LEISURE LINES

by J J Clessa

Quickie

No prizes, no answers! What can be found at the back of a bus and at the front of a sports car?

Prize puzzle

In a certain street in East London, there are six families whose surnames are Adams, Baker, Chambers, Dawson, Eastwood and Finch.

In each family there are three children, and of the 18 children in all, there are three Malcolms, two Bernards, two Susans and two Tinas. The others are Anne, Charles, Leslie, Yvonne, Peter, Roger, Joan, Fred and George.

The families decide to select one child from the 18 to represent the street at a forthcoming festival. The method of selection is as follows:–

The families line up in alphabetical order, and within each family the children are also placed in alphabetical order. Then, starting with the first child of each family — Adams family first — the children count off alphabetically, and the first child who is 'counted' with the initial letter of his own christian name is to be the one selected for the festival.

Thus, the Adams' first child calls 'A'; the Bakers' first child calls 'B'; and so on to 'F' for the Finchs'.

Then the Adams' second child calls 'G'; Bakers' second child calls 'H'; and so on.

Finally when 'R' is reached by the third child of the Finchs' the count goes back to the start again. Also when 'Z' is reached, the count continues with 'A', 'B', etc.

After 20 times through the alphabet, still no decision has been reached, so the families decide to call it a day and choose instead the only child of Mr and Mrs Grant, who also live on the street.

What are the christian names of the children in each family?

Answers please — postcards or backs of envelopes only — to reach *PCW* by 31 August, 1983. Send your entries to: *PCW*, August Prize Puzzle, Leisure Lines, 62 Oxford Street, London W1.

May prize Puzzle

A good response — about 180 in all — of which about 30 were disqualified because they were not on postcards or outsides of envelopes.

Now, to the May winner — drawn by random selection from the mostly correct heap. The correct entry was from Les King of Ormskirk, Lancashire. Congratulations Mr King — your prize is forthcoming.

Meanwhile, to all others, keep trying, your turn might be next.

The winning solution was:–
Celia was the Mother; and
Doris was the Daughter.

NUMBERS COUNT

Indefatigable Mike Mudge continues to reveal his zest for numbers.

HARSHAD NUMBERS IN THEORY AND PRACTICE

In the *Journal of Recreational Mathematics*, Volume 13, 1980-81, D R Kaprekar defines a Harshad Number (H-Number) for d as a number that is a multiple of the sum of its digits, d. For example, 247 is an H-Number for 13 because 2+4+7=13 and 247 = 13 × 19.

Clearly every positive integer less than 10 is an H-Number for itself. Kaprekar states that there is at least one H-Number for each positive integer, hence there is an infinity of such H-Numbers, since if N is an H-Number for d then so is $10^n H$ for n = 1,2,···. N is said to be a Non-Zero Harshad Number (NZH-Number) for d if it is an H-Number for d and *none* of its digits are zero.

Note: The number of NZH-Numbers for a given d is clearly finite and the difference between any two of them is by definition a multiple of d.

Problem A: Given d, a positive integer, find the smallest H-Number and the largest NZH-Number for d.

Problem B: Generalise the above results to arithmetic radix $r \neq 10$. Known theoretical results include the following:

If $m = 3^s$ then

(i) the largest NZH-Number for m is the Repunit R_m defined by $(10^m - 1)/9$. viz. a sequence of m 1's.

(ii) the smallest H-Number for m is $9R_n$ where $n = 3^s - 2$.

Known practical results include the following:

(i) 37999 is the smallest H-Number for 37

(ii) 2918999999999 is a small H-Number for 101

(iii) 8587 followed by 27 nines is a small H-Number for 271.

Are (ii) and (iii) the smallest H-Numbers?

Readers are invited to submit a program, or suite of programs, to solve the above problems. 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 prize of £10 will be awarded to the best entry received.

Entries, to arrive by 1 October, 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.

Steinhaus Problem

The Steinhaus problem attracted detailed submissions in both Basic, assembly language and Z80 Machine Code on hardware including a NewBrain AD, BBC Micro, and ZX81. Undoubtedly the 'best' submission was that programmed in assembly language on a TRS-80 model one 16k, the machine language program being down loaded onto a 48k ZX Spectrum for running. This technique adopted by Gordon Grant of 305 Stand Lane, Radcliffe, Manchester, M26 9JA allowed the determination of all cycles for orders from 2 to 12; the results being printed on a Tandy line printer VII. Gordon can expect a bonus for the orginality of his approach in the form of a publication in one of the mathematical journals.

A cheque for £10 is on its way to Manchester and it is hoped that Gordon will advise readers of *PCW*, through the correspondence column, of the progress with his attempts at publication.

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