
Recreational & Educational
Computing Newsletter

May/June 1986 - Volume 1, Number 3.

Copyright 1986, Michael W. Ecker, PhD. All Rights Reserved. It is unlawful to photocopy any portion of the contents herein without special license.

Editor & Publisher: Dr. Michael W. Ecker & Recreational Mathematical Software.
Published six times per year at 129 Carol Drive/ Clarks Summit, PA 18411.
Publication date is the first week after the two months of the issue date.
Annual Subscription: \$18.95; full reproduction rights \$25 extra.
Samples and back issues \$3.50 each.

Editorial

Some of the exciting developments in recreational mathematics and educational computing sometimes pass by with little fanfare.

For instance, take last September (1985). It was announced that the largest known prime number to date had been found. So what, you say?

In this issue of REC, we'll look at some of the significance of this in terms of math and computer recreations and education, as well as other aspects which may surprise you.

We have a nice problem involving postage for computer solution. We will continue trying to help the novices among you get involved with programming by giving more explicit hints for solutions, both computer-wise and math-wise. Math buffs may recognize the problem involved as a Diophantine one (which we'll define in the article).

Part 2 of Strange Attractors and Black Holes, continued from last issue, will start off with a nice card trick. Believe it or not, you'll see how all these tricks and math recreations tie in together in a neat, little bundle!

Of course, we'll have our usual other features, including at least one review, and other goodies. It all begins next page, so dig in and enjoy!

Mike

Michael W. Ecker, PhD
Editor/Publisher of REC

This issue of REC was produced on a TRS-80 Model 4P using the LeScript word processor from Anitek Software, and printed with a C Itoh 8510 Prowriter.

Update on Largest Prime Number (Sept. 1985)

Though I'll describe this largest prime number found (in a moment), first recall what we're talking about. A prime number is a natural number greater than 1 whose only divisors are 1 and itself. The first few primes are 2, 3, 5, 7, 11, 13, 17, 19, 23. Recall also that the number of primes is infinite, a theorem which may not be obvious and which was first proved by Euclid - of Euclidean geometry fame - a few thousand years ago. Thus, there is no largest prime.

So, why go on looking for larger and larger prime numbers? There are lots of reasons: the sheer challenge of finding them for number theorists and math & computer recreation buffs; their utility in security codes in which factoring numbers - breaking numbers down into primes - is involved; their connection to other elegant aspects of mathematics.

Consider the last aspect with the new number. It is a number which, when written out in usual fashion, contains 65,050 digits. If memory serves, the number has the form $2^{216,091} - 1$. If you read my early "Recreational Computing" columns in Popular Computing in mid-to-late-1983, then you might recall that such a prime has a special significance.

You see, whenever a number which can be expressed in the general form $2^n - 1$ (where n is a natural number) is prime, then the new number $2^{n-1} \cdot (2^n - 1)$ can be proven to be a special number called a perfect number. A perfect number is just a natural number with the property that the sum of all of its divisors other than itself is the number. For example, 6 is perfect because its divisors less than itself are 1, 2, and 3, but $1 + 2 + 3 = 6$. The next perfect number is 28. Can you find the next one?

In the case of 6, if you use the prime number $n = 2$, the form gives $2^{2-1} \cdot (2^2 - 1)$, which of course is our 6. Can you tell which prime gives the perfect number 28?

You might think that each ^{such} prime number gives a corresponding perfect number, but this is not so, even though the first few primes do do this. In fact, the number of perfect numbers known is about only 30 now, with this latest discovery.

Hhmmmm, ... "only" 65,050 digits, huh?

Note: When you write us - and we hope more of you do - if you would like a reply or acknowledgment, please enclose a self-addressed, stamped envelope. Thank you! We have mostly TRS-80s and IBM compatibles, so check before mailing disks. We'll keep you posted as we develop capability of reading other disk formats.

Before we get to the "meat" of this issue, a special "thanks!" to good patron-friend Mr. Darryle Parker, of Monroe, Michigan, for a very generous financial contribution to REC! Besides the obvious help from such financial support, dear readers, more significant to me is the beautiful expression of feeling it conveys. Even your letters just to say that you really enjoy REC really make my day. Thanks, Darryle, and thank you readers who write with expressions of enjoyment.

(By the way, notice how valiantly I resisted the temptation to say, after noting how these letters make my day, "Go ahead... Make my day!")

Editorial Update and Query

Production: Well, the TRS-80 Model 4P is in worse shape than it was last month, so I'm using the Model 3, of which the 4, 4P, and 4D are successor models. The second drive of the 3 is out now, too. Hope I can finish this issue before all my computers go Ka-bloopy! (Anything to keep from having to rush into using one of the high-powered word processors for the IBM/compatibles, although I have started using Volkswriter Deluxe 2.2, and will be using 3.0 soon. I will give The Newsroom a try in a forthcoming issue, too.)

This issue should be back on schedule. Ideally, I won't even be mentioning such mundane matters in the future. It might also interest readers to know that the entire profit for one year of REC - in fact, more than the profit - has been invested in equipment, including two photocopy machines, plus more on computer equipment (we have seven computers and two printers as well). I tell you this to indicate that I would like REC to be around for the long haul. As for the photocopy machines, I needed a second to be able to reproduce REC in-house, as the first one was not producing decent quality, and so I had been paying to have REC offset.

Policy Question: I've been pretty free with using the names of solvers, inquirers, contributors, etc. Should REC make a policy not to use names unless permission is explicitly given? I hope not. So, if I don't hear a storm of protest to the contrary, then I will continue with the policy I've been using implicitly up until now, and make it explicit here: Any reader who does not request anonymity will be assumed to be tacitly granting tasteful and appropriate use of his or her name in the context in which it arose. Thus, readers who contribute either money or solutions or problems or programs or whatever, can expect to be mentioned. Is this okay with you readers?

Contributions: This is an area where I particularly like to express my gratitude. You don't have to contribute a bundle to be mentioned, either.

I also wish to remind you that I am not actively soliciting as such in the sense of a fund drive, but some of you must realize that this is not a money-making enterprise and are concerned about REC folding. Donations or not, the main issue will be seeing whether we can maintain a sufficient subscription base. One way to show you wish REC to continue in 1987 (at least) is by renewing early - meaning even right now. Besides, by doing so now, you'll beat a price increase, should one become needed in the future.

Level: Please let me know if you would like to see more elementary activities.

Other Activity: At this time, since some of you were nice enough to ask, I am writing full-time, self-employed, after 14 years of being a mathematics professor. I will return to academia as soon as possible, but this year I will be reviewing for Government Computer News, the Computer Shopper, and one or two others, perhaps, possibly including magazines for which I was a contributing editor before, notably Byte and Soft Sector. I have just contracted to write for Family Computing magazine, but on finances, not recreations, and to write for the National Business Employment Weekly. (How's that for fun?)

Enough of this business. I'd just like to invite you to phone (not collect) me at (717) 586-2784 if you'd like to chat instead of writing.

Let's get on with the fun, including a surprise on the next page.

The First REC Sweepstakes and First REC Contest

As a promotion for REC, and to have a little fun, we're going to have a sweepstakes and a separate contest. The sweepstakes will be judged by a random drawing and is open to everybody, whereas the contest will have a skill component and is open to subscribers only. Here are the rules and the prizes:

Sweeps - Send your name and address on 3x5 paper, indicating whether or not you are a subscriber, to:

Dr. M. Ecker/ REC's First Sweepstakes/ 129 Carol Drive/ Clarks Summit, PA 18411. Top prize will be a choice of software from a list to be compiled later, the retail value of which can be as low as \$20 or as high as \$2500. Second prize of free subscription to REC for one year. If winner has already subscribed, he may elect to receive a \$25 savings bond (value at maturity). Only one entry per person. Deadline: Feb. 1, 1987. Random drawing on Feb. 2, 1987.

Contest - (Subscribers only) On separate entry from your sweeps entry, send your name and address on standard 8 1/2 x 11 paper, with a program to calculate the first 100 prime numbers. (See this issue for definition of prime number). You may get help, but program should be original and one goal is speed. However, you must not have any DATA statements, use any data files or input/output, or otherwise have the answers themselves, other than the number 2 being the first known prime, already within the program itself. Include the name of the machine on which you tested the program and your best speed in seconds and/or minutes. (If possible, list the speed of the machine. For instance, an IBM-PC runs at 4.77 MHz.) Judging will be on the basis of speed, particularly relative to your machine (why should AT users win automatically?), elegance of code, and transportability to other machines. Do not use machine-specific calls, peeks, pokes, assembly language or ass. lang. subroutines, etc.

Prizes: Same as for the sweeps, except that for each 100 new subscribers or more the contest generates, there will be a grand prize of a home computer. Winner will be given a choice among such models as the Color Computer, Spectravideo, Commodore, subject to availability at the discretion of REC. In the event that the contest and sweepstakes combined fail to generate at least 100 new subscribers, no home computer will be awarded (after all, the prize money comes out of the subscription money). Send entries to:

Dr. M. Ecker/ REC's First Contest/ 129 Carol Drive/ Clarks Summit, PA 18411

Contest deadline - same as sweeps. Winners will be announced in REC shortly after the conclusion of the contest. You may obtain help, but your work should be otherwise original. Only one entry per person. Judge's decision is final. You may possibly see some announcements in other publications. This should be a fun, interesting way to help us grow and afford fun for readers and new subscribers.

Editor's Tips and Hints - We'll be looking for conciseness as well. Very long programs will not, in all likelihood, be looked upon with favor. Also, there must be no-precomputation of when to stop in the program. That is, the program should be easily modifiable, with little human intervention, so as to provide, say, the first 50 prime numbers. Please have your printouts sent to the screen via Print commands, rather than to the printer with Lprint commands. Failure to follow any of the rules will result in disqualification of the entry, regardless of quality otherwise.

A Postage Problem: How much did I spend?

As a matter of general practice, I purchase postage in these denominations, in cents: 1, 14, 17, 22, 39. At any one time, I have a drawer with plenty of such stamps (1 cent, 14 cent, ...).

Suppose that I spent exactly one dollar on postage, but know that I did not use any one-cent stamps in the process. I might have used some combination of some or all of the others. Can you tell me how many of each I purchased?

Now, there may be more than one solution, and you probably can find one in a minute or so just by trial and error. Can you write a computer program to do this for us? It should print out all solutions obtained.

As a hint to get you started, realize that you must spend 100 cents precisely. Moreover, the cost, in cents, of buying x stamps at 14 cents is $14x$; of buying y stamps at 17 cents is $17y$, etc. The sum of such terms ($14x + 17y + \dots$) must therefore be 100. You should consider some appropriate loops to test all possibilities, but you don't want the program to work harder than needed.

In one of the next two issues, we'll look at one or more solutions from you readers, so send in your best solution. All readers who provide a program listing and printout of output will be given credit or otherwise mentioned in that issue. So, come on: send in those solutions!

Strange Attractors and Black Holes (Part 2)

In the previous issue of REC, we considered questions involving numerical recreations in which you do some process to a number, such as taking the sum of the cubes of its digits, and possibly repeating that process to the new number thus formed, and so on.

One question asked is: Are there numbers for which the result of the process is the number you are doing the process to? For instance, with 153, if you cube each digit (to get 1, 125, and 27 respectively) and then sum, you get 153, the same answer. (In mathematics, we would say that 153 is a fixed point of the function f defined by $f(n) = \text{sum of cube of digits of } n$, where n is a natural number. However, it is not essential to be conversant with this topic.)

One other question asked is: What if the number is not "self-replicating" in the manner of 153? Does anything interesting happen then? In this example, it turns out that if you take any multiple of 3 (it has to be a multiple of 3), and iterate the process, eventually you hit 153. Now that's interesting!

I therefore define a number as being a black hole with respect to some function (or process, if you prefer to keep the terminology at a low level), if:

- 1) The process applied to the number produces the number itself, and,
- 2) The process applied to many numbers, possibly all other numbers, when iterated sufficiently, eventually hits the number in part 1) (at which point further iterations only keep producing the same value).

I now present a card trick without further explanation, and in the next issue of REC, I'll explain how it relates to this phenomenon I've described above. For some of you, it is possible that you will not see the connection, but I will provide it next issue, so be patient. I might add that there are more analytical/mathematical proofs of the trick's validity, but I find the

diagrammatic one I will present easier and more relevant. For now, just enjoy!

The trick: Take an ordinary deck of playing cards, and carefully count out and choose 21 cards. Leave the other 31 cards aside, and use just the 21. Now deal out the cards, face up, in 7 rows (horizontal) and 3 columns (vertical). Ask a friend to think of one of the 21 cards on your table. Have him or her now tell you whether the card is in column 1, column 2, or column 3.

Now, this is the important part. Let's say that the friend reports column 1. Carefully pick up the cards a column at a time in such a way that the column picked (#1 in this case) is always picked up second, or, if you prefer, in the middle. (The middle is related to our black hole here.) You might pick up the second column first, then the first column, then the third, all placed together in that exact order. Remember: The chosen column must be sandwiched in.

Now lay out the cards in the same fashion, but be sure to deal out the cards horizontally, which is to say, across rows of three cards each, for a total of seven rows. (Do not lay the cards out by going down columns, or the trick will fail.) You now will have your 21 cards out again. Ask your friend where his or her card is now in terms of which column. Repeat my instructions from before, picking up cards and making sure the column identified is sandwiched in. For maximum effect, show disinterest in looking at the cards themselves. Lay out cards again as before, and ask one more time (for a total of asking 3 times). Put cards together as before.

Now you have a choice in how you can present your finale. Probably the most relevant way to next month's pictorial explanation is to lay out the cards (again, still laying them out across in seven rows of three each). The card in the very middle - that is, the card in the middle (2nd) column, middle (4th) row - is the card your friend chose. (This center position is the black hole.)

Try the trick out, and let me know how it works. If you have other such tricks, send them in. I know of many others, and most of the time they are familiar ones sent in, but I don't mind giving you all some credit. The same applies to programs, new challenges, etc. Again, look for connection next issue.

Now that we've had that little fun, I would like to take one more moment to thank good reader/friend Dr. George D. Montag of Portland, Oregon, for his financial contribution to REC. I believe that George was himself a math instructor or professor at a community college, and remains an active ham radio buff. He confesses to the latter activity "for the last 50 odd years", but is glad to be involved with the pleasurable aspects of computing. Thanks George!

Other Materials of Possible Interest to Readers

Last issue, I mentioned some other newsletters which might be of some interest to computerists. For those of you who like following the general trend in what's going on with most of the major systems, I recommend Dr. Eydie Sloane's The Sloane Report, PO Box 561689, Miami, FL 33256 (\$96 per year of six issues). Eydie is also an educational consultant with particular concern for special education and social work, and frequently on the speaker circuit or found at conventions, educational gatherings and computer conferences. This newsletter is not concerned with programming or recreations, but I find it informative, even gossipy, but interesting reading.

Another newsletter of interest is PC Productivity Digest, 10076 Boca Entrada Blvd., Boca Raton, FL 33426. Edited by Mr. Lawrence Oakley, PCPD keeps readers current on the business end of computing. You won't find programs, recreations, or the like, but you will find a lot of updates, reviews, announcements, and that sort of thing. The editor personally tests some high-powered software and/or hardware each issue. At anywhere from \$48 to \$119 per year, depending on whether PCPD is having a promotion or special subscription offer, it's a bit pricey, but some of you readers nonetheless may find it worthwhile to follow what goes on in the main business PC arena.

1987
Update
no longer
being
published

I should also confess to an attachment: I served as temporary editor of PCPD last summer.

Speaking of PCPD, I have an extra set of it from mid-1985 to mid-1986 (up to present issue). If somebody would care to have it in exchange for a \$15 donation to REC, plus \$3 for the mailing, please let me know. You'll also be thanked in the next issue, unless you prefer anonymity.

Doubtless you've noticed the different looking output on this page. The Model 4P is in the shop again, the III's drives are in almost as bad a shape as the 4P's, and so I've switched to using the Tandy 1000, Radio Shack's basic PC clone, and Volkswriter Deluxe 2.2, the word processor from Lifetree Software, in plain-jane mode. Volks actually can produce proportionally spaced, right-justified output, as does LeScript, but I thought this would break the monotony. (Translation: I'm too lazy or rushed to install it.)

Speaking of Volks, I have version 3 as well as two of version 2.2, one of which is brand new and unopened, in the original wrapper. (REC does not condone piracy.) As a frame of reference, it was originally \$295, but if somebody would be interested in a fine word processor for IBM or clone, namely one of the version 2.2's, and would like to make an offer of a donation to REC, please let me know.

For those of you who own Radio Shack or Tandy computers, I've been asked to pass on the word that TRSDOS 6.02 has been upgraded to 6.02.01. I believe the upgrade is free to registered owners. (This DOS applies to Model 4, 4P, 4D owners.)

Speaking of Tandy, it has responded to competition by lowering the price of a basic 128K, one-drive Tandy 1000 (monitor extra) to \$699. Wish I had waited for these prices....

Tandy has also released the Model 102 portable computer, based very closely on the 100. Recommendation: Wait for the 100 to go on sale again for \$299 for the 24K machine, and add 8K to bring it up to a full 32K. Then look into products such as Super Rom from the Portable Computer Support Group. I reviewed Write Rom

for Computer Shopper a few months ago, and Super Rom recently for Government Computer News. Also, Purple Computing has a nice \$100 portable printer to complement the system.

In terms of other recommendations for neophytes, I suggest attending local computer shows as a good way to pick up software and other goodies (disks, printer paper, hardware, computers, peripherals such as printers). Prices are coming down on even the biggies. It's becoming the norm to see \$400-600 software going for about \$100. And, though I know you think I've forgotten that this newsletter is devoted to recreations and education, you can get good bargains on entertainment and the like. I attended one computer show for hams and hobbyists, and saw software such as Pac-Man, Centipede, and other classics for Apple, Commodore, Atari, TI, IBM, TRS-80, etc. for under or around \$10! You'll also see IBM clones going for around \$700 and up. This is a good time to buy! Let's see if I still say that after PC Expo in New York City tomorrow (July 9th)! Hope my press credentials are good!

Returning to publications, if you want to keep up with business, I like InfoWorld and PC Week. The latter is free to qualified subscribers. Anybody out there want me to write up how to get free subs to such publications? Drop me a note....

"I goofed" department: I just noticed that I promised to define a Diophantine equation on page 1 but did not do so in the postage problem. It's an equation involving more than one variable, but whose solutions are restricted to integers (whole numbers). The fact that there are more variables (unknowns) than equations leads to the possibility of many solutions, but many of those solutions may be rejected due to not being integral. As a simple example, consider the equation $3x + 4y = 100$. One solution is (0,25) -- meaning $x=0$ and $y=25$ -- and another is (33,1/4). However, we might reject the latter solution if we stipulate that we want integral values only.

Letters department: Good reader Richard Barth contributed an alternate program for the 50-card problem and a one-page letter (which I won't reproduce here solely for reasons of space limitations) tactfully encouraging greater care for structured code and time-honored programming techniques. These could include remarks, more suggestive variable names, little or no use of GOTO, insights into speeding up execution, etc. By way of a survey, how many of you are concerned about this? How many of you feel that just doing the job is enough, and to heck with fancy devices, structured programming, etc.? How many of you need help with programming and are not even clear what the issue is?

That will be it for this issue. I know we have a bit to catch up on, there are lots of announcements to be made, etc. Look for lots of other great stuff coming next issue!

*Till then - Enjoy!
Mike*