MUSICAL INTERLUDE

TRACKS & PATTERNS

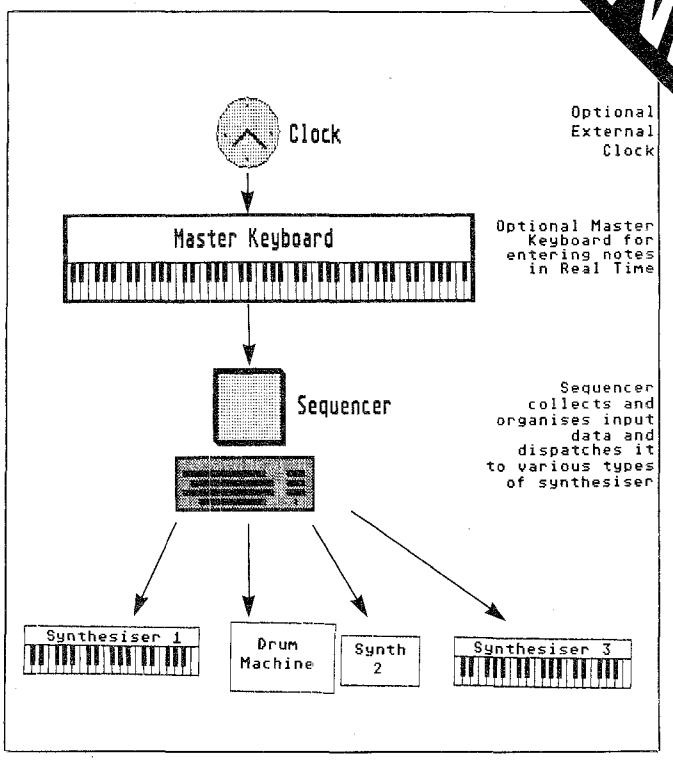
Sequencers often split the computer's memory into different areas or 'tracks' — think of them as separate documents on a word processor, except that the tracks are all audible (or on the screen) at one time. There may be 60 or more tracks available but only one may be altered at any time. These could have totally different things recorded on them, and can be edited, copied or deleted as desired. Furthermore, tracks can usually be sub-divided into patterns, which can be manipulated in similar ways. This system avoids re-entering identical data throughout a song which, for example, has four verses. On most instruments these verses are exactly the same. The verse pattern need only be recorded once for each instrument and then copied and moved around as required.

CRITERIA

When comparing sequencers, check the amount of memory available for note storage, both in terms of RAM and disk, editing facilities, the number of tracks and/or patterns available and the clock resolution (which is as crucial to the quality of recording as the screen resolution is to graphics).

External clocking is vital if a sequencer is to be used in recording studios, as it allows the sequencer to be synchronised with a tape recorder so that different sequences can be recorded on the same piece of tape and still be in time with each other.

Roger Howorth is a freelance computer journalist and sound recording engineer who owns and experiments musically with an Atari ST. If you would like to share your musical experience with Roger or you would like to pass on any interesting snippets, why not write to him care of *PCW*, 32-34 Broadwick Street, London W1A 2HG.



The diagram shows a basic set-up for a sequencing system (all detail has been omitted)

NUMBERS COUNT

Magic squares, sums and cubes — no, it's not a combination of Rubik's Cube and Paul Daniels, but this month's Numbers Count column from our own mathematical marvel, Mike Mudge.

Definition A 'magic square' of order n is a table of n^2 natural numbers written in n rows and n columns such that the sum of the numbers of each row, the sum of the numbers of each column, and the sum of the numbers in the two principal diagonals are all equal.

Albrecht Dürer, a 16th century German artist, made a famous engraving entitled 'Melancholy' which contains the magic square of order 4:

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

in which the sums mentioned above are all equal to 34.

In *Problems in the Theory of Numbers* (Pergamon Press, 1964) W Sierpinski quotes the following magic squares of order 3 & 4 consisting of prime numbers only:

569	59	449
239	359	479
269	659	149

17	317	397	67
307	157	107	227
127	277	257	137

347 47 37 367

The magic sum in the above cases is 1077 and 798 respectively.

Sierpinski further quotes the *Recreational Mathematics* magazine (October 1981, page 28) as displaying a magic square of order 13, consisting of 169 distinct prime numbers.

The conjecture has been advanced that for n greater than 3e (where e is approximately 2.718), there exists infinitely many magic squares formed from n^2 distinct primes.

Readers are invited to write computer programs to construct and display magic squares of a given order using:

(i) natural numbers less than a specified N;

(ii) natural numbers between specified N_1 and N_2; and

(iii) prime numbers only.

An obvious extension of this work would be to magic cubes where, for example, the magic sum may be required in each plane parallel to the faces or in some other carefully defined region.

Readers are invited to express their thoughts on the possible generalisation of the magic square to three (or more!!) dimensions. Submissions should be sent to Mike Mudge, 'Square Acre', Stourbridge Road, Penn, Staffordshire WV4 5NF to arrive by 1 January 1988.

All submissions will be judged using subjective criteria, and a prize will be awarded by *PCW* to the 'best' contribution received by the closing date.

It would be appreciated if such submissions contained a brief summary of results obtained, in a form suitable for publication in *PCW*.

Please note that submissions can only be returned if a suitable stamped addressed envelope is provided.

(April's review on 'W-sequences' will appear in next month's issue.)

Mike Mudge welcomes correspondence on any subject within the areas of numbers theory and other computational mathematics. Particularly welcome are suggestions, either general or particular, for future Numbers Count articles; all letters will be answered in due course.

Isolated readers can be put into contact with others sharing the same interests. However, greater efficiency regarding published problems should result from contacting the prizewinner.