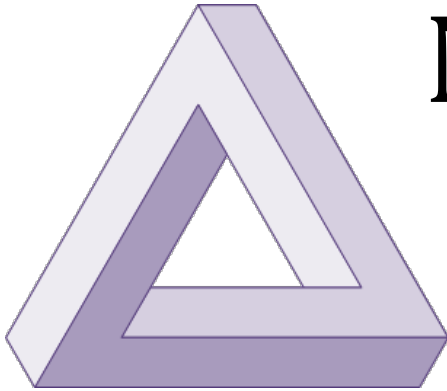


TCU Math Newsletter



This winter I am giving two courses of lectures to three students, one of whom is only moderately prepared, another less than moderately and the third lacks preparation and ability. Such are the burdens of a mathematics professor.

- Carl Friedrich Gauss
(from an 1810 letter to Friedrich W. Bessel)

Frank Stones Memorial Colloquium Talk on March 18

Dr. Milvoje Lukic of Rice University will present the next talk in the Frank Stones Memorial Colloquium series at 3:30 pm on Tuesday, March 18. Refreshments will be served before the talk in TUC 300.

When they become available, the talk title and location will be posted on the TCU Math Department webpage at <http://www.math.tcu.edu>.

Pi Day

Pi Day, a holiday commemorating π , is celebrated on March 14 because in month/date format 3/14 matches the first digits of π . To learn more about Pi Day and pi, see the web site <http://www.piday.org>.

Call for Abstracts for the TCU Student Research Symposium (SRS)

The TCU College of Science and Engineering Research Symposium (SRS) is a relaxed forum in which students can present their work in a poster presentation. Any TCU undergraduate or graduate student who has been engaged in some form of research is strongly encouraged to participate. SRS will be held on April 11, 2014, and the deadline for abstract submissions is Thursday, March 20, 2014. For more information about SRS and to submit an abstract, visit the SRS website www.srs.tcu.edu.

Career Service Advising in Tucker Technology Center

Shannon Merchant, the TCU College of Science and Engineering Career Advisor is now holding some office hours in Tucker Technology Center 136. Walk-ins are welcome on Tuesdays and Wednesday from 1 pm to 3 pm. For other appointment times call 817-257-2222 to schedule.



Solution to the February 2014 Problem of the Month

Problem: Find the smallest integer greater than 10,000 whose base 3 and base 5 representations consist only of 0s and 1s.

Solution: The smallest such integer is $81,255 = 10100010_5 = 11010110110_3$.

Let n be the smallest such integer. We have

$$3^8 + 3^7 + 3^6 + 3^5 + 3^4 + 3^3 + 3^2 + 3 + 1 = \frac{3^9 - 1}{2} = 9841,$$

$$5^6 + 5^5 + 5^4 + 5^3 + 5^2 + 5 + 1 = \frac{5^6 - 1}{4} = 19,531, \text{ and } 3^9 = 19,683. \text{ Thus,}$$

$$n \geq 5^7 = 78,125 > 68,890 = 3^{10} + 3^8 + 3^7 + 3^6 + 3^5 + 3^4 + 3^3 + 3^2 + 3 + 1.$$

$$\text{Therefore, } n \geq 3^{10} + 3^9 = 78,732 > 78,281 = 5^7 + 5^3 + 5^2 + 5 + 1,$$

$$\text{so } n \geq 5^7 + 5^4 = 78,750 > 78,745 = 3^{10} + 3^9 + 3^2 + 3 + 1.$$

$$\text{Hence, } n \geq 3^{10} + 3^9 + 3^3 = 78,759 > 78,756 = 5^7 + 5^4 + 5 + 1.$$

$$\text{Thus, } n \geq 78,756 = 5^7 + 5^4 + 5^2 = 78,775 \geq 78,772 = 3^{10} + 3^9 + 3^3 + 3^2 + 3 + 1$$

$$\text{and } n \geq 3^{10} + 3^9 + 3^4 = 78,813 > 78,781 = 5^7 + 5^4 + 5^2 + 5 + 1.$$

$$\text{Thus, } n \geq 5^7 + 5^4 + 5^3 = 78,875 > 78,853 = 3^{10} + 3^9 + 3^4 + 3^3 + 3^2 + 3 + 1$$

$$\text{and } n \geq 3^{10} + 3^9 + 3^5 = 78,975 > 78,906 = 5^7 + 5^4 + 5^3 + 5^2 + 5 + 1.$$

$$\text{Therefore, } n \geq 5^7 + 5^5 = 81,250 > 81,247 = 3^{10} + 3^9 + 3^7 + 3^5 + 3^4 + 3 + 1.$$

$$\text{Finally, we have } n \geq 3^{10} + 3^9 + 3^7 + 3^5 + 3^4 + 3^2 = 81,252 = 5^7 + 5^5 + 1$$

$$\text{And } n \geq 5^7 + 5^5 + 5 = 81,255 = 3^{10} + 3^9 + 3^7 + 3^5 + 3^4 + 3^2 + 3.$$

It is not clear whether there are infinitely many such numbers. The largest example the Editor found before exhaustion set in was 2,479,585,020,019,501.
 [*Post-Publication Edit. Incorrect comment deleted.*]

The February Problem of the Month was solved by Brad Beadle ('96).

March 2014 Problem of the Month

Let a and r be positive constants. Prove that $e^x = ax^r$ has at most two positive solutions.

Students and others are invited to submit solutions to Dr. George Gilbert by e-mail (g.gilbert@tcu.edu) or hard copy (Math Dept. Office or TCU Box 298900). Correct solutions submitted by persons who are not members of the TCU math faculty will be acknowledged in the next issue of the newsletter. Note that a correct solution is an answer and a justification of its correctness. The solution to the problem will be published in the next edition of the newsletter.

Editor: Rhonda Hatcher
 Problem Editor: George Gilbert
 Thought of the Month Editor: Robert Doran