NEWSPRINT

STOP PRESS

Amstrad Benchtest – (p170)

The original marketing plan to keep the basic machine as bare and plain as possible, with absolutely no accessories, has been rethought and a disk will be available around July.

The result will be that the Amstrad will be the cheapest CP/M micro on the market.

There will be a £400 system with a green monochrome monitor and a single Hitachi drive, including CP/M 2.2 plus the programming/teaching language, Logo, also from Digital Research.

And for £500, the same system, but with a colour display, will be available as a 'top of the range' model.

It was not possible to obtain a sample disk for the Benchtest; this will be covered in a future issue of *PCW*. However, the Hitachi drives are known to be reliable, and the only drawback is that there are many programs on CP/M which don't come readily available on 3in diskettes.

However, once there are a few thousand Amstrad systems with CP/M, I predict that there will suddenly be an interesting supply of software for the new format.

Guy Kewney

NUMBERS COUNT

Diophantine Equations

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.

Those readers who have been with us since the first Numbers Count back in February 1983 — 'Waring's Conjecture and a certain Diophantine Equation' — will recall that a Diophantine Equation is one which is solved in terms of integers only.

The first writer to study such equations in detail was Diophantus of Alexandria *c* 250AD. For example, the equation $x^2\ y^2 = z^2$ yields the integer sided right-angled (or Pythagorian) triangles beginning with (3,4,5) and (5,12,13).

Problem

Here are three distinct problems in this field, indicating fundamental differences in the state of the art relating to each. Readers are invited to contribute.

(1) Consider $z(1 + xy) = x^2 + 2y^2$; this has only one known solution in integers, namely x = 30905, y = 663738, z = 43 due to ES Barnes, *J London Math Soc* Vol 28, 1953 pp242-244. Further, LJ Mordell in *Diophantine Equations*, Academic Press 1969 writes: 'The only procedure seems to be to try if there is a solution for various values of z.' How does one best do this trying, and do we need all values of z?

(2) Consider $6y^2 = (x+1)(x^2 - x + 6)$ (those readers familiar with the Binomial Theorem will recognise this as $y^2 = 1 + x + x(x-1)/2! + x(x-1)\ (x-2)/2!$). This is known to have integer solutions for x=2,7,15 and one other non-trivial value of x (x=0, and x=−1 are regarded as trivial). Find the fourth non-trivial x-value: it has only two digits — are there others?

(3) The Arabs *c* 972AD are believed to have been the first to study the pair of simultaneous Diophantine Equations

$$y^2 = x^2 + 5\,u^2.$$
$$z^2 = x^2 - 5\,u^2$$

The solution x=41, y=49, z=31 and u=12 was published by Leonardo of Pisa 1220AD. A further solution x = 3444161, y = 4728001, z = 113279 and u = 1494696 is known, as is a yet larger solution involving 15-digit integers.

Theoretically, this problem is completely solved because algebraically every solution may be derived from Leonardo's by rational operations. See Uspensky and Heaslet, *Elementary Number Theory*, McGraw Hill 1939 pp419-427.

How efficiently can the above solutions be found using a computer? Readers are invited to submit a program, or suite of programs, to investigate the above questions. All submissions should include program listings, hardware descriptions, run times and output; they will be judged for accuracy, originality and efficiency. A prize of £10 will be awarded to the 'best' entry received by 1 July 1984. Please address all correspondence to Mr MR Mudge, 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffs WV4 5NF.

Absolute differences of Prime Numbers — December 1983

This problem proved to be exceptionally popular, attracting multiple responses from Belgium and West Germany. The languages chosen included VSAPL under CMS in a 2Mbyte virtual machine of a 4Mbyte IBM4331/2; Pascal on an Altos ACS 68000 with the Unix System III in multi-user mode; C-language on an IBM Personal Computer; Basic on an Acorn Atom with 29k of RAM but with a 7-track ½in tape drive interfaced to give mass storage with a transfer time of around 4k per second.

The prizewinner however, after a very careful evaluation, is Michael Robinson of 2 Lower Merrion Street, Dublin 2 who addressed himself precisely to the problem as posed. Using Cobol written for a 16-bit micro, with assembly routines for the repetitive parts, the program was ultimately run on a Burroughs B22 up to a_{110} = 103961 and then in mortuary time on a B21. A very careful operations estimate was included and the entire study well documented. a_{64} = 5940 was reached in 4mins 42secs from approximately 6000 primes, the study being terminated at a_{146} = 733576 in 27hrs from 786575 primes, the last of which was 11975597. Empirical evidence for the Gilbreath conjecture is considerably strengthened by this computation, revealing, for example, that around a_{126} = 271621 large differences are seen 'spreading like ripples in a sea of 0s and 2s.'

Perhaps those who submitted studies of this problem could communicate one with another either via Michael Robinson or myself, with a view to a final assault on the a_n and its associated number patterns? END

Note. Submissions can only be returned if a suitable stamped addressed envelope is provided. Telephone comments, both favourable or otherwise, are welcome on (0902) 892141.