1983 PCW SHOW PREVIEW

Ulster Management Centre Stand No 302
Manor House
Rathlin Island
County Antrim
N Ireland
Tel: 02657 71220

As well as a range of management training materials, Ulster Management Centre will demonstrate a game generator for the BBC, Apple, IBM, Sirius and Spectrum. Also on show will be a veterinary practice program on the Sirius, special service systems and a welfare benefits program on the Epson HX-20 — £850 complete with the computer.

Vector International Stand No 435
Becketts Wharf
Lower Teddington Road
Hampton Wick
Kingston
Tel: 01 943 1259

Vector International will show three ranges of products:
Everyman, a business management tool;
Chang Labs' integrated product line of office aids, covering word processing, financial planning, data management and graphics; and
MicroCAL, well known in the training field.

Virgin Games Stand No 276
61/63 Portobello Road
London W11
Tel: 01 221 7535

Details unavailable at press time.

Visionstore Ltd Stand No 205
3 Eden Walk Precinct
Kingston upon Thames
Surrey KT1 1BP
Tel: 01 549 4900

Details unavailable at press time.

John Wiley & Sons Ltd Stand No 332
Baffins Lane
Chichester
West Sussex PO19 1UD
Tel: Chichester 784531
Wiley publishes and distributes a wide range of computer books and software. New products from Acornsoft, Sulis Software, Sinclair Computerguides, NCC, Hayden and Ellis-Horwood combine with Wiley's own considerable output to provide a comprehensive selection.

NB: all dealers—please call, we need you!

Your Computer & Practical Computing Stand No 158
Quadrant House
The Quadrant
Sutton
Surrey SM2 5AS
Tel: 01 661 3500

Your Computer is a popular home computer magazine. Every issue contains reviews, software evaluations, games, answers to readers' problems and pages of program listings to try out. It's on sale every month at 80p. *Practical Computing* caters for business and professional users every month, priced 85p.

NUMBERS COUNT

ABUNDANT, DEFICIENT AND PERFECT NUMBERS... ALIQUOT SEQUENCES.

New readers start here. The topics dealt with in this column attempt to reach the frontiers of knowledge in number theory with the minimal background information. The problems posed therefore have no complete solution known to the author, and readers are encouraged to submit their attempts at solution, however incomplete they may seem.

A proper divisor of an integer n is any positive integer divisor of n except n itself. f(n) denotes the sum of the proper divisors of n, and $f_k(n)$ denotes the sum of the k^{th} powers of these divisors — eg, f(6) = 1+2+3=6, f(15) = 1+3+5=9.

The divisors of an integer n consist of the proper divisors of n, defined above, together with n itself. $\sigma(n)$ denotes the sum of the divisors of n, and $\sigma_k(n)$ denotes the sum of the k^{th} powers of these divisors. Thus $\sigma(n) = f(n) + n$, while $\sigma_k(n) = f_k(n) + n^k$.

n is Perfect if and only if $\sigma(n) + 2n$, *viz,* f(n) = n.
n is Abundant if and if only $\sigma(n) > 2n$.
nn is Deficient if and only if $\sigma(n) < 2n$.
eg, 6, 28, and 496 are perfect since:
1+2+3+6 = 2.6 = 12; 1+2+4+7+14+28 = 2.28 = 56;
1+2+4+8+16+31+62+124+248 = 2.248 = 496.

Since some numbers are known to be abundant and some deficient, it is natural to ask what happens when we iterate the function f(n) to produce an Aliquot Sequence $\{f^m(n)\}$ m = 1,2, . . . where by iteration we mean repeated application of the function, eg $f^3(15) = f(f(f(15))) = f(f(9)) = f(4) = 3$.

Now E Catalan Bull, Soc Math France 16 (1887-88) pp128-129, conjectured that the iteration is either periodic or stops at the number 1.

There now exists a heuristic argument together with much experimental evidence to suggest that some sequences, perhaps almost all of those with n even, are of infinite length.

P Poulet has calculated that for n=936 we obtain the sequence 936, 1794, 2238, 2250, . . . 74, 40, 50, 43, 1 containing 189 terms, the greatest of which has 15 digits.

The smallest n for which the behaviour was in doubt was 138 but D H Lehmer eventually showed that, after reaching a maximum of $f^{117}(138) = 179931895322 = 2.61.929.1587569$, the sequence terminated at $f^{177}(138) = 1$.

The next value for which there continues to be real doubt is 276 $f^{469}(276)$ = 149384846598254844243905695992651412919855640 reported to 3rd Conf Numerical Math Winnipeg 1973 by R K Guy, D H Lehmer, J L Selfridge and M C Wunderlich.

Problem

Submit a program, or suite of programs, to determine if a given integer is perfect, abundant or deficient. . . check that there are 23 odd abundant numbers less than 10,000 . . . use the same routine to iterate either the f(n) or $\sigma(n)$ function and display the resulting sequences in the most useful manner to shed light upon the Catalan Conjecture.

All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order). A suitable prize will be awarded to the 'best' entry received.

Entries, to arrive by 1 December, to: Mr M R Mudge, BSc FIMA FBCS, Room 560/A, Department of Mathematics, The University of Aston in Birmingham, Gosta Green, Birmingham B4 7ET.

Note: Submissions will only be returned if suitable stamped addressed envelopes are included.