms is not the most efficient method for calculating Fibonacci numbers. It can be shown that

$$F_n = ((j)^n – (j^*)^n)/5^{0.5}$$

From the above theorem,

$$j^n = F_n j + F_{n-1} \text{ and } (j^*)^n = F_n(j^*) + F_{n-1}$$

Subtracting these, $(j)^n – (j^*)^n = F_n(j-j^*) = F_n(5)^{0.5}$, and the formula for F_n follows naturally.

From here, it is a short step to show that the ratio of successive Fibonacci numbers tends to j as n becomes large.

For from the above formula,
$$F_{n+1}/F_n = ((j)^{n+1} – (j^*)^{n+1})/((j)^n – (j^*)^n)$$

Since $|j^*| < 1$, $(j^*)^n$ tends to 0 as n becomes large, so F_{n+1}/F_n tends to $(j)^{n+1}/(j)^n = j$ as n becomes large.

This was taken from Peter Wang's web page at www.ugcs.caltech.edu/~peterw/studies/ For more information on the golden mean, including some applications to the geometry of platonic solids with some beautiful drawings, I suggest checking out this web page.

Careers Section

This month's careers section focuses on the actuarial profession. Actuaries are professionals who use statistical analysis to calculate the cost of future risks we all face. Actuaries calculate the financial effects of things such as sickness, damages to property, retirement, and accidental injury. All of these events are insurable, making actuaries important to the insurance and financial security industries since actuaries determine the cost of financing these events.

Actuaries come to the profession from a variety of academic backgrounds. Many of them pursue undergraduate degrees in actuarial science but others choose to major in business, economics, mathematics, or the liberal arts. People hoping to become actuaries go through a series of examinations given by the Society of Actuaries or the Casualty Actuarial Society. This process usually takes several years. During this time, prospective actuaries usually attempt to concentrate their studies in a specialty area such as health insurance, life insurance, or property/casualty insurance.

Although actuarial work involves lots of math, actuaries must be well-rounded in issues like business, trends, social science, law, and economics. They must also be good communicators in order to explain things to non-actuaries. Being well-rounded in business issues and having good communication skills makes an actuary very valuable to insurance companies, investment firms, and other companies that need to calculate financial risks.

Currently, entry level salaries for actuaries range from 30k to 45k. It is not uncommon for someone who is considered a good candidate to receive a signing bonus.

Although there are only about 20,000 actuarial professionals in North America, their work has had a great influence on people's lives. Two UCSD graduates that recently became actuaries are Kathleen Miller and Jennifer Schofield. Miller graduated in 1996 with a degree in Applied Math and now works for Deloitte and Touche LLP in Los Angeles as a property and casualty actuarial consultant. Schofield graduated in 1995 with a B.S. in Pure Math. She now works for Hewitt Associates in Newport Beach. As consultants, Miller and Schofield help companies design pension and benefit plans and evaluate assets and liabilities. They also help companies calculate the cost of certain business risks.

Actuaries are important to a company's management team. They enjoy problem solving and applying their analytical skills while working with other colleagues to project the cost of certain business risks. People who are interested in math – or statistical analysis in particular – and are looking for an application to the business world should consider a career as an actuary.

Rad Math Internet Links

euclid.ucsd.edu/~mathclub

-The One, the Only, the Truly Incomparable UCSD Math Club Homepage!!!

xxx.lanl.gov

-No, it's not a porn site, it the Los Alamos National Labs e-Print Archive. Here you will find the most recent science and mathematics research papers published in electronic format for free download… I couldn't find anything to help with my 110 homework, but I did find "Pseudo-holomorphic curves and envelopes of meromorphy of two-spheres in CP^2" and "Amalgamated free products, unstable homotopy invarience, and the homology of SL_2(Z[t])".. Rad…

[ed. Note: my spell checker claims that half the words in the preceding sentence are not, actually, words…]

www.ticalc.org

-Got a Texas Instruments Calculator? Think you're hot 'cause you got Tetris on it? You ain't nothing until you learn how to code in ASSEMBLY language for the Z80 and MC68000 microprocessors and port Quake and Starcraft over to your calculatory unit… On the TI Calculator Homepage, you'll find information, tips, and calculator programs (in "BASIC" and assembly) for a wide range of applications, all coded by kids with a LOT of time on their hands who really wish they had laptops.

www.wolfram.com/posters/quintic/main.html

-"You kids have got it easy. When I was a boy we had to memorize the quadratic, cubic, AND the quartic equations. And our slave driving teacher had us working on the quintic all period long. He'd whip us when one of us would claim that it was impossible. Galois was his name..."

Remember that cool poster on the wall of the science and engineering library last year? The Mathematica one that showed the general solution of the quartic equation… I tried to solve it on my TI-92 and it crashed the thing. Apparently Mathematica can do it just fine. Here's a page on "Solving the Quintic Formula with Mathematica" It's impossible, of course, but with mathematica, you can see just HOW impossible it is..

www.best.com/~cgd/home/flt/flt01.htm

-If you want to learn more about the recent proof of Fermat's last theorem, done by Andrew Wiles, but are too lazy to walk over to the science and engineering stacks and check out The Annals of Mathematics #141 (3), May 1995, check out this page instead: The Mathematics of Fermat's Last Theorem. It's not the whole proof (I haven't found it in its entirety anywhere on the web), but it's the most thorough overview I've seen.

more next time…

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