MICROCHESS

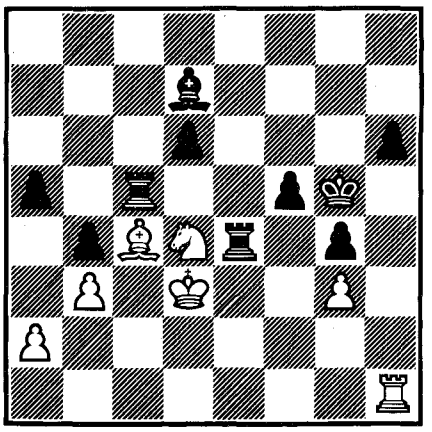
play endgames ... or can they?

23	...	Rf8-d8
24	Kg1-f2	Kg8-g7
25	Kf2-e3	f7-f5
26	h3-h4	Rd8-e8
27	Ke3-f4	

Of course, not 27 Rd2xd6? Be6xc4+ and 28...Bc4xf1, winning another piece.

27	...	Ra8-d8
28	h4-h5	Kg7-f6
29	Bf1-e2	g6-g5+
30	Kf4-f3	h7-h6
31	Be2-d1	g5-g4+
32	Kf3-f4	Be6-f7
33	Bd1-c2	Re8-e5
34	g2-g3	b7-b5

There is no rush to take the h-pawn. Indeed, it would not be good at the moment due to 34...Bf7xh5 35 Rd2-h2 Kf6-g6, and Black's bishop is stuck.



Black is in control

35	c4xb5	c6xb5
36	Nc3-e2	Re5-c5
37	Ne2-d4	Bf7-e6
38	Rd2-f2	b5-b4
39	Kf4-e3	Rc5-e5+
40	Ke3-d2	Be6-d7
41	Bc2-d3	Kf6-g5
42	Rf2-f1	Rd8-c8

Now Black has taken over all the important squares.

43	Bd3-c4	Kg5xh5
44	Bc4-f7+	Kh5-g5
45	Rf1-h1	Rc8-c5
46	Bf7-c4	Re5-e4
47	Kd2-d3?	

The final mistake. 47 Nd4-e2 would have enabled him to prolong the hopeless struggle.

47	...	d6-d5
	0-1	White resigns

After the bishop moves, 48...Rc5-c3+ forces away the knight's defender so that the other rook can remove the hapless steed.

NUMBERS COUNT

Mike Mudge looks at the interesting sums of reciprocals.

The harmonic series 1/1 + 1/2 + 1/3 + 1/4 + . . . is known to be divergent, which means that the sequence of partial sums:
$S_n = 1/1 + 1/2 + 1/3 + 1/4 + \ldots 1/n$
does not tend to a limit as n tends to infinity.

The sequence, S_n, in its lowest terms begins (1/1, 3/2, 11/6, 25/12, 137/60, 49/20, 363/140 . . .)

Problem 1a. What is the most frequently occurring denominator?

Problem 1b. Can there be a repetition among the numerators?

Note. $S_{13} = 1145993/360360$,
$S_{14} = 1171733/360360$,
$S_{15} = 1195757/360360$.

Now $S_n - \log_e n$ tends to Euler's Constant, denoted conventionally by a small Greek letter gamma, as n tends to infinity. This constant is of fundamental importance in number theory and is approximately 0.577.

Problem 2. Determine this constant as accurately as your hardware allows.

The sum of a finite number of different terms chosen from the harmonic series may itself yield an integer — for example, 1/2 + 1/4 + 1/6 + 1/12 = 1.

Problem 3. How can a given integer be expressed as a sum of such terms?

Reference: RC Lyness, *Math Gaz* 24, 1940, pp206-209, established that the decomposition of 10 requires more than 12366 terms.

Consider now the sum of three fractions of the form 1/n (not necessarily all different) write $T_3 = 1/x + 1/y + 1/z$.

Can T_3 yield 4/n for any n greater than 1? For example, 4/2 = 1/1 + 1/2 + 1/2,
4/3 = 1/2 + 1/2 + 1/3.

R Oblath and SA Rosati have proved this for n less than 141648.

Can T_3 yield 5/n for any n greater than 1? For example, 5/2 = 1/1 + 1/1 + 1/2, 5/3 = 1/1 + 1/1 + 1/3.

G Palama, *Boll Un Mat Ital* (3) 13, 1958, pp 65-72, has proved this for n less than or equal to 922321.

Problem 4. Construct possible T_3 decompositions of 4/n, 5/n, 6/n . . . for a range of n and investigate possible patterns. How does this extend to T_4 . . .?

Appendix . . . . . a large number

The largest number which the author has met recently is SKEWES' Number:

$$e^{e^{e^{79}}}$$

where e as usual is approximately 2.71828.

Investigate the significance of Skewes' number in number theory and determine (approximately) how many decimal digits it has.

Readers are invited to submit the results of the above investigation (to be used in the event of a tie-break situation), together with solutions to some, or all, of the above problems to: Mike Mudge 'Square Acre', Stourbridge Road, Penn, Nr Wolverhampton, Staffordshire WV4 5NF. Tel: (0902) 892141.

Submissions, which must reach me by 1 March 1986, will be judged using suitably vague criteria. A prize will be awarded for the best entry received.

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

Expanded reviews of previous problems together with, subject to the approval of the contributor, copies of detailed programs from the winning entry may also be requested.

The Moebius function — June review

Readers interested in some background to this and other elementary functions of number theory are referred to *An Introduction to the Theory of Numbers* by GH Hardy and EM Wright, OUP, 4th Edition 1960; those with mathematics background may find *Exercises in Number Theory* by DP Parent, Springer-Verlag 1984, most rewarding reading.

The efficient handling of the Moebius Function on a digital computer clearly requires its storage to be restricted to two bits. (Recall that it is a three-valued function.) Thus, for example, its value for eight consecutive integers can be represented in one 16-bit integer variable: the efficient insertion and extraction of this information then being an interesting programming exercise.

The holiday period, or the predominance of Greek characters in the original article, may have been responsible for the poor response to this problem. However, the clear winner is Herr M Meuser, Aloysiusstrasse 13, 4047 Dormagen 5, West Germany, who used his Tandy model 100 with 24k RAM to tabulate M_n and S_n up to n = 5439600. The strange behaviour of these functions is clearly visible and the theoretical explanation seems as far away as ever.

Perhaps other interested readers would contact Herr M Meuser directly for an exchange of information relating to the details of his prize-winning effort. Details of the many tables produced

NUMBERS COUNT

before the days of digital computers are to be found in *Guide to tables in the theory of numbers* by DH Lehmer, Bulletin Number 105, National Research Council, Washington DC, 1941.

LEISURE LINES

Quickie

If the earth were a perfect sphere and a steel band could be placed around it, how much extra length would be needed to ensure that the band was raised 6in from the ground all the way round?

Dec 85

Prize puzzle

Short and sweet this month — and not too hard since it's Christmas. Can you make a fraction, using all the 10 digits 0-9, which has a value of 9 exactly?

Answers on postcards please, or backs of envelopes, to reach us not later than 30 December 1985.

Merry Christmas to all, and keep puzzling — it could be your turn to win next.

September prize puzzle

Obviously the September prize puzzle was much harder than usual. About 35 entries were received for this problem — and only 32 of them contained the correct solution.

The winning entry — chosen at random from the pile — came from Mr Sam Bowlin of Cambridge in the US!

Congratulations to you, Mr Bowlin — your prize is on its way.

The winning solution is as shown.

2	3	5	■	1
■	1	0	7	6
2	■	1	■	3
1	1	4	1	■
4	■	4	5	5

ACC NEWS

Rupert Steele looks at the changing face of computer clubs and this month's club news.

The amateur computer movement is growing up! It started in 1972 with the formation of the Amateur Computer Club, the first computer club in the UK. Members built their own two or four-bit processors from discrete TTL chips (and a hefty power supply), with a particular design called the 'weeny bitter' being promoted by the club. Now it's all changed. With the help of Intel, Clive Sinclair and others, home computer enthusiasts can afford to avoid detailed knowledge of the electronics and concentrate on the software.

As 'home brewing' of micro systems became less necessary, so the function of computer clubs has changed. Some clubs have 'games evenings' where the delights of the latest flight simulator or adventure game can be tried out. Others aim to give their members information, with talks and presentations. Many are showing an increasing interest in communications, with systems such as Prestel, and they are accessing computers running MUD (Multi-User Dungeon — probably the most addictive of all computer games).

As well as the local clubs, which meet to share the hobby, there are user groups for most major machines where members can obtain software (public domain, of course!) and information about the particular quirks of the machines. One of the most successful of these groups is the CP/M Users' Group, which has a large library of 8080/Z80 software written for the (machine-independent) CP/M operating system. For more information, send an *sae* to Mrs D Fordred, 72 Mill Road, Hawley, Dartford DA2 7RZ.

The Association of Computer Clubs is the national body that represents all these clubs. Our national database of clubs allows us to tell you where your nearest club or user group is, and we also have free information and advice for those contemplating starting their own clubs.

Around the clubs

Steve Janday has written with news of the Gravesend Computer Club. The club meets at 7pm every Thursday at the Council Tenants' Club, Whitehill Lane, Gravesend, and you can get more details from Steve at 58 Apsledene, Hever Farm Estate, Singlewell, Gravesend, Kent DA12 5EE. The club has a wide variety of computers, including the Spectrum, the BBC, the Commodore 64 and the Vic-20.

Kendall Jones is chairman of the Deptford Adult Games Group (no, not *that* type of 'adult games'). It has a thriving computer games section which includes competitions — including a recent one for American Football. The club meets on the first and third Sunday of every month at 3pm, until late or sometimes very late, at the Community Centre, Idonia Street, Deptford, London SE8 4LY. For more information, write to Ken, c/o the club, at the Community Centre.

Mr GA Hudson writes from 53 Alma Road, Sheerness, ME12 2PA to tell me of the Sheppey Computer Club. Its main interest is in Spectrums and QLs, but there are Commodores and occasionally IBM PCs, Epson 20s, and so on. The club meets twice a week, on Saturday afternoons, at the Seaview Hotel and Wednesday evenings at the local teachers' college. During the Wednesday meeting, there are teaching sessions in Basic, machine code/assembly language and Pascal. The club has an extensive lending library of books and (games) tapes, as well as some items of loan hardware, including a modem. For more information about this well-organised and equipped club, contact Mr Hudson at the above address.

Mr MK Gates is secretary of the Mid-Kent Micro Club (formerly the Mid-Kent TRS-80 Users' Club). The club, which now caters for all types of micro, meets at the Maidstone Teachers' Centre, Sittingbourne Road, Maidstone. The meetings are held about once a month, on Friday evenings. For more information contact Mr Gates at 65 Buckland Road, Maidstone, Kent.

Peter Kiff is the organiser of ComputerTown! Thanet. A ComputerTown! is a club, often meeting in a library, which places great emphasis on hands-on use of the micros, and may have a