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Pickover

"Mazes for the mind"

Just 2 pages
from the book

Musings on Large Robbins Numbers And Friden Calculators

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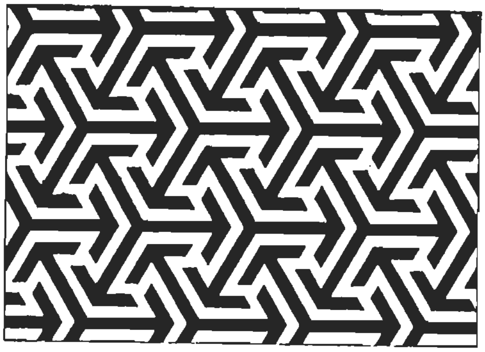

"Jesearc sat motionless within a whirlpool of numbers. He was fascinated by the way in which the numbers he was studying were scattered, apparently according to no laws, across the spectrum of integers."

Arthur C. Clarke, 1956, *The City and The Stars*

In 1991, David P. Robbins published an article in *The Mathematical Intelligencer* with the unusual title "The Story of 1, 2, 7, 42, 429, 7436, ..." The paper deals with an interesting sequence of integers starting with 1 – but very quickly its members include behemoth numbers with 100's of digits. The sequence can be represented by $R_1, R_2, R_3, \ldots$, and it can be computed using the following formula:

$$R_n = \prod_{i=0}^{n-1} \frac{(3i+1)!}{(n+i)!} \tag{75.1}$$

The Π symbol indicates a repeated product. For example,

$$\prod_{i=1}^{3} i = 1 \times 2 \times 3 = 6. \tag{75.2}$$

The exclamation point is the factorial sign: $n! = 1 \times 2 \times 3 \times \cdots n$. Using Equation (75.1) it is not too difficult to determine the seventh and eighth terms of the series:

218347, 10850216

and I've included a list of the first 25 numbers in Figure 75.1. The 31st number (the largest I've computed) is:

745790164537531254584694336446020102450093361981171934259444873965806173020494546519036225529743875880642 4576

Clifford A. Pickover, Mazes for the Mind. 1992

n	R
1	1
2	2
3	7
4	42
5	428
6	7436
7	218347
8	10850216
9	911835460
10	129534272700
11	31095744852375
12	12611311859677499
13	8639383518297652500
14	9995541355448167482000
15	19529076234661277104897199
16	64427185703425689356896743840
17	358869201916137601447486156417296
18	3374860639258750562269514491522925455
19	53580350833984348888878646149709092313243
20	1436038934715538200913155682637051204376827211
21	64971294999808427895847904380524143538858551437757
22	4962007838317808727469503296608693231827094217799731304
23	639678600348796935600782403668485485893162060205454197694128
24	139195130590028911121955178430809752278606772281224640157476731327
25	51125173829571287017224567391919410147905063533336189533617647958933055

Figure 75.1. *Robbins Numbers.*

Before going further and offering a challenge, let me tell you a bit about Dr. Robbins himself (picture at left) and the problem he was working on. Robbins is a

mathematician at the Communications Research Division of the Institute for Defense Analysis in Princeton, New Jersey. He received his formal mathematics education at Harvard and MIT. Robbins refuses to state any mathematical speciality, insisting that he is "interested in any mathematical problem as long as its statement is easily understood and surprising." I was interested to learn that he has enjoyed computers since childhood, beginning with a peculiar fascination with his father's Friden calculator. (I had never heard of a "Friden calculator," but quickly found out after consulting colleagues. More about Friden calculators later in this chapter....)

Robbins exclaims that the sequence in Equation (75.1) has the mathematical community all in a quandary. In the last few years the sequence has arisen in three separate and distinct problems dealing with the analysis of combinations, and no one on earth has been able to explain why. The details of the branch of