Abundant Weirdness:

Our Journey to Breaking a World Record

Honors Math (MATH 207) Fall Quarter 2013
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Why Weird Numbers?

- Dr. Klyve’s challenge to the honors math class
  - Find an integer series you are interested in and come up with 20 questions about it.
  - Luke’s search.
  - Once the presentation in class was complete, the first thing Dr. Klyve said was, “We can do something with this.”

So What Exactly is a Weird Number?

- A Number!
- Precisely, a number whose sum of proper divisors is more than the number itself; and no subset-sum of those divisors equals the number.

Example:

Starting Number: 70
Sum of Divisors: 1 + 2 + 5 + 7 + 10 + 14 + 35 = 74
No sum of these numbers equals 70.
Thus, 70 is a weird number.

In fact, 70 is the first weird number!

An Open Question in Mathematics

- Weirds are unique because they have a long standing unanswered question in mathematics.
  - Are there odd weirds, or is it only possible to have even weirds?

Researching Weird Numbers

- Sidney Kravitz
  - Largest weird number: 53 Digits
  - k is a positive integer
  - Q is a prime exceeding 2^k
  - If R is prime, n is a weird number

$$R = \frac{2^k Q - (Q+1)}{(Q+1) - 2^k}$$

$$n = 2^{k-1} Q R$$

Testing Kravitz's Formula

- We wanted to make sure that Kravitz's equations actually worked.
  - The first numbers we tried didn't make R prime.
  - Then we tried some more and came up with a prime R.
- This is how we got our first world record weird number that was 74 digits long!

$$R = \frac{2^k Q - (Q+1)}{(Q+1) - 2^k}$$

$$n = 2^{k-1} Q R$$

First Weird Number Larger than Kravitz's:
2828336327242701402627518356391262145196488715650734698559492888375328768

Example of Kravitz's Formula

$$R = \frac{2^k Q - (Q+1)}{(Q+1) - 2^k} \qquad n = 2^{k-1} Q R$$

$$n = 2^{56} \cdot (2^{61} - 1) \cdot 1537228672809129 29 \approx 2 \cdot 10^{52}$$

No... We aren't going to find all of its divisors....

Bashing Out Code

- Wrote code based on Kravitz's equations.
- We worked on it each week in our one hour class sessions.
- It took about 3 class days to have our first rendition of the code ready.

$$R = \frac{2^k Q - (Q+1)}{(Q+1) - 2^k}$$

$$n = 2^{k-1} Q R$$

Testing the code

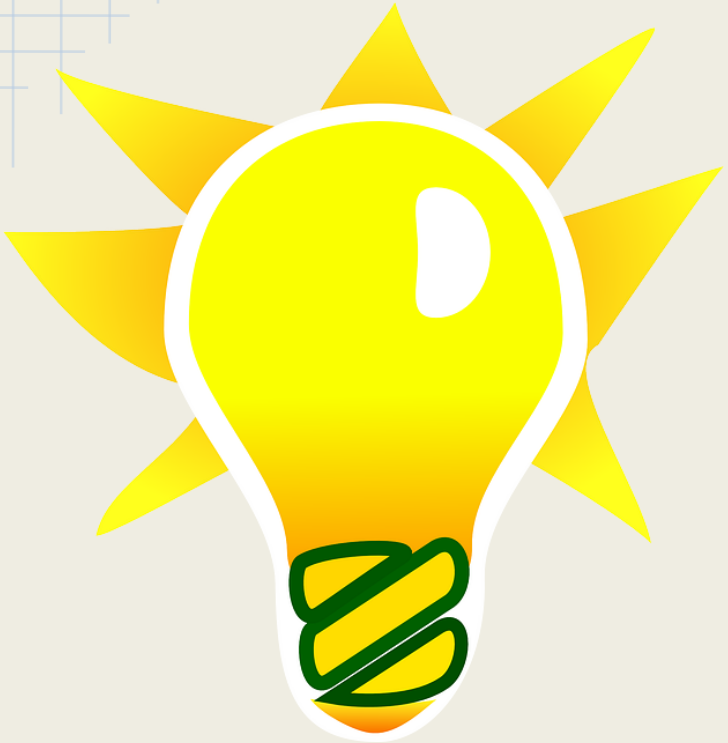
- Ran the code to find number.
- It failed.
- We looked through the code and fixed our errors!

Success

- The first weird number our code found was a 127 digit number.

1,304,478,802,221,037,336,898,806,
955,880,590,950,108,213,611,184,
211,428,152,436,309,358,286,058,
099,789,749,839,735,498,620,012,
494,920,476,023,972,998,095,015,
247,872

Optimizing Code for Bigger Weirds



- Wanted to find more Weirds!
- What did we need to change to make the code work better?
- Researched more into Kravitz's formula and how it worked.

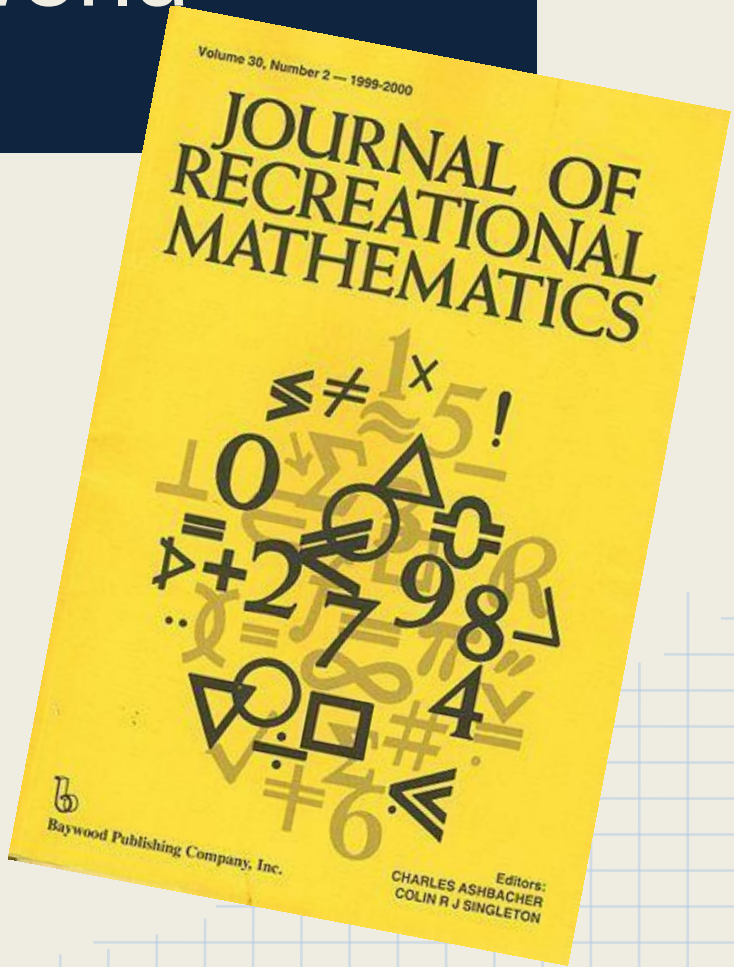
Success (Again!)

- It worked!
- A number with 226 Digits and 500+ Digits!

26,963,672,211,957,831,828,322,834,071,143,299,817,754,720,290,127,404,079,937,026,385,368,922,075,196,690,720,690,562,498,337,038,657,263,353,255,952,256,005,850,803,053,091,152,216,128,172,198,270,512,414,580,092,743,322,379,544,478,286,025,897,899,890,351,444,085,611,625,835,160,270,418,964,124,507,243,890, 975,821,522,176,465,361,680,177,670,297,930,314,037,850,339,675,559,057,554,452,347,547,946,165,134,639,879,111,112,583,151,946,671,967,876,920,506,598,818,088,728,910,330,021,016,856,674,391,763,268,224,262,067,132,913,691,721,407,174,127,885,521,288,146,239,271,038,154,486,086,650,600,357,888

Now that we have a world record, what next?

- We are currently working with Dr. Klyve on publishing our findings to the Journal of Recreational Mathematics.
- Most of us are in Honors Math still and are having a great time!



Want to Take Part in a Mathematics Adventure?

- Join us in Honors Mathematics!
- For information talk with one of us after or contact Dr. Dominic Klyve.

"Use math like it's never been used before!"
- Anna Cockrum

References

Images;

- http://www.nea.org/assets/img/pubToday/1105/superheroes1.png
- http://www.proactiveinvestors.co.uk/genera//img/companies/news/computer_code_350_51e7bc37a43df.jpg
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