Problem of the Week #1
8/19/2019 to 9/1/2019

I choose an integer from 0 through 15. You ask me 7 yes or no questions. I answer them all, but I am allowed to lie once—I don’t have to lie, but I am allowed to. How do you determine my number?

Solution: If my number is written in binary, then it is one of 16 possible 4-digit numbers. So, for your first three questions, ask if each of the first three digits is a 0. On your fourth question ask, “Have you lied yet?”

- Note that if I answer “no,” then this must be correct, because otherwise I have used up my lie already, and this last answer would be another lie! In this case you now have three questions to determine the last digit, which can be done by asking about the last digit 3 times, and then picking it to be the answer that shows up twice.

- Otherwise the answer was “yes,” which may itself be the lie, but regardless, the lie is now used up. Thus you can safely use one question to inquire about the last digit, leaving two questions to verify the first three digits. So, now ask, “Did you lie about either of the first two digits?”

  - If the answer is “no,” then they are correct and you simply ask about the third digit.
  - If the answer is “yes,” then ask again about just the first digit.

(Note: Some folks just emailed me that you should just ask about the digits of the (7,4) Hamming code. For those of you who don’t know about Hamming code, there are lots of quick, interesting reads online.)
Solutions for this problem were submitted by Ziad Aramouni (Lebanon), Colin Bown (Austin, TX), Phil Boyd (Manchester, England), T.J. Gaffney (Las Vegas, NV), Ben Gustafson (TU), Rob Hill (Gambrells, Maryland), Kipp Johnson (Beaverton, OR), Jack Kennedy (San Antonio), Hari Kishan (India), Tengiz Kutchava (Georgia, the country), Yann Michel (Paris, France), Benjamin Phillabaum (Bothell, WA), Michael Tomaine (Bellevue, WA), F. Wallner (Germany), and Zurab Zakaradze (Georgia, the country).