Name(s)	Project Number
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Project Title
Exploring Binary Sequences

Abstract

Objectives/Goals
My first intention on the goal of this project was to find something new, like an invention to innovate this society. I had no trouble starting with a topic, since my head is always full of questions. I was more interested in computers and binary numbers, and so I studied binary numbers in depth.

Methods/Materials
I researched on the fundamentals of computing algebra, and found out the arithmetic operations in the computer. This inspired me to see what happens to the counting number sequence after it has undergone a binary transformation. My original hypothesis was that I wouldn#t get any noticeable patterns, or maybe one that won#t be helpful. The Inverse Sequence came directly from computer subtraction algorithm, but I invented the Reverse Sequence (a.k.a. #the Richard Sequence,# which I happily named it after myself). Converting a number to binary, and converting it back to decimal after a string operation could be a tedious duty. And so I prepared my procedures accordingly: write all programs on my TI-89 graphing calculator, generate sequences for at least the first 1000 terms, observe sequences, and try to prove or explain patterns if any.

Results
After generating the sequences, I noticed astounding patterns. The Inverse sequence was generated by inverting the binary (0=1 1=0) of the natural number sequence, and the results came out as expected (the subtraction sequence). But the Richard Sequence did surprise me. Created by reversing the string of the binary of the natural number sequence, it holds many patterns, some obvious and some hidden. I derived formulas of some patterns for both sequences. (Although the formulas look complex, they are the only mathematical explanation of the observed patterns.) Uncovering some patterns required grouping of terms, summing, and manipulation of entire sequences.

Conclusions/Discussion
After my whole research, I concluded that I discovered something entirely new that no one has ever done, thus I am the one who should be able to find a pertinent use for this invention. Overall, I think the Richard Sequence is a very interesting sequence, and proofs will be needed to follow-up my patterns, formulas, and theories. I will try to work on proofs in the future, and maybe someday, my sequence would become an innovation others can base their work on.

Summary Statement
I invented a new binary sequence and found many interesting properties.

Help Received
N/A