DOZENAL SOCIETY OF AMERICA
c/o Math Department
Nassau Community College
Garden City, LI, NY 11530

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THE DUODECIMAL BULLETIN 55;

The 1985 DSA Annual Meeting Ended on a Light Note.

SCHEDULE -- 1986 ANNUAL MEETING, Page 4;

Volume 2#;
Number 3;
Fall 1986
1196;

THE DOZENAL SOCIETY OF AMERICA

(Formerly: The Duodecimal Society of America)

is a voluntary, nonprofit, educational corporation, organized for the conduct of research and education of the public in the use of base twelve in numeration, mathematics, weights and measures, and other branches of pure and applied science.

Membership dues are $12.00 (US) for one calendar year. Student membership is $3.00 per year, and a Life membership is $144.00 (US).

The Duodecimal Bulletin is an official publication of the DOZENAL SOCIETY OF AMERICA, Inc., c/o Math Department, Nassau Community College, Garden City, LI, NY 11530.

The DSA does NOT endorse any particular symbols for the digits ten and eleven. For uniformity in publications we use the asterisk (⋇) for ten and the octothorpe (#) for eleven. Years ago, as you can see from our seal, we used χ and ℰ. Both ⋇ and χ are pronounced "dek". The symbols # and ℰ are pronounced "el".

When it is not clear from the context whether a numeral is a decimal or a dozenal, we use a period as a unit point for base ten and the semi-colon, or Humphrey point, as a unit point for base twelve.
Thus ½ = 0.5 = 0;6.

THE DUODECIMAL BULLETIN

Whole Number Five Dozen Five

Volume 2#; Number 3;

Fall 1196;

FOUNDED 1944

IN THIS ISSUE

Patricia McCormick Zirkel, *Editor*
Editorial Office:
6 Brancatelli Court
West Islip, New York 11795

DOZENAL SOCIETY OF AMERICA

Annual Meeting

Friday to Sunday
October 10 to 12, 1986
*(October * to 10; 1196;)*

Nassau Community College
Garden City, LI, NY 11530

Schedule

Friday Evening, October 10, 1986

A theatre party, with friends and spouses. Possible shows include the comedies *Alone Together* or *Brighton Beach Memoirs* at local theatres, or Walt Disney's *World on Ice* at the Nassau Veterans Memorial Coliseum.

Following the show we will gather locally for refreshments and fun -- location to be decided by the participants.

Saturday, October 11, 1986

I BUSINESS MEETING -- Tentative Agenda

10 A.M. (Administrative Tower - Nassau Community College)

1. Call to order; attendance - G. Zirkel
2. Minutes of 1985 Annual Meeting - F. Newhall
3. President's Report - G. Zirkel
4. Treasurer's Report - J. Malone
5. Editor's Report - P. Zirkel

SCHEDULE, 1986 ANNUAL MEETING, Continued

6. Reports of other Officers, as called for.

Reports of Committees

7. Annual Meeting - Catania, Berridge, Smith, Gwydir
8. Finance - Scordato, D. George, Malone, P. Zirkel, Razziano
9. Nominating - Catania, Berridge, Scordato
   (a) Election to Board of Class of 1989
   (b) Election of Nominating Committee for 1986-1987
10. Reports of other Committees, as called for.
11. New business

Continued . . .

Fred Newhall and Alice Berridge listen to the President's Report at the 1985 DSA Annual Meeting.

II. BOARD OF DIRECTORS MEETING

1. Call to Order - J. Impagliazzo

2. Election of Officers

3. Remarks

4. Committees and Appointments for 1986-1987

III LUNCHEON

12 to 2 P.M.

PRESENTATION OF AWARDS

IV AFTERNOON PRESENTATIONS

Speakers - Partial Listing

1. Gene Zirkel

WHAT! ANOTHER SET OF SYMBOLS?

Binary Coded Dozenal Digits

2. Other speakers, as scheduled

V EVENING

Members, spouses, guests and friends will gather for cocktails and dinner, as we did last year, on the top floor of the Nassau Community College Administrative Tower. We will dine and mingle amidst spectacular views of all Long Island and the New York City skyline. Last year's cost was $20.00 per person.

Sunday, October 12, 1986

Sightseeing and departure, at leisure.

Please let us know if you plan to attend, so that arrangements can be made for refreshments,, tickets, etc. Out-of-towners who call will be directed to local hotels.

For further information, please call us at

(516) 669 - 0273

WHAT DO YOU THINK?

Member Charles F. Marschner writes the following:

> The solution of problems based on 12s and the conversion of higher math to the dozen system is very necessary. However, I fear that you may lose more supporters than you gain by being more esoteric in the regular publication. May I suggest that, to gain adherents, your Dozenal Society *Bulletins* bang away at the basics, repeating if necessary the fundamental advantages of a 12s system...

What do you think about the level of articles in this *Bulletin*? Too esoteric? Not esoteric enough? More metrics? Less metrics? Computers? Other number bases? Why not drop us a line today and let us know what type of articles you would like to see in future *Bulletins*. Thanks for taking the time to write! *-Ed.*

TWO-WAY NUMBERS

Cedric Smith
University College, London, England

Hindu-Arabic numerals and the decimal point constituted the most far-reaching revolution in history, penetrating every corner of the globe. For the first time arithmetic became easy for all numbers great and small.

But the system has several defects. Traditional criticism has concentrated on the inelegance of the base ten. But among other points one may mention:

(1) while most people find it easier to write from left to right, the most frequent arithmetical operations go from right to left. Wouldn't it be better to reverse numbers, writing this year as 6891 = ;6911? (See Gene Zirkel, *Duodecimal Bulletin* 52;, 10-12.)

(2) The figures 1, 0 are frequently written exactly like the letters I, O.

(3) The decimal point, written with a ball point, is usually so small as to be almost invisible. what is worse, the numbers written 1.234 and 1,234 in English-speaking countries usually become 1,234 and 1.234 elsewhere, sometimes resulting in international confusion.

Reform is tempting, but it is also wise to ask just how much difference it would make. Ideally one should have controlled comparisons, such as presenting two teams with a series of sums, which sums one team is to do decimally, the other duodecimally, and then comparing the results for speed and accuracy. This would give a numerical measure of relative advantage.

In the absence of such tests some clues are possible. The multiplication 4 x 5 = 20 is easy in decimals, and 4 x 6 = 20 easy in dozenals, because there is only one non-zero figure in the answer. One could therefore try writing out the addition and multiplication tables using various bases,

and finding the average number of non-zero figures in the entries. Don't forget that times have changed. Fifty years ago almost all calculations were done by hand; today only additions, subtractions and simple multiplications are done by hand or mentally; otherwise pocket calculators are easier to use, quicker and more reliable. Also a change can be difficult (though not necessarily impossible) if it needs general agreement. We still have the QWERTY typewriters, and the eccentricities of English spelling, whereby ONE, TWO are pronounced WUN, TOO (ridikyoolusli unsootid too a wrld in hwich Inglish has bikum in praktis dhee yoonivrsl seknd langwidj)!

As it happens, there is at least one way of considerably simplifying arithmetic which doesn't require general acceptance (though that would help). It is also applicable to any scale, decimal, dozenal, or whatever. That is the use of negative digits, or what the (duodecimalist) engineer J. Halcro Johnston called "Two-way numbers". The famous mathematician Cauchy used them extensively, remarking that "addition, subtraction, multiplication, division, the conversion of ordinary fractions into decimals, and all the other arithmetical operations will be found to be greatly simplified." I have used them for over forty years in my professional work.

I give only a few examples, hoping to inspire the reader to explore on his or her own. To denote -1, -2, etc., let us turn the figures upside down: I, Z, Ɛ, ϧ, S. (A more traditional way is to write a bar over the figures: $\overline{1}$, $\overline{2}$, etc. This is OK for occasional use, but in regular use it has the disadvantage that the bar can easily be overlooked or displaced unintentionally.) To make an easier comparison with ordinary life, I use decimals; there is no difficulty in finding similar examples in dozenals. Since 24 means 20 + 4, 2ϧ will mean 20 + ϧ = 20 - 4 = 16. Similarly 81 = 100 - 20 + 1 can be written 1Z1, and 729 as 1ƐZI, and so on, thus dispensing entirely with the figures 6, 7, 8, 9. Notice that the familiar formulas

$$(x - y)^2 = x^2 - 2xy + y^2,$$
$$(x - y)^3 = x^3 - 3x^2y + 3xy^2 - y^3,$$

Continued . . .

with x = 10 and y = 1 immediately show that 1Ƨ1 = 11² (i.e. 81 = 81) and 1Ɛ3I = 1³ (i.e. 729 = 729), which is much less obvious in the form 81 and 729. The sum 729 + 81 in ordinary (one-way) and two-way numbers is:

```
          7 2 9            1 Ɛ 3 I
        + __8_1          + __1_Ƨ_1
(carry)   1 1
          8 1 0            1 Ƨ 1 0
```

Twice there is a carrying figure in the one-way form, but no carry in the two-way form, because positive and negative digits tend to cancel, as 1 + I = 0. Notice also that there is no need for a minus sign to indicate negative numbers: -2 can be written as Ƨ, and -34 as Ɛ4. So subtraction does not need to be learned as a separate process; just change the sign and add.

Thus the subtraction sum 729 - 81 becomes

```
          7 2 9          1 Ɛ 3 I
        - __8_1        + __I_2_I
          6 4 8          1 4 5 Ƨ
```

In the one-way form, one has the problem "8 from 2 won't go", but not in the two-way form. Since the digits 1 + 4 + 5 + Ƨ clearly add to 0, it is immediately obvious that 1454Ƨ is divisible by nine (11), which is not so obvious in the form 648.

From the product 4 x 5 = 20, one can immediately deduce that 4 x 5 = 4 x 5 = 5 x 4 = 5 x 4 = Ƨ0, and 4 x 5 = 5 x 4 = 20, thus greatly reducing the amount of memorizing in the multiplication table.

The recurring decimal 1/7 = .142857... is famous. In two-way form it is .143I4Ɛ..., revealing an "alternating" structure.

Two friends and I have started a journal, *Colson News*, similar in form to the *Duodecimal Bulletin*, to explore the properties of two-way and other unorthodox numbers. We send fraternal greetings to the *Duodecimal Bulletin*.

For those who are interested the subscription rates are £1 for Vol.1 (1984/20Ƨ4) and £2 for Vol.2 (1985/20Ƨ5). (Checks in sterling, please, made out to "Cedric A.B. Smith", (not Colson News), 141 Portland Crescent, Stanmore, Middx, Ha7 1LR, England.)

TGM Still Available!! *-- See Review, this Issue!*

Copies of Tom Pendlebury's *TGM: A Coherent Dozenal Metrology based on Time, Gravity & Mass* are still available. Send for your *FREE* copy today.

BOOK REVIEWS

TGM: A Coherent Dozenal Metrology based on Time, Gravity & Mass

Compiled by Tom Pendlebury
Dozenal Society of Great Britain
Denmead, Hants, UK; 1985

TGM, or Time, Gravity and Mass, is a comparative system of dozenal measurement including measures of time, distance, mass, force, work, energy, power, temperature, geometry, electricity, chemistry, sound and light -- practically everything except a dozenal calendar. There are also many intriguing innovations in terminology and notation. *TGM* is virtually a whole metrological language of dozenal measurement.

The featured innovation of *TGM* is the novel way distance is defined and measured. The gravity foot is defined as the distance an object falls in a unit of time. This measure simplifies many calculations involving gravity and weight that are frequently encountered in engineering and physics.

TGM also offers a clever solution to a current scientific debate. Some scientists prefer to define and measure energy in mechanical units, while others insist that thermal measures are best. In *TGM* both mechanical and thermal are measured in identical units, dispensing with this dilemma quite gracefully.

In contrast, the zero point of the temperature scale is set at the freezing point of water, which seems to be clumsy by comparison. Many computations in thermodynamics would be simplified if the scale began at absolute zero instead. *TGM* generally employs consistent dozenal base, except for its division of the circle and the day into twenty-four units instead of twelve. This inconsistency is intended to simplify certain calculations in radial geometry. However it is debatable as to whether this unoxthodoxy is actually simpler than the pure dozenal system proposed in the *Manual of the Dozen System*.

One may also wonder if the gravity foot is ultimately the best way to measure distance on the earth. The earth can be mapped very nicely by a dozenally divided grid of identical geodesic squares covering the entire globe. Such a system would simplify geographical and navigational calculations. It would require a unit of distance based on the geodesic properties of the earth, rather than gravity.

Despite the disputable flaws, *TGM* is generally a very impressive system. It is vastly superior to any other availible system. It provides an exhaustive compendium of dozenal measurement within a single reference. It should prove indispensable to dozenalists who are ready to start living and breathing by the dozens. It also offers a very inspiring model for those interested in creating their own system. We may hail it as a giant leap for dozenkind.

-Jerry Brost

The American Metric Journal

AMJ Publishing Co.
BOX 3251
Camarello CA 93010

The *AMJ* has been mentioned in these pages before. With all the biased materials published by those who are for or against the metric system, it is always refreshing to pick up a copy of this *Journal*. It continues to honestly present both sides of the news regarding metrics. For example, in the July/August 1986 issue on pages 28-29 one reads:

> "In the past, many sources of metric information have selected only the stories of success and the encouraging experiences to relate to the public. They were anxious to assist the country in conversion and felt it would be best accomplished by avoiding the problems and pitfalls.
>
> "It has been the firm belief of the *Journal* editorial staff that telling both sides of the story and relating both the good and the bad

Continued on page 13;...

AN ANSWER

Jean Kelly
New York, NY

In the last issue of this BULLETIN John Earnest posed some questions on pronouncing numerals in various radices or bases. One possible answer follows. Using radix 3 as an example we have:

dozenal numeral	radix 3 numeral	pronunciation of radix 3 numeral
1	1	one
2	2	two
3	10	radix (or one-radix)
4	11	radix one
5	12	radix two
6	20	two-radix
7	21	two-radix one
8	22	two-radix two
9	100	radix-squared
*	101	radix-squared one
#	102	radix-squared two
10	110	radix-squared radix
11	111	radix-squared radix one
12	112	radix squared radix two
13	120	radix-squared two-radix
	etc.	

Thus the numeral 3456 in any radix would be pronounced as

3-radix-cubed 4-radix-squared 5-radix 6

just as it is pronounced

3 thousand 4 hundred fifty six

in radix dek.

AN ANSWER, Continued

The other question John posed: how to pronounce the numerals A thru F in hexadecimals, might be solved as follows.

We sometimes hear people pronounce 2* or 3# as 2 do ten and 3 do eleven instead of 2 do dek or 3 do el. In the same way we might pronounce the hexadecimal digits A thru F as

ten, eleven, twelve, thirteen, fourteen, and fifteen.

Using these ideas the hexadecimal numeral A3F could be read digit by digit as

'ten three fifteen' instead of 'A 3 F'.

This would certainly be a lot clearer to students of computer science who often have great difficulty in understanding the size of the number represented by the numeral A3F.

If we combine the two ideas above, we might want to pronounce A3F as

'ten-radix-squared three-radix fifteen' instead of

'A-radix squared three-radix F'.

BOOK REVIEWS, Continued from page 11;

better prepares an individual to cope with the many obstacles encountered in learning an entirely new international language of measurement."

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"All other nations changing to the modernized

Continued . . .

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metric system in the past ten years have had to compel the citizens of each and every nation to make the change. In the beginning some contended the conversion was voluntary, but all enacted various kinds of legislation in order to enforce the exclusive use of metric."

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"In Europe, there are many variations and varieties of metric. They have not changed to the SI."

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"Those who started on a voluntary program, in all known instances wound up with several types of legislation."

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"Up to this time in history, we have had over 100 years to change to metric on a voluntary basis. It has been legal to use metric scince 1866, and less than 5% of the nation elected to use it at any one time. The fact is, we need various forms of legislation to enforce the use of metric over the customary. We will never get the public to volunteer to forget the old and adopt the new completely." (Emphasis added)

Of course, I would take issue with the idea that *we need* such legislation. Far from it! What we need is freedom to use whatever system we wish to -- freedom to decide what is best for ourselves without Big Brother forcing his wishes down our throats. Freedom of the majority from the tyranny of a few who know "what is best for us". -Gene Zirkel

PROGRAM TO CONVERT TO BASE TWELVE

Bruce Newhall

The following is pseudo code for a computer program to convert decimal numbers into base twelve by making use of a character string. It has been implemented in both BASIC and in Pascal.

```
Start
  Initialize DIGITS = '0123456789*#'
    {DIGITS may be an array or a string depending upon
     which computer language is being used.}

  Input the number N in base ten
  If (N < 0) then
    Print '-'
    Set N = -N
  End If

  {Set TEST = to the smallest positive power of 12 > N}
    Set TEST = 12.0
    While (TEST ≤ N) do
      TEST = 12.0 · TEST
    End while

    {Find and print next dozenal digit}
    Begin Repeat Until Loop
      TEST = TEST / 12.0
      J = 11
      While (N < J·TEST) do
        J = J - 1
      End While
      Print (J+1)th character found in DIGITS
      Set N = N - J·TEST
      If (N < 1) and (TEST = 1) then
        Print ';' {the Humphrey point}
      End If
    Until (N = 0) and (TEST < 1)
Stop
```

DOZENAL JOTTINGS

...From members and friends...News of Dozens and Dozenalists....

CHARLES DALE, 193; writes from Silver Spring, MD about a nickname for the Dozenal Panda in Issue 54: "The Giant Pandas in the National Zoo in Washington all have double names (such as *Ling-Ling*), so I recommend the Dozenal Panda be called *Dek-Dek*. Anyone curious enough to ask the meaning of the name could be told about dozenals. *El-El* sounds too much like rapid transit in Chicago, and *Do-Do* has already been used -- an extinct animal would be inappropriate! Besides, note that there is even a one-to-one correspondence between the number of points on an asterisk and the number of fingers on a Panda!"...

On the same subject, JERRY BROST of Gainesville, FL comments: "If Pandas are genetically endowed with six fingers on each hand, that implies that this trait could be cloned and future dozenalists could have children with twelve fingers, and perhaps twelve toes. Who knows, maybe even twelve heads!"...

DON HAMMOND of the DSGB, from Hampshire, England, likes "the idea of the Panda, but it's difficult to think of just the right name: it should be alliterative and Panda-sounding and somenow suggestive of what we do ... a tall order! Perhaps one could simply say, 'Panda'."...

WE NEED YOUR IDEAS about the Dozenal Panda. Let us hear from YOU before our January issue...

DON HAMMOND also notes it as "interesting" that Jean Kelly, in her base-conversion algorithm (Bulletin 54;) designates a decimal number as DECIM, which is the DSGB's alternative name for ten...

DSA Fellow BILL SCHUMACHER, 84; was the first to 'crack the code' of the meaning of 'Dizebak' -- which is a spelling of our Society's name which results when a typist's right hand is shifted one key to the left!...

Nassau Community College has decreed that our DSA archives have to be moved to a new location on campus. To prepare

for the move FRED and MARY NEWHALL, GENE, PAT and GEORGE ZIRKEL, JOHN IMPAGLIAZZO and TONY SCORDATO had a 'packing party' on July 14. Short work was made of the packing of assorted Society literature, since all had been well-organized and cataloged in advance by Fred. Many thanks to him and to all who helped...

FRED NEWHALL also addressed the Rotary Club of Commack/Kings Park (LI), NY on September 23. His topic was "Dozenals in the Future." Back in May, Fred conducted two workshops on counting by dozens at the annual Student Symposium in Mathematics, held May 30 at Nassau Community College. This marked the third year that he was invited by the Nassau County Association of Mathematics Supervisors to speak on that topic...

The current issue of *Colson News* includes a very informative article on duodecimals by CEDRIC SMITH. The *Colson News* is published in England and is devoted to exploring the properties of unusual types of numbers and number notations, especially to the theoretical and practical uses of 'two-way numbers', that is, numbers using both positive and negative digits...

Continued . . .

NUMBER BASES ELSEWHERE *PART II*

In "A Babylonian Geometric Algebra", The College Mathematics Journal, volume 17, number 1, Jan 86, pp. 22-31, James K. Bidwell uses the 'Humphrey Point' (or semicolon) to indicate Babylonian fractions. The Babylonians used a base of 5 dozen, and hence we have

0;35 = 35/60 in decimals.

The Humphrey Point is so named in honor of the late H. K. Humphrey, member number 9, who for a dozen years served as Treasurer of our Society.

DOZENAL JOTTINGS, Continued

DICK TRELFA, 159; of Lisbon, NH recently donated several items to the DSA Archives. These include a copy of Andrews' *New Numbers* and **HENRY CHURCHMAN's** "Dozenal Essays of 1967"...

A flyer received recently here at our offices announced the Eugene Strens Memorial Conference on Intuitive and Recreational Mathematics and Its History. Two of the speakers featured in the flyer are the DSA's own **JOHN SELFRIDGE**, 38; and **DAVID SINGMASTER**, 28;...

EMILY K. LOVELL wrote to say that member, **ROBERT E. LOVELL**, 122; has been ill. We wish him a speedy return to health...

CHARLES F. MARSCHNER, 270; of Melbourne, FL, sent us an article on the death of the U.S. Metric Board. He also wrote about some recent travels in Europe, posing a couple of questions:

"We just returned from Scandinavia including a visit to North Cape, Norway, the northern-most point in Europe. We bused from Helsinki north, and then back to Stockholm. I try to inquire about and look at metric countries' packaging, etc., when I think of it. They have a problem! Some few in Germany pack in dozens (3 x 4) and some in 20's (4 x 5). But the latter gets too heavy. Most don't have six-packs and they sure don't have five-packs. So it's interesting. And as you know there is no equivalent word for 'mileage' -- I've never heard 'kilometerage', a real tongue-buster if it existed.

"Possibly one of your students might wish to make some observations and study in Europe of Metric System problems and shortcomings. My casual observations are far from adequate.

"Here I must wonder about the meter, an amount I recall as 1/10,000,000th of the distance from pole to equator. This was probably figured on the basis that the earth was a sphere instead of an oblate spheroid. Also, I would not be sure that the distance from South Pole to equator is the

DOZENAL JOTTINGS, Continued

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same as from the North Pole to equator. And how was 'mean surface' arrived at back in the late 18th century? Some inquisitive student could have some fun with this!"...

ELAINE SEELBACH RENSTROM of Homosassa, FL, wrote recently to the Society with regard to her deceased uncle, former member **LEWIS CARL SEELBACH**. She is researching her family history and is missing some papers...

FAYE RUSSELL of West Tisbury, MA, recently transferred her subscription to this Bulletin to her local Public Library. This both enriches the local collection and makes others aware of dozenals. In a similar vein, **ROBERT McPHERSON** of Gainesville, FL, informed his University

Continued . . .

SEXIST LANGUAGE -- *CONTINUED*

In our last issue we raised several questions concerning sexist language in our Constitution and By-Laws. The following letter, received from authors Casey Miller and Kate Swift, is pertinent:

> In writing both *Words and Women* (Anchor/Doubleday, 1977) and *The Handbook of Nonsexist Writing* (Harper & Row, 1980) we did considerable research on the word <u>fellow</u> and reached the considered opinion that it is, indeed, gender neutral and so may be used of either women or men. This opinion is based on the historical record of the word's usage.

We look forward to hearing from *YOU* on this subject.
-ED

Library of the availability of the *Dozenal Journal* of the DSGB which the library, in turn, requested through us...

Insight, June 16, 1986, page 58, reports that the Tangent Toy Company of San Francisco is marketing a 'Bubble Trumpet' that produces glistening spheroids 4 feet in diameter. Among the bubbles that can be created is a twelve-sided one...

JAMISON HANDY wrote from Pacific Palisages, CA, to comment on several items from Bulletin 54;:

"(P. 14;) **IGOR VALEVSKY's** way to convert decimal fractions to dozenal fractions, or back, caught my eye for comparison with what I did in the past. I simply wrote the decimal fraction in full 'proper' or 'raw' form. Or, to put it another way, I supplied the 'understood' or missing denominator, and then, after rendering it in the desired base or radix form, performed the indicated division.

"For example, (using Valevsky's for side by side comparison): Rewrite .125 as 125/1000 = *5;/6#4; (t5/6e4) = ;16

"It would be fun to run a time study to see which is faster, and if one method is not consistently so, which favors which class of cases. (I'm speaking of pencil and paper as the only tools available. Actually, because I had printing calculators at my disposal, I stayed decimal as long as possible and only at the last step (with decimal input) or at the first step (with dozenal input) would I convert, using tables of powers of twelve expressed in decimals to economize key punching.

"(P. 18;) With regard to **JOHN EARNEST's** question about names for digits over ten that do not clearly show radix or base structure: The Teutonic root languages go through 'twelve' before showing base (examples: 'thirteen' , and *dreizehn*), but Spanish and French do not until 'seventeen' (*dies y siete, dix-sept*), so hexadecimalists have it easy in those two languages if they choose. On the other hand, the Eastern European languages

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I happen to have looked at don't even have special words for 'eleven' and 'twelve'. They say, in effect, 'firstteen' and 'secondteen', as one might put it. I would like to see a story as to how *unodecim* evolved into 'once' and *onze*; and *duodecim* into *dolce* and *douze*.

"On the other hand (not directly related to John's question) while the French have imaginatively evolved special words for 'thirteen' through 'sixteen', through some cultural quirk, they have no 'decimal structure' word for 'seventy', 'eighty', or 'ninety'. If a Frenchman sees '99' in print, he will read it '*quatre-vingt-dix-neuf*', which is literally 'four-score nineteen', even though it is written in ten base form!"...

The Society recently heard from an Esperanto enthusiast, **VALO A. MUELEJE**, of San Jose, CA. (Esperanto was

Continued . . .

The following are available from the Society

1. Our brochure (free)
2. "An Excursion in Numbers" by F. Emerson Andrews. Reprinted from the *Atlantic Monthly*, Oct. 1934. (Free.)
3. *Manual of the Dozen System* by George S. Terry ($1;00)
4. *New Numbers* by F. Emerson Andrews ($10;00)
5. *Douze: Notre Dix Futur* by Jean Essig, in French ($10;00)
6. Dozenal Slide rule, designed by Tom Linton ($3;00)
7. Back issues of the *Duodecimal Bulletin* (as available) 1944 to present ($4;00 each)

DOZENAL JOTTINGS, Continued

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invented some years ago as a universal language. Some DSA members became very interested in it, and had much of the Society's literature translated. -*Ed.*) Valo says: "I am just on the verge of taking an active role in Esperanto. Beginning with penpals in various countries and looking for a group I can be active with for a purpose beyond just Esperanto. I am a novice at the language, however; though I have little trouble reading it. I would certainly be interested in your Esperanto literature." The Society still has literature available in Esperanto. Is anyone interested in pursuing duodecimal interests in Esperanto along with Valo??...

JOY M. HEINE, 100; has recently retired. Congratulations and enjoy!...

Welcome to new member number 2*2; **DR. SHARON WHITTON AYERS**, Professor of Math and Education at Mercer University, Atlanta, GA.

End...

A PROBLEM...

The first expedition to Mars found only the ruins of an extinct civilization. Oddly, the first bit of Martian writing to be translated was an equation, which had the following form:

$$5x^2 - 50x + 125 = 0$$

(x=5 or x=8 are solutions)

How many fingers did the extinct Martians have?

(From metronymaa *NEWSLETTER*, Spring 1985. Alan Hoenig, Editor, John Jay College, NY, NY.)

WHY CHANGE?

This same question was probably rife in Europe between the years 1000 and 1500, when the new Hindu-Arabic numerals were slowly making their inching progress in displacing the comfortable and familiar Roman numerals then universally used.

Yet, although it took D years, and despite much opposition—("Who needs a symbol for nothing?")—the new notation did come into popular use. Released from the drag of Roman notation, man's thinking leapt forward dramatically, and mathematicians discovered a new dimension in mathematical symbolism. Working with Hindu-Arabic numeration, they found that the new system better accomodated mathematical statements and facilitated the working out of ideas. Re-examining their fundamental concepts of numbers, they made advances in arithmetic, algebra, logarithms, analytic geometry and calculus, and thus contributed to the explosion of human thought which later became known as the Renaissance.

In a related development, man awoke to the fact that different number bases could be used, and as early as 1585, Simon Stevin stated that the duodecimal base was to be preferred to the base ten.

The parallel seems tenable. The notation of the dozen base better accomodates mathematical statement and facilitates ideation. It, too, is a step forward in numerical symbolism. The factorable base is preferred for the very same advantages which led the carpenter to divide the foot into twelve inches, the baker and the grocer (one who deals in *grosses*) to sell in dozens, the chemist and the jeweler to subdivide the Troy pound into twelve ounces. And yet, this is accomplished by such simple means that students in the primary grades can tell why they are better. Literally, the decimal base is unsatis**FACTOR**y because it has **NOT ENOUGH FACTORS.**

Then should we change? Yes, but no change should be forced, and we urge no mandated change. All the world counts in tens. But people of understanding should learn to use duodecimals to facilitate their thinking, their computations and their measurings. Base twelve should be man's second mathematical language. It should be taught in all the schools. In any operation, that base should be used which is the most advantageous, and best suited to the work involved. We expect that duodecimals will progressively earn their way into general popularity because they simplify the all-important problem of the correlation of weights and measures, the expansion of fractions (1/3 = 0;4) and give an advantage in calculations involving time and our twelve-month calendar. Perhaps by the year 2000, (or maybe by 1200; which is 14; years later!) duodecimals may be the more popular base. But then no change need be made, because people will already be using the more convenient base.

If "playing with numbers" has sometimes fascinated you, if the idea of experimenting with a new number base seems intriguing, if you think you might like to be one of the adventurers along new trails in a science which some have erroneously thought staid and established and without new trails, then whether you are a professor of mathematics of international reputation, or merely an interested pedestrian who can add and subtract, multiply and divide, your membership in the Society may prove mutually profitable, and is most cordially invited.

COUNTING IN DOZENS

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*	#	*10*
one	two	three	four	five	six	seven	eight	nine	dek	el	do

Our common number system is decimal—based on 10. The dozen system uses twelve as the base, which is written *10,* and is called *do,* for dozen. The quantity *one gross* is written *100,* and is called *gro. 1000* is called *mo,* representing the meg-gross, or great-gross.

In our customary counting, the places in our numbers represent successive powers of ten; that is, in 365, the 5 applies to units, the 6 applies to tens, and the 3 applies to tens-of-tens, or hundreds. Place value is even more important in dozenal counting. For example, *265* represents *5* units, *6* dozen, and *2* dozen-dozen, or gross. This number would be called *2 gro 6 do 5,* and by a coincidence, represents the same quantity normally expressed as 365.

We use a semicolon as a unit point, thus two and one-half is written 2;6.

Place value is the whole key to dozenal arithmetic. Observe the following additions, remembering that we add up to a dozen before carrying one.

94	*136*	Five ft. nine in.	*5;9′*
31	*694*	Three ft. two in.	*3;2′*
96	*3#2*	Two ft. eight in.	*2;8′*
19#	*1000*	Eleven ft. seven in.	*#;7′*

You will not have to learn the dozenal multiplication tables since you already know the 12-times table. Mentally convert the quantities into dozens, and set them down. For example, 7 times 9 is 63, *which is* 5 dozen and 3; so set down *53.* Using this *"which is"* step, you will be able to multiply and divide dozenal numbers without referring to the dozenal multiplication table.

Conversion of small quantities is obvious. By simple inspection, if you are 35 years old, dozenally you are only *2#,* which is two dozen and eleven. For larger numbers, keep dividing by 12, and the successive remainders are the desired dozenal numbers.

12) 365
12) 30 + 5
12) 2 + 6
0 + 2 Answer: *265*

Dozenal numbers may be converted to decimal numbers by setting down the units figure, adding to it 12 times the second figure, plus 12^2 (or 144) times the third figure, plus 12^3 (or 1728) times the fourth figure, and so on as far as needed. Or, to use a method corresponding to the illustration, keep dividing by *, and the successive remainders are the desired decimal number.

Fractions may be similarly converted by using successive multiplications, instead of divisions, by 12 or *.

For more detailed information see *Manual of the Dozen System* ($1;00).

DETACH HERE -- OR PHOTOCOPY

We extend an invitation to membership in our society.
Dues are only $12 (US) per calendar year; the only requirement is a constructive interest.

Application for Admission to the Dozenal Society of America

Name _____ (LAST) (FIRST) (MIDDLE)

Mailing Address (for DSA items) _____

_____ (See below for alternate address)

Telephone: Home _____ Business _____

Date & Place of Birth _____

College _____ Degrees _____

Business or Profession _____

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Annual Dues ..... $12.00 (US)

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School _____

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Year & Math Class _____

Instructor _____ Dept. _____

Other Society Memberships _____

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Alternate Address (indicate whether home, office, school, other)

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Signed _____ Date _____

My interest in duodecimals arose from _____

_____

_____

Use space below to indicate special duodecimal interests, comments, and other suggestions, or attach a separate sheet:

Mail to: Dozenal Society of America
c/o Math Department
Nassau Community College
Garden City, LI, NY 11530