He Collects Patterns in 'Random Wo

Continued From Page C1

jects listed a few sequences. He spent hours searching libraries and entering numbers on computer punch cards. When other mathematicians heard about the project, they contributed sequences by the dozens.

"A Handbook of Integer Sequences" appeared in 1973 and became an instant classic, at least by the extremely finite standards of mathematics books. Unfortunately, it also became instantly outdated. New sequences poured in.

Now Dr. Sloane's collection is fully computerized, and he is planning a new edition, although many sequences still lie uncollated in cartons on the floor. In theory, of course, the number of sequences is infinite. "The book could get very thick indeed," he said. "I've had to draw a line and throw away sequences that I considered not so interesting."

He has certain rules. Sequences must consist entirely of whole numbers. They must be infinitely long, which disqualifies the famous sequence 14, 18, 23, 28, 34, 42, 50, 59 . . . — the local stops on the West Side IRT.

For some sequences, a simple formula calculates any desired term. To get the *n*th number in the sequence of perfect squares (1, 4, 9, 16 . . .), just multiply *n* by itself. For other sequences, the process is less direct — one calculates the *n*th term from the terms immediately before it, using a rule known as a "recurrence." Among the best-known sequences generated by a recurrence is the Fibonacci sequence, in which each term is the sum of the two preceding.

For many other sequences, though, neither a formula nor a recurrence is known, even when they are easy to define. An example, is the Mersenne primes — prime numbers that are one less than a power of 2, such as 3, 7, 31. Finding the next Mersenne prime quickly starts to tax the limits of computational ingenuity. It is not even known for certain whether they meet the requirement of being an infinite sequence, but Dr. Sloane gives them "the benefit of the doubt."

And sequences can be defined in many conceivable ways, not all of which get them into the book. There are some mind-twisting possibilities. "You couldn't have *the first sequence that's not in the book*," said Ronald L. Graham, head of mathematical research at Bell Labs.

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Dear Neil, Let me try to kill two birds with one sloane. Here is a new sequence: 1, 2, 3, 8, 10, 54, 42, 944, 5112

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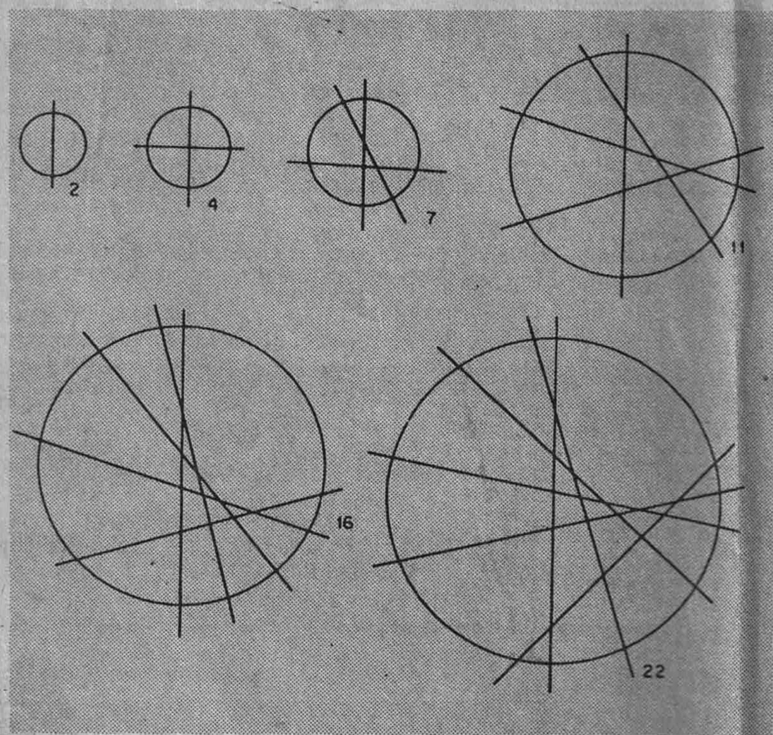
As the curator of this bizarre museum, Dr. Sloane, a wiry native of Wales who is also a serious rock climber, sometimes regrets the time lost to more earnest mathematics. "I probably spend too much time on it," he said. "I should have done more abstract things."

Sequences and Pancakes

Many sequences arise in geometric problems, such as finding the largest number of pancake pieces that can be made by *n* straight cuts: 2, 4, 7, 11, 16, 22 . . . The sequence is generated by $\frac{1}{2}n(n+1)+1$.



Source: A Handbook of Integer Sequences by N. J. A. Sloane

He has worked in coding theory, algebra and combinatorics. Perhaps his most intense interest and his best contribution to hard-core mathematics lie in the area of "sphere packing" — a surprisingly large field of study devoted to questions of how best to arrange many identical balls so that they take up the least volume.

Sphere packing leads to some hard questions. In three dimensions, there is an obvious, very good arrangement: the regular, symmetrical array used for piling oranges or cannonballs. Many crystals, at the molecular level, favor the same array. But mathematicians have never managed to prove that some other arrangement would not be even denser.

Where sphere packing really gets lively, though, is in imaginary spaces of more dimensions than the usual three. Higher dimensions have a lot of room to play around in.

For example, the "kissing number" — the number of spheres that can be arranged around one central sphere — rises rapidly. In two dimensions, it is 6, as anyone can quickly see by placing some pennies on a table. In three dimensions, it is 12, but there is room left over, and some mathematicians long thought that there might somehow be a way to squeeze in a 13th.

Dr. Sloane keeps handfuls of pennies and ball bearings within easy reach. His most important contributions to sphere packing have been clever ideas about spaces of 8 and 24

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