Squambling, anyone?

The Squambling Function and related numerical pastimes, presented by **Mike Mudge**.

In David Wells' book, *The Penguin Dictionary of Curious and Interesting Numbers*, page 169, there appears the somewhat isolated entry: $175 = 1^1 + 7^2 + 5^3$. However, in the *Sunday Times* Brain Teaser 1712 published on 9 July 1995, the SQUAMBLING FUNCTION is defined, for positive integer argument, as the result of squaring the first (most significant) digit, cubing the second, raising the third to the fourth power etc, and summing the results. Thus

SQM(18) $= 1^2 + 8^3 = 513$

while

SQM(175) $= 1^2 + 7^3 + 5^4 = 969$.

The *Sunday Times* Problem required the value of the (unique?) number which, if squambled once, produced a three-digit answer, and if squambled twice, produced the original number increased by 1.

However, George Sassoon of Tytherington was prompted to ask the result of iterating the squambling function for a given initial argument — his investigation has produced the following loops:

Using the notation N/L where N denotes the largest number in the loop and L the total number of numbers (i.e. the length) in the loop;

1/1, 43/1, 63/1, 278/8, 43055027/105

PROBLEM SQAM. Investigate the behaviour of the squambling function defined as above, reproduce George Sassoon's loops, and address the questions: how many loops are there? Are there starting values for which the process diverges?

PROBLEM EXTENDED SQAM. Reduce the powers to which each digit is raised by one, in line with the entry from Wells quoted above, and carry out the same investigation.

Note: While one might prefer to associate the powers with the integers in the reverse order, i.e. least significant raised to the lowest power, this is not a different problem as the input to the squambling function is essentially a string of digits.

However, the pursuit of this argument leads to reducing the powers by one yet again, to bring them into coincidence with the associated powers of ten in decimal representation. Hence a function:

MODSQUAM$(n_1 n_2 n_3 \ldots n_k) = n^0{}_k + n^1{}_{k-1} + n^2{}_{k-2} + \ldots n^{k-2}{}_2 + n^{k-1}{}_k$

For example,

MODSQUAM(6789) $= 6^3 + 7^2 + 8^1 + 9^0 = 274$.

PROBLEM MODSQUAM. Investigate the general behaviour of this function for positive integer argument.

Food for abstract thought: if the integers are represented in some (as yet unknown manner) by points in a plane, do mappings by functions such as those defined above have an elegant geometrical representation? Is there a natural way to extend such functions to rational (and subsequently irrational!) argument? What about

SQAM(a/b) = SQAM(a) / SQAM(b)

yielding

SQAM(11/17) = 2/344 (=1/172).

Clearly arguments must be in their lowest terms...?

Complete or partial responses to the above problems may be sent to Mike Mudge, 22 Gors Fach, Pwll-Trap, St. Clears, Carmarthen, Dyfed SA33 4AQ, tel 01994 231121, to arrive by 1st February 1996. Any complete or partial solutions received will be judged using suitable subjective criteria, and a prize in the form of a £25 book token or equivalent overseas voucher will be awarded to the "best" solution arriving by the closing date.

Feedback from readers

Is there a new natural constant? Lars Gullbransson of Malmo, Sweden, has been interested in the constant k defined by the transendental equation $e^{-k} + 2k/3 + 1$ since early 1993. It first arose in his study of prices on the London Terminal Market for cocoa, sugar and coffee and later appeared in an analysis of the barometric pressure readings at 0800 hours each day! k is approximately 0.874217... Do any other readers have any knowledge of this constant?

The cake-slicing problem revisited... Kevin Yeo of Chatham is interested in the number of region defined by the chords connecting n points on the circumference of a circle... BUT in the degenerate case when the points are symmetrically distributed. Any thoughts?

The Smarandache Society in the form of Dr. Muller, c/o Ehrus University Press, 13333 Colossal Cave Road, Box 722, Vail, Arizona 85641, USA, would welcome correspondence. Numerous publications may be obtained on request to Dr. Muller.

Review of Numbers Count -144- *PCW* April 1995: 'In your prime'

Programs to generate primes proved to be as popular as always, but revealed nothing exciting. Most readers who attempted problems (A) and hence trivially (B) achieved success within the computing power available to them. Paraprimes were not appealing and readers are urged to re-read Charles Lindsay's ideas as this seems to me to be a field worthy of study. Henry Ibstedt generated some results here which could, with the writer's agreement, be made available to anyone who is interested.

Dr. J.H.E. Cohn, Reader in mathematics at Royal Holloway College, established that Brown's solution was not the smallest and corrects this with a solution in which neither A nor C (58 digits) is divisible by any of 37, 17 or 21 but B=D (58 digits) is divisible by all of them.

This month's prizewinner is David Price of 13 The Hall Close, Dunchurch, Rugby, Warwickshire CV22 6NP, who used Blitz Basic on an Amiga A1200 for such computation as was necessary. Details on request.

PCW Contributions Welcome

Mike Mudge welcomes readers' correspondence on any subject within the areas of number theory and computational mathematics, together with suggested subject areas and/or specific problems for future Numbers Count articles.