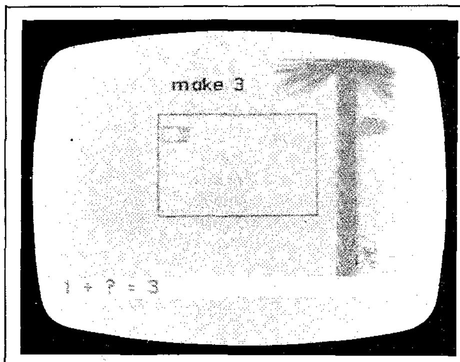


COUNTABOUT

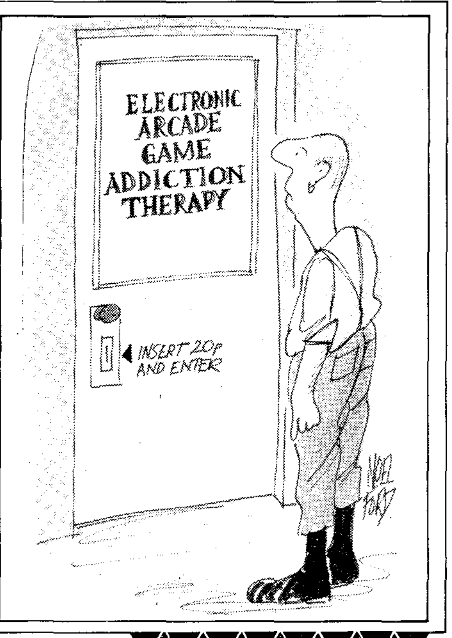
Program: Countabout
Machine: 16/48k Spectrum
Publisher: Longman Software
Available from: Retail outlets
Price: £7.95
Age range: 4-6 years

Countabout in intended to introduce children to the concepts of simple addition and subtraction.

Between one and ten everyday objects are presented in a box on the screen. By adding to or subtracting from the number of objects in the box, the child attempts to end up with a given total. If seven objects are presented, for example, and the child is asked to make three, he will have to subtract four.

A correct response results in the appropriate number of objects entering or leaving the box via little trap doors, a tuneless jingle is played and a monkey climbs a little further up a banana tree. After two incorrect responses, the correct solution is graphically displayed. The game ends when the monkey reaches the bananas.

Documentation: Brief but adequate.
Conclusion: Aside from the awful jingle (!), a very nice program. Likely to prove extremely useful as an aid to simple arithmetic. END



NUMBERS COUNT

THE PERSISTENCE OF AN INTEGER

Mike Mudge muses mathematically

In the sequence 6788, 2688, 768, 336, 54, 20, 0, each term is the product of the decimal digits of the previous one; thus 6.7.8.8 = 2688.

The number of steps before a given integer collapses to a single digit (in the above example 6) is defined to be the *persistence* of that integer. (N Sloane, *Journal of Recreational Mathematics,* 6, 1973, pp 97-98).

The smallest integer with persistence n is denoted by y(n).

n	1	2	3	4	5	6
y(n)	10	25	39	77	679	6788

Notes:

(i) In binary (base 2) the maximum persistence is trivially 1, since only digits 0 or 1 may be present.

(ii) In base 3 (as used by the first generation of Russian digital computers) the second term is zero or a power of 2, since only digits 0,1 or 2 may be present.

There is a conjecture that all powers of 2 greater than the fifteenth contain a zero when written base 3: (this is certainly true up to 2^{500}) this conjecture implies that the maximum persistence in base 3 is 3.

(iii) Sloane has conjectured that in base b there is a number, which he denotes by c(b), such that the persistence cannot exceed c(b).

(iv) Erdös has considered theoretically the case where one forms the product of the *non-zero* digits and asks how fast one reaches a single digit and for which numbers the descent is slowest.

Problem

Submit a program, or suite of programs, to investigate some of the following:

(a) To compute y(n) for n = 7,8,...,11, see M R Mudge, *Mathematics in School,* Vol 12, No 1, January 1983 for these results.

(b) To attempt to find y(12), it is known to be greater than 10^{50}.)as are y(n) for all n greater than 11.)

(c) To investigate the expansion of 2^m base 3 for m significantly greater than 500. See note (ii) above.

(d) To investigate the persistence of an integer in bases greater than 3, within the context of note (iii) above.

(e) To construct empirical evidence relating to the work of Erdös, note (iv), above, where any zero digits are excluded from the product.

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 January, 1984, 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.

U-sequences

Responses to this problem tended to concentrate on the fundamental U-sequence, ($u_1 = 1, u_2 = 2$), several reaching $u_{20000} = 268553$ and beyond.

The algorithms used for construction were the obvious ones and run times were often great. Readers interested in accessing these working programs are reminded that this is a genuine research problem, with no known 'correct answer', but I would hope to be able to put them in contact with other U-sequence enthusiasts.

However, a fundamental error in Muller's work or its subsequent interpretation has been revealed, in fact approximately 36.4% of the terms differ by 2 and not the 60% quoted. Frantic attempts are being made (M.M) to obtain sight of Muller's thesis from The State University Of New York at Buffalo, so that his algorithm can be studied: readers will be informed as soon as this has been achieved.

Interested readers are also referred to M C Wunderlich's, *The Improbable Behaviour of Ulam's Summation Sequence, in Computers and Number Theory,* Academic Press, 1971, pp 249-257, for further information.

Those correspondents writing in Basic and reaching typically $u_{220} = 2034$ in the fundamental sequence or as far as u_{100} in a range of related sequences resulting from somewhat arbitrary choice of u_1 and u_2 are not really in a position to add to the existing empirical evidence.

The choice of a prizewinner this month has proved difficult, but in the context of originality and dedication it is Mr P J H Fox of 12 Plumpton Close, Luton, Beds LU2 8JU using Forth with many assembler definitions who has stored the U-sequence as a difference table pending further investigation. He has incidentally two successive terms differing by more than 255; readers may like to discover for themselves and maybe contact Mr Fox.

The prize of £10 will shortly find its way North, up the M1, roadworks permitting.

END