```
program memoryaccess;
var j,k,l:integer;
begin
  writeln ('s');
  for k := 1 to 10000 do
    for j := 1 to 10 do l := j;
  writeln ('e')
end.
```

```
program forloop;
var j,k: integer;
begin
  writeln ('s');
  for k := 1 to 10000 do
    for j := 1 to 10 do;
  writeln ('e')
end.
```

```
program realarithmetic;
var k:integer;
  x:real;
begin
  writeln ('s');
  for k := 1 to 10000 do
    x := k/2★3+4−5;
  writeln ('e')
end.
```

```
program magnifier;
var k: integer;
begin
  writeln ('s');
  for k := 1 to 10000 do;
  writeln ('e')
end.
```

NUMBERS COUNT

ABSOLUTE DIFFERENCES OF PRIME NUMBERS... AN HYPOTHESIS OF GILBREATH.

Mike Mudge presents more mathematical mind-benders

A Prime Number is defined to be a positive integer greater than 1 that is divisible only by itself and 1. Thus the sequence of primes (known since the time of Euclid c 400BC to be infinite) begins
P = (2,3,5,7,11,13,17,19,23,29,31,37,41, 43,47, . . .).

The first row of the table of Absolute Differences of Prime Numbers is obtained from P by taking the absolute values of the differences between successive terms: thus $|\triangle_1 P| = (1,2,2,\underline{4},2,4,2,4,6,2,6,4,2, 4,6, \ldots)$

This elementary process is repeated to obtain consecutive rows of absolute differences:
$|\triangle_2 P| = (1,0,2,2,2,2,2,2,\underline{4},4,2,2,2, 2,0, \ldots)$
$|\triangle_3 P| = (1,2,0,0,0,0,0,2,0,2,0,0,0, 2,\underline{4}, \ldots)$

For any positive integer n we define a_n to be the smallest positive integer such that the $(a_n + 1)$ − th. term of $|\triangle_n P|$ is the first such term to be greater than 2; thus from the above $a_1 = 3$, $a_2 = 8$, and $a_3 = 14$.

In 1958, NL Gilbreath conjectured that the first term in each row, $|\triangle_n P|$, is unity. If we could prove that $a_n > 2$ for all n then the validity of Gilbreath's conjecture would be established.

*W Sierpinski, *A Selection of Problems in the Theory of Numbers,* Pergamon Press, 1964, page 35. Empirical evidence suggests that a_n is indeed a rapidly increasing function of n, but to the best of my knowledge the required result has not been proved.

Problem

This month's problem is in two distinct parts:

(i) To generate the first N-terms in the sequence P of Prime Numbers for a given N.

(i[1]) Alternatively, justify the direct input of P from existing tables or a 'library-tape'.

(ii) To generate the first M values $a_1, a_2, a_3, \ldots a_m$ for a given M, verifying in the process that $a_4 = 14$, $a_5 = 25$, $a_{10} = 59$, $a_{15} = 174$.

Conjecture the type of function best describing a_n as a function of n: this work may be aided by the use of a graphical output device if available. A valuable reference could be provided by RB Kilgrove & KE Ralston, *On a conjecture concerning primes,* MTAC vol 13, pp 121-122. 1959.

Note. Please include, in addition to the usual program listings, hardware descriptions, run times and output, a count and breakdown by type *viz* multiplication, addition, etc, of the number of arithmetical and logical operations needed to establish $a_{64} = 5940$. This may be precise or an intelligent estimate; its purpose is to compare and contrast the widely differing approaches which are possible to this problem.

Submissions will be judged for accuracy, originality and efficiency (not necessarily in that order), and a suitable prize will be awarded to the 'best' entry received.

Entries, to arrive by 1 February, 1984, to: Mr MR 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.

Review of n-tuples

The response to this project was most disappointing, whether due to the summer weather, holidays, the title, or some property of the problem is not apparent.

It would be most informative to receive readers' suggestions as to why this problem was found to be particularly unattractive and perhaps to indicate desirable characteristics of number theoretic problems suitable for investigation using a microcomputer.

(i) The smallest common sum of four associated triples is indeed 118, arising from (14,50,54)a(15,40,63)a(18,30,70)a(21,25,72).

(ii) The smallest common product of four associated triples is indeed 25200, arising from (6,56,75)a(7,40,90)a(9,28,100)a(12, 20,105).

Minimum sum n-tuples.

	N	Sum	Product
Triples . . .	4	118	37800
	5	185	83160
	6	400	846720
	7	511	1965600

There exists no 8-tuple with sum less than 835.

	N	Sum	Product
4-tuples . . .	4	24	720
	5	42	7200
	6	52	10800
	7	51	7200
	8	60	20160
	9	71	30240
	10	80	75600
	11	105	100800
	12	105	201600

There exists no 13-tuple with sum less than 112.

	N	Sum	Product
5-tuples . . .	4	20	360
	5	25	720
	6	30	2160
	7	34	2880
	8	39	4320
	9	47	10080
	10	45	8640
	11	53	14400
	12	54	30240
	13	52	20160
	14	61	20160

There exists no 15-tuple with sum less than 61.

Many of the above results are due to our recent prizewinner, Mr G Grant, of Manchester.

Now, with regard to this month's prizewinner, neither the response nor the resources justify separate prizes according to hardware or software. I therefore nominate Mr Gareth Suggett of 69 Stockbridge Road, Chichester PO19 2QE for his achievements in Basic on a BBC model B. £10 will be despatched to the south coast in due course.

PS Why is each product listed in the table divisible by 360? Answers on a postcard to GS GG or MM !! END