COUNTING IN DOZENS

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

Our common number system is decimal - based on ten. 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.

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	*3Ɛ2*	Two ft. eight in.	*2;8'*
19Ɛ	*1000*	Eleven ft. seven in.	*Ɛ;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 *2Ɛ*, 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 *X*, and the successive remainders are the desired decimal number.

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

Numerical Progression

1	One		
10	Do	*;1*	Edo
100	Gro	*;01*	Egro
1,000	Mo	*;001*	Emo
10,000	Do-mo	*;000,1*	Edo-mo
100,000	Gro-mo	*;000,01*	Egro-mo
1,000,000	Bi-mo	*;000,001*	Ebi-mo
1,000,000,000	Tri-mo	and so on.	

Multiplication Table

1	2	3	4	5	6	7	8	9	X	Ɛ
2	4	6	8	X	10	12	14	16	18	1X
3	6	9	10	13	16	19	20	23	26	29
4	8	10	14	18	20	24	28	30	34	38
5	X	13	18	21	26	2Ɛ	34	39	42	47
6	10	16	20	26	30	36	40	46	50	56
7	12	19	24	2Ɛ	36	41	48	53	5X	65
8	14	20	28	34	40	48	54	60	68	74
9	16	23	30	39	46	53	60	69	76	83
X	18	26	34	42	50	5X	68	76	84	92
Ɛ	1X	29	38	47	56	65	74	83	92	X1

The Duodecimal Bulletin

Whole Number *28*

Volume *14*, No. *1*
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THE DUODECIMAL SOCIETY OF AMERICA

20 Carlton Place ~ ~ ~ ~ ~ Staten Island 4, N. Y.

THE DUODECIMAL SOCIETY OF AMERICA

is a voluntary nonprofit organization 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.

Full membership with voting privileges requires the passing of elementary tests in the performance of twelve-base arithmetic. The lessons and examinations are free to those whose entrance applications are accepted. Remittance of $6, covering initiation fee ($3) and one year's dues ($3), must accompany applications.

The Duodecimal Bulletin is the official publication of the Duodecimal Society of America, Inc., 20 Carlton Place, Staten Island 4, New York. F. Emerson Andrews, Chairman of the Board of Directors. Kingsland Camp, President. Ralph H. Beard, Editor. Separate subscriptions $2.00 a year, 50¢ a copy.

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The Duodecimal Bulletin

All figures in italics are duodecimal.

THE ANNUAL MEETING

The Annual Meeting of the Duodecimal Society of America was held on the 21st of April, 1960, in the Terrace Lounge of the Carnegie International Center, 1st Avenue and United Nations Plaza, New York City.

The meeting opened at 8:30 P.M., with President Camp's request that the Secretary report on the year's activities. Mr. Beard began his report with the statement that the Estate of Lewis Carl Seelbach has now been settled. The net result to the Society is $8449.82. The final payment was not made to Treasurer Humphrey until January 15th, 1960 - so that the complete total is not reflected in the Treasurer's Report for 1959.

We have enrolled 9 new members in the year, most of whom have completed their tests and become full members. This raised the membership total at year's end to 110. In the past, it has been our practice to drop no one from our rolls for non-payment of dues. We reasoned that it was short-sighted to interrupt our contact with any dozener for merely financial reasons. However, this situation was reviewed at the time of mailing of the bills for 1960 dues, and we found that nearly 30 of our membership owed three or more years dues. Since these people have been advised each year of their arrears, it was decided that further correspondence with them would be unproductive, and much burdensome work would be obviated by recognizing their evident disaffection. Therefore their names were deleted from our rolls, and the figures at present show 58 Members, 8 Student Members, total 66; and 10 Aspirants, 5 Student Aspirants, total 15; grand total 81.

The demand for our literature continues to grow, though the volume of the requests from our Esperanto friends has diminished from its initial surge. We have made one major change in our policy of free distribution of our literature at the yearly institutes of machematics teachers. Some of the requests have been for large quantities, and there has been little tangible return. We now answer such requests with the advice that the bulk rate of 10¢ a copy will apply, and such requests have subsided. No change has been made in freely supplying every individual request for duodecimal information, nor in supplying classroom quantities for the mathematics classes of teachers colleges at the request of the department head. It is noted, that the somewhat tighter policy has left us with a relative larger distribution than last year.

There have been two issues of the Duodecimal Bulletin this year, each printing order being for 2000 copies. This quantity has just about sufficed our needs, and future printings will have to be enlarged. We are well satisfied with the quality of their contents, and their presentability.

Our general publicity has been fairly good. The Portland Oregonian ran an excellent article on an interview with Fred Miller and President Camp, which has resulted in a number of inquiries from the wide area of its coverage. William C. Schumacher wrote a letter to the editor of Design News which was warmly received. It appeared in their issue of August 21st, and we still get a response to that publication. They total 67 to date.

So far, our cultivation of the field of Esperanto has not won us a very rich harvest. But many friendships have sprouted from it, among that world-wide organization of independent minds. We prize these highly, and intend to continue the unhurried cultivation of further such friendships. They take an important role in our long range planning. This past month, the Japanese Esperanto magazine, Oomoto, carried a review of the Ekskurso en Nombroj, of Mr. Andrews, and the official organ of the Universal Esperanto Association (UEA), also printed a review. There have been about a dozen reviews all told, some of them unfavorable.

Our sister organization, the Duodecimal Society of Great Britain, continues its satisfying growth, and vital activity. There have been three issues of its official paper, the Duodecimal Newscast. This is an important addition to the literature of duodecimals, and its originality is a fine tribute to its editor, Brian Bishop.

Perhaps the most important accomplishment of the year is that we can present to you the Manual of the Dozen System. This is a collation of material from many sources, setting forth in detail the number system, the arithmetic and the measures of the twelve-base, and the current practices for using that base most conveniently. It is dedicated to the memory of one of our fonders, F. Howard Seely, whose manuscript "Dipping into Dozenals," has been largely incorporated into its text. A copy of the Manual is being supplied free to every member, and sold to non-members for $1.00.

It has been a productive year, and our improved financial status permits us to plan now for a more active one.

Treasurer Humphrey then gave his report of the Society's fiscal operations for the year. Normal revenues of $286.60 were supplemented by donations of $946.74, bringing our receipts to $1233.34. Expenses for the year were as follows:

1959 Annual Meeting		$ 409.74
Printing and Publications		
Duodecimal Bulletin, 2 issues	$1058.15	
Ekskurso en Nombroj	225.65	
7th reprint Excursion in Numbers	259.92	
10 M Folders and applications	231.80	1775.52
Postage & Misc. Expense		201.97
Total Expenses		$2387.23
Deficit		$1153.89

This is the largest deficit in our history, as well as our largest budget. But the estimates for the coming year indicate greater figures for both. There will be three issues of the Duodecimal Bulletin chargeable in 1960, as the last issue was not billed until 1960, and two issues are planned for Vol. *14*. They have cost us about $550 an issue, but this figure is expected to increase. In addition, the publication of the Manual of the Dozen System will cost about $1400.

Receipts from the Estate of Lewis Carl Seelbach have added $5452.60 to our Endowment Fund in 1959, and a final $2997.22 in 1960, total $8449.82. Thus, our resources are somewhat greater than hitherto, but deficits of this magnitude may not continue without jeopardy.

Some of the publication expense for 1959 is for supplies of literature that will last well beyond the current year, and that is also true for the estimated expenses for 1960. Moreover, we can reasonably estimate some financial return from the sales of the Manual of the Dozen System. Even with such modifications, it is clear that we need additional revenue.

We wish to express our deep obligation and gratitude to those members whose donations form the larger part of our revenue. We can carry on our work only because of their generous support. And the work that we do is important, though that is not yet widely recognized. We have operated on a deficit basis for most of our years, and there is no necessity that we restrict our operations now. But the increasing budgets in prospect emphasize the grave and serious necessity for larger revenues. We have to keep healthily ahead of the costs of supplying duodecimal information to a hungry world.

President Camp then called for the report of the Nominating Committee. This recommended the reelection of the Directors of the Class of 1960 as the Class of 1963, and the election of a new Nominating Committee for 1961 as follows:

Directors F. Emerson Andrews
Louis Paul d'Autremont
Jamison Handy, Jr.
Henry C. Churchman

Nominating Committee for 1961:

Wm. C. Schumacher, Chairman
Michael L. Cantor
Nelson B. Gray

The President called for any nominations from the floor. But none were proposed, and he declared the nominations closed, and those nominated were duly elected.

Chairman Andrews was asked to review for the meeting the actions of the Board of Directors which met earlier that afternoon. He remarked that he had looked forward to relating the developments of the directors meeting, but had listened in dismay while Secretary Board had covered his material, item by item. There were some transactions which the Secretary had not reported. Mr. Bagley had suggested that there might be advantages for us in affiliation with the American Association for the Advancement of Science. The Board had requested him to proceed with the discussions with the Association with that objective in view.

Mr. Bagley had also suggested that a simple modification of the Inch Micrometer would provide us with an ideal Dozenal Micrometer. With 4 dozen threads to the inch for the spindle, and 3 dozen divisions marked on the barrel, the dozenal micrometer would read to 1/1728 of an inch directly; - and with a vernier scale of eleven divisions on the spindle, the readings could be refined to 1/20736 of an inch. This would nearly double the fine-measurement capacity afforded at present.

Mr. Terry and Mr. Beard had discussed their recent work on factorization of the nth powers of the dozen, plus or minus one, and Mr. Terry had suggested that this work should be carried forward in application to any base. It seemed possible that the theory of the Fermat primes might be disestablished except for small values of n.

Mr. Beard had been given authorization to print an Esperanto version of the Society's folder, as an effective supplement to the Esperanto literature we now have, in order to clarify and emphasize the aims of the Duodecimal Society to our Esperanto friends.

One recent development had possibilities of great significance for us. Correspondence with Brian Bishop of the Duodecimal Society of Great Britain and with Jean Essig of France, had resulted in an invitation from M. Essig for our own "Summit Conference" at his estate in Normandie with President Camp and Mr. Bishop, in late September or early October. Mr. Andrews commented that there is just the slightest possibility that he also might be in Europe at that time.

It was his pleasure, Mr. Andrews said, to inform the meeting that the guest of honor at the Directors Dinner at the Beekman Tower Hotel - was Mrs. Cora L. Fellows, who active, alert and charming in her 88th year, had passed her Aspirant's tests with distinction, who was an ardent Esperantist, and who had delighted us with her presence here tonight.

President Camp then introduced Charles S. Bagley, member of our Board of Directors, Geodesist of the Air Force Missile Development Center at the Holloman Air Force Base, past President of the American Rocket Society, a Bishop of the Latter Day Saints, and an activator of community affairs in Alamogordo, New Mexico.

Mr. Bagley made a brief address about Units of Measurement. He said that the scientific basis of the units of the Metric System has been exaggerated. For example, the foot affords a closer unit as an aliquot part of the quarter meridian than the meter. And that all such standards in any one system need to be interrelated on defined standard conditions. He cited as an instance of this, the duodecimal temperature scale, providing gro (*100*) degrees between the freezing and the boiling points of water. Under present definitions of standard conditions, Absolute Zero is then about *290*° below freezing. Modified conditions might be specified so that the freezing point would occur at *300*° and the boiling point at *400*°, providing more convenient and practical readings.

Alfonso Lomo, Ph.D. in Philology, spoke about our customary duodecimal terminology*. He mentioned several possible improvements in our names. Two-syllabled names for numbers would afford less possibility of error, and similarity of sounds should be avoided for different quantities. He questioned the desirability of "do", and has a personal preference for "zen". This happens to concur with Mr. Andrews

*See his paper, p. *1Ɛ*

original choice, but he modified this in deference to the general opinion of the original group.

The discussion that followed these talks became quite lively. President Camp interrupted it to suggest that, since the formal business of the meeting had been completed, the meeting be adjourned, and this was approved. While the refreshments were enjoyed, the meeting dissolved into the discussion groups and the personal visiting that we all relish.

BINOMIAL COEFFICIENTS $(a \pm b)^n$

by Michael L. Cantor

T ≡ Order of terms. C = Coefficient of that term.

n = 1 T	C	2 T	C	3 T	C	4 T	C	5 T	C	6 T	C	7 T	C	8 T	C	9 T	C	X T	C
1 2	1	1 3	1	1 4	1	1 5	1	1 6	1	1 7	1	1 8	1	1 9	1	1 X	1	1 Ɛ	1
		2	2	2 3	3	2 4	4	2 5	5	2 6	6	2 7	7	2 8	8	2 9	9	2 X	X
						3	6	3 4	X	3 5	13	3 6	19	3 7	24	3 8	30	3 9	39
										4	18	4 5	2Ɛ	4 6	48	4 7	70	4 8	X0
														5	5X	5 6	X6	5 7	156
																		6	190

n = Ɛ T	C	10 T	C	11 T	C	12 T	C	13 T	C	14 T	C	15 T	C	16 T	C	17 T	C
1 10	1	1 11	1	1 12	1	1 13	1	1 14	1	1 15	1	1 16	1	1 17	1	1 18	1
2 Ɛ	Ɛ	2 10	10	2 11	11	2 12	12	2 13	13	2 14	14	2 15	15	2 16	16	2 17	17
3 X	47	3 Ɛ	56	3 10	66	3 11	77	3 12	89	3 13	X0	3 14	Ɛ4	3 15	109	3 16	123
4 9	119	4 X	164	4 Ɛ	1ƐX	4 10	264	4 11	31Ɛ	4 12	3X8	4 13	488	4 14	580	4 15	689
5 8	236	5 9	353	5 X	427	5 Ɛ	6Ɛ5	5 10	959	5 10	1078	5 12	1464	5 13	1930	4 14	22Ɛ0
6 7	336	6 8	560	5 9	8Ɛ3	6 X	11XX	6 Ɛ	18X3	6 10	2640	6 11	36Ɛ8	6 12	4Ɛ60	6 13	6890
		7	650	7 8	ƐƐ0	7 9	18X3	7 X	2X91	7 Ɛ	4774	7 10	71Ɛ4	7 11	X8Ɛ0	7 12	13850
						8	1ƐX0	8 9	3883	8 X	6754	8 Ɛ	Ɛ308	8 10	16500	8 11	251Ɛ0
										9	7546	9 X	1209X	9 Ɛ	213X6	9 10	378X6
														X	24178	X Ɛ	45562

n = 18 T	C	19 T	C	1X T	C	1Ɛ T	C	20 T	C	21 T	C	22 T	C
1 19	1	1 1X	1	1 1Ɛ	1	1 20	1	1 21	1	1 22	1	1 23	1
2 18	18	2 19	19	2 1X	1X	2 1Ɛ	1Ɛ	2 20	20	2 21	21	2 22	22
3 17	13X	3 18	156	3 19	173	3 1X	191	3 1Ɛ	1Ɛ0	3 20	210	3 21	231
4 16	7Ɛ0	4 17	99X	4 18	X84	4 19	1037	4 1X	1208	4 1Ɛ	13Ɛ8	4 20	1608
5 15	2979	5 16	3569	5 17	4297	5 18	515Ɛ	5 19	6196	5 1X	73X2	5 1Ɛ	879X
6 14	8Ɛ80	6 15	Ɛ939	6 16	132X6	6 17	17581	6 18	20720	6 19	268Ɛ6	6 1X	32098
7 13	1X520	7 14	274X0	7 15	37219	7 16	4X503	7 17	65X84	7 18	865X4	7 19	Ɛ1194
8 12	38X40	8 13	57360	8 14	82840	8 15	Ɛ9X59	8 16	148360	8 17	1Ɛ2224	8 18	278808
9 11	60X96	9 12	99916	9 13	135076	9 14	1Ɛ78Ɛ6	9 15	2Ɛ5753	9 16	441XƐ3	9 17	634117
X 10	81248	X 11	122122	X 12	1ƐƐX38	X 13	334XƐ2	X 14	5307X8	X 15	82633Ɛ	X 16	1068232
Ɛ	8XƐ04	Ɛ 10	150150	Ɛ 11	272272	Ɛ 12	4720XX	Ɛ 13	7X6ƐX0	Ɛ 14	1117788	Ɛ 15	1941Ɛ07
				10	2X02X0	10 11	552552	10 12	X04640	10 13	15XƐ620	10 14	26071X8
								11	XX4XX4	11 12	18X9524	11 13	3298Ɛ44
												12	3596X48

The table can be easily extended as far as needed. The coefficient for any term for a certain value of n, is the sum of the coefficients of the same term and the preceding term for the next lower value for n. To obtain the coefficient of the 7th and 19th terms for n = 23, add the coefficients of the 7th and 6th terms for n = 22; thus: Ɛ1194 + 32098 = 123270, the coefficient of these terms for n = 23; et seq.

THE KEYSORT SYSTEM

by F. Emerson Andrews
34 Oak Street, Tenafly, N. J.

Known popularly as "the poor man's IBM," the keysort System is presently being promoted by the Royal McBee Corporation of Port Chester, New York, and Toronto, Canada. In its usual form it consists of rectangular cards with holes punched at regular intervals along all four sides. Significant data are notched into these cards by opening out one or more of these holes with a hand or machine punch, so that at this point there is an open V to the edge of the card instead of a closed hole. To sort "automatically," the cards are evened up against a guide, then the Keysorter (a long sharp-ended skewer) is pushed through the significant hole, then lifted with the pack held loosely. Of course all the V-punched cards drop down.

The chief mathematical interest of the Keysort System lies, however, in a sorting principle that is probably not widely known. In terms of operational achievement, this principle can be stated simply:

1. As many as 14 categories, represented by any number of cards in random order, can be ranged in an agreed order with no more than 4 (not 14) sortings.

   (A sorting consists in pulling out only one group of cards, which in the Keysort operation is done with a single motion of the skewer; these cards are then placed in back of the remaining cards, and all are involved in each of the four sortings.)

2. As many as 196 categories (14^2) can be ranged in an agreed order with no more than 8 sortings.

3. As many as 14^n categories can be ranged in an agreed order with no more than 4n sortings.

In the Keysort System, prepared for persons accustomed to the decimal system of numeration, the full power of the principle is not utilized; we go only to 10^n categories by 4n sortings. The top of a Keysort card may look like this:

```
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
7 4 2 1 7 4 2 1 7 4 2 1 7 4 2 1 7 4 2 1 7 4 2 1 7 4 2 1
mill'ns hun.th. ten th.  thous.  hundrds  tens    units
```

Even so short a card, using the inefficient decimal numbers, would permit arranging in an agreed numerical order up to 10,000,000 categories by only 28 sortings.

It will be observed that the only numbers used are 1, 2, 4, and 7. These are the numbers which in combination, using none more than once, will produce all numbers up to 14. It is obvious that any number up to ten million can be notched on the above card.

How Cards Are Notched				
	Notches			
Number	*7*	*4*	2	*1*
0				
1				v
2			v	
3			v	v
4		v		
5		v		v
6		v	v	
7	v			
8	v			v
9	v		v	
X	v		v	v
Ɛ	v	v		

A demonstration of how this simplified sorting actually works out may be desirable. For duodecimal mathematicians, we will take for simplicity twelve numbers, randomly arranged, and see what really happens. In the illustration that follows, the random arrangement appears first. Then we sort for *1*, with those cards punched for *1* (indicated with dots below them in the example below) removed, and placed behind the rest. Obviously, this first sorting pulls out five cards, namely, *1* (*1*); *3* (*1*+2); *5* (*1*+*4*); *8* (*1*+*7*); and *X* (*1*+2+*7*). The next line in the example shows the cards reassembled, and the dots below it show the seoond sorting, for 2; and so on.

7	*3*	*X*	*4*	*8*	*Ɛ*	*6*	*9*	*0*	*1*	*2*	*5*	Random arrangement
	.	.		.					.		.	Sorted for 1
7	*4*	*Ɛ*	*6*	*9*	*0*	*2*	*3*	*X*	*8*	*1*	*5*	Consolidated
			.	.		.	.	.				Sorted for 2
7	*4*	*Ɛ*	*0*	*8*	*1*	*5*	*6*	*9*	*2*	*3*	*X*	Consolidated
	.	.				.	.					Sorted for 4
7	*0*	*8*	*1*	*9*	*2*	*3*	*X*	*4*	*Ɛ*	*5*	*6*	Consolidated
.		.		.			.		.			Sorted for 7
0	1	2	3	4	5	6	7	8	9	*X*	*Ɛ*	CONSOLIDATED!

If the reader be somewhat amazed at the sudden falling out in proper order in the final operation, or thinks this example may have been just a happy accident, he can set up his own convenient laboratory with a deck of playing cards. Indeed, he can use all the aces, and all the twos, and all the threes, for that matter; our example used only one in each category to simplify presentation. He can also use the jacks, queens, and kings if he takes care to remember that a jack is *Ɛ* and is notched for *4* and *7*; the queen for *1*, *4*, and *7*; and the king for 2, *4*, and *7*.

To continue the sorting process to ƐƐ (or 99, decimally), one simply sorts for units as above; then, with the cards already arranged for units, sorts in exactly the same way for the dozens (or tens) section of the cards. Four more sortings do the complete job, *0* to ƐƐ (or 0 to 99). And so on.

At some convenient date we shall point out to the Royal McBee Corporation how much more efficient their already fascinating operation would be if people would count by dozens. The card with a capacity of 10,000,000, illustrated earlier, would have a capacity of 35,831,808--three and a half times as great. Moreover, the number of sortings would often be materially reduced; for example, for categories between 100 and 143 (*84* to ƐƐ) the sortings required would be reduced from 12 to 8. This is a large gain, more than compensating, even in the punching operation, for the fact that *X* cards required three punches (*7*+2+*1*).

If we consider sorting as an abstract process, without relation to the limitations of any number base to which people are accustomed and in which data are expressed, the binary system is ideal, and is, indeed, the basis of sorting theory. This is the equivalent of using 8-4-2-1 in place of the 7-4-2-1; the latter is preferable for 10-system data only because it requires no more than two punches for any numeral below 10. Merely to translate any number into its binary expression is to indicate precisely which holes are punched; the table below showing numbers up to 16 expressed as binaries will both demonstrate this principle and show precisely why any sorting system of this character "works".

Sorting by a Binary System

0	0
1	1
2	1 0
3	1 1
4	1 0 0
5	1 0 1
6	1 1 0
7	1 1 1
8	1 0 0 0
9	1 0 0 1
10	1 0 1 0
11	1 0 1 1
12	1 1 0 0
13	1 1 0 1
14	1 1 1 0
15	1 1 1 1

The binary expression is also the index for punching; and mere inspection will show that in as many sortings as there are columns all numbers must fall in proper order. It may be useful to look at a three-sorting example for binary numbers, done just like our previous example:

111	11	100	110	0	1	10	101	Random arrangement
.	.				.		.	Sorted for 1 in 1st column
100	110	0	10	111	11	1	101	Consolidated
	.		.	.	.			Sorted for 1 in 2d column (2)
100	0	1	101	110	10	111	11	Consolidated
.			.	.		.		Sorted for 1 in 3d column (4)
0	1	10	11	100	101	110	111	CONSOLIDATED!

Binary sorting (well adapted to machine manipulation) provides maximum capacity, which ascends by the successive powers of 2. The formula is, 2^n categories can be sorted by n-1 sortings, provided we use an initial zero.

DOZENALS FOR THE MATH CLUB

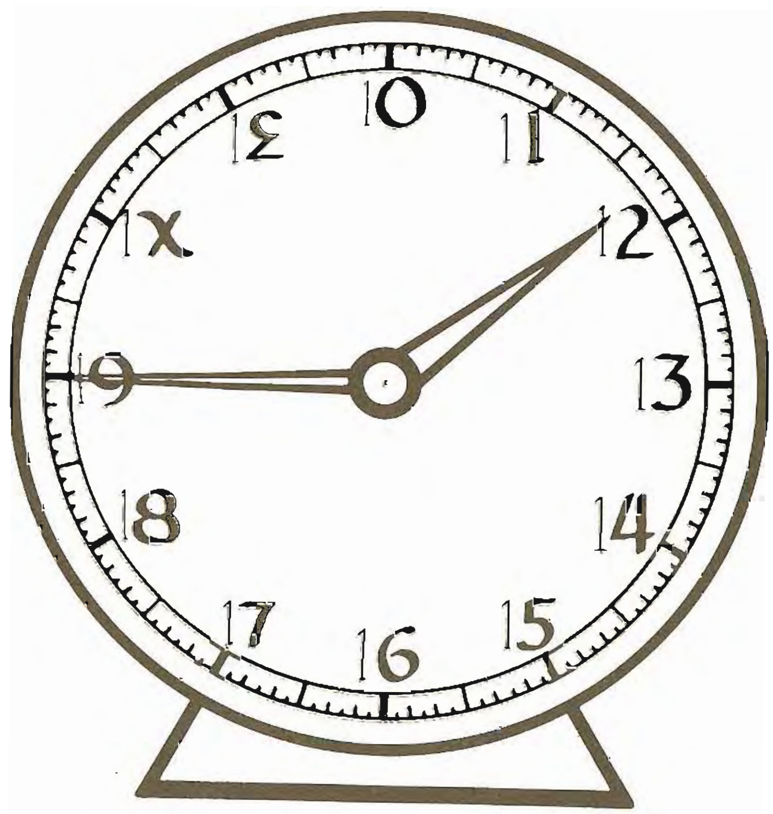
by Rev. Joachim Watrin, O. S. B.
St. John's University, Collegeville, Minn.

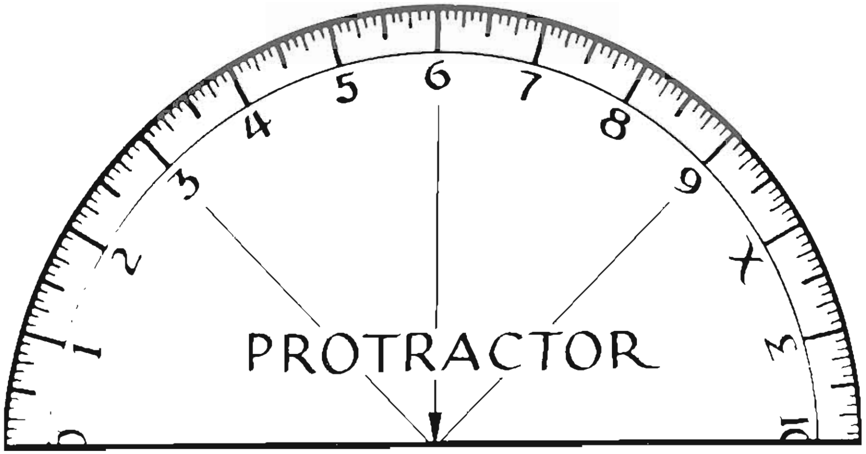
Our high-school Mathematics Club has been fruitful in encouraging independent interest and activity among its members. When the Club showed interest in duodecimals, we sought to present the dozenal idea, and its relationships, as simply and clearly as we could.

We prepared a number of charts to illustrate their applications, and these have proved effective aids in supplementing our talks. Many will not agree with the units of measure used in them, but they have served well with our pupils.

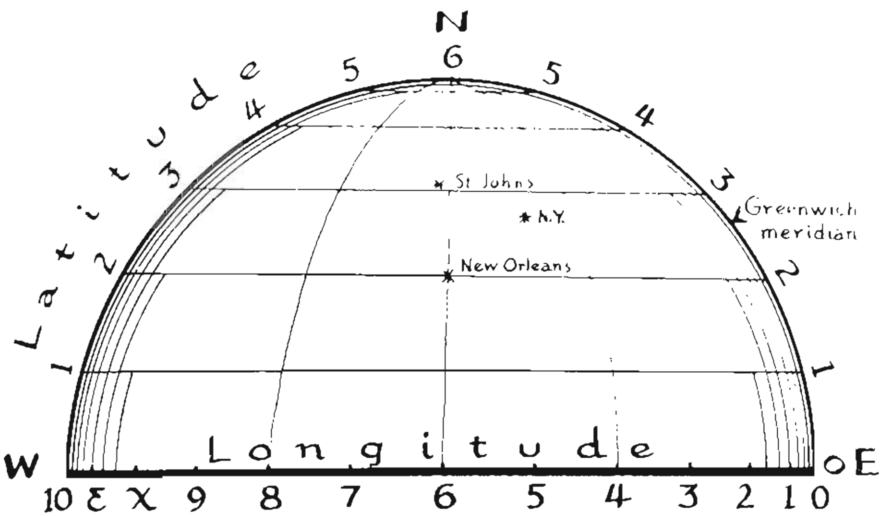
We have based the charts on the premise of dividing the straight-angle (180°), into a dozen units (do-grees). This associates them all in the simplest way.

And with this understanding, you have my permission to reproduce them in the Duodecimal Bulletin.





1 'dogree' = 15 degrees

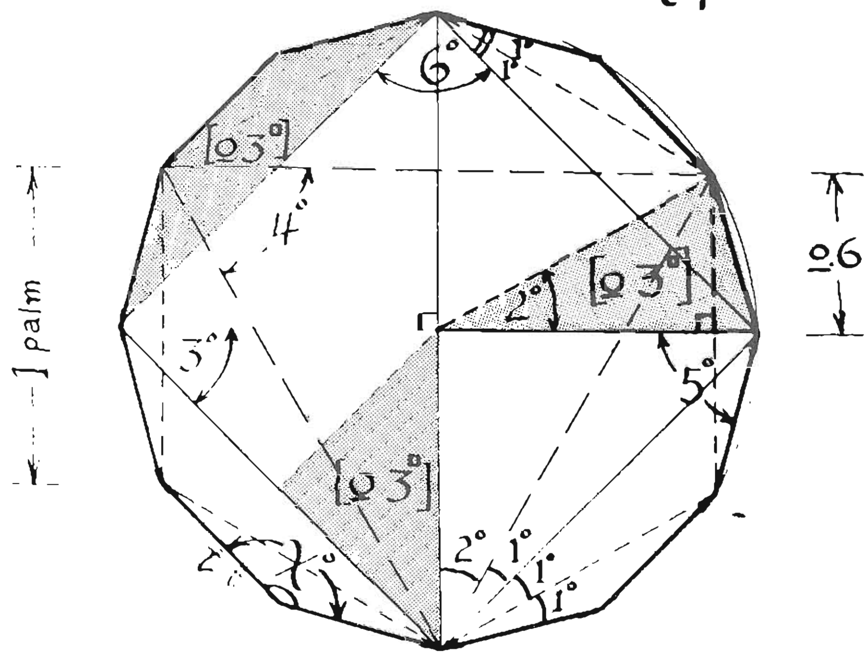


Each 'dogree' of latitude equals 1000 duodecimal miles
Each 'dogree' of longitude is one time zone

NORTHERN HEMISPHERE

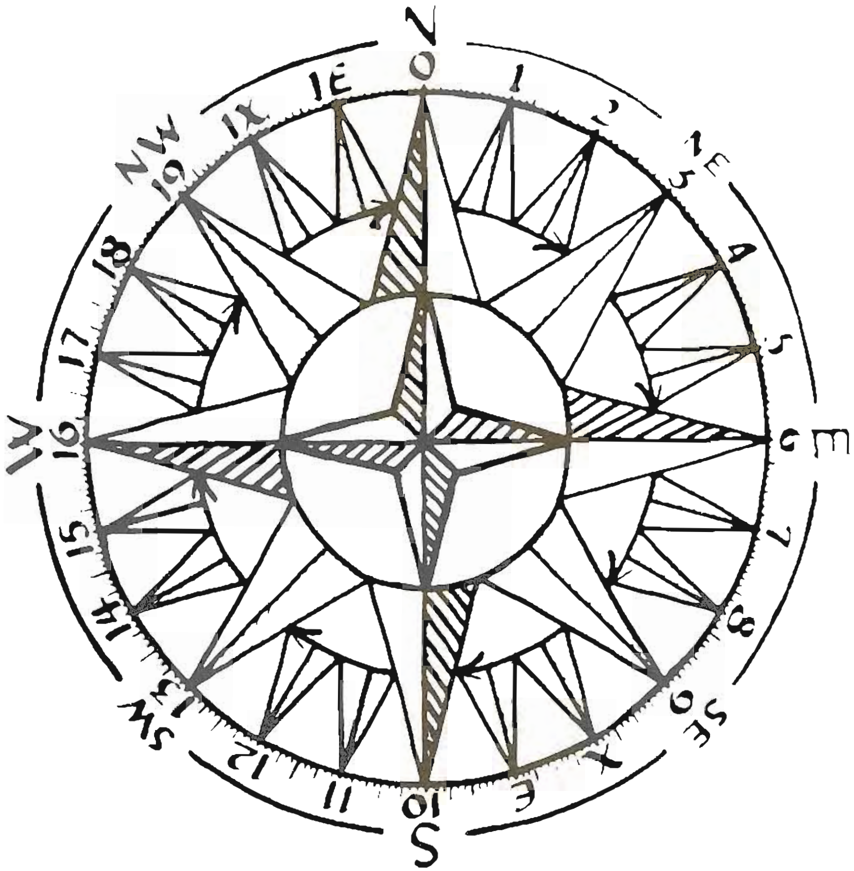
Duodecagon

Radius = 1 palm   Area = 3 sq. palms



Shaded areas = $\frac{1}{12}$ of whole, or .3°

Contained are: 1) Equi. Triangle, 2) Square (2 sq. palms), 3) Hexagon, 4) Angles constructable by Geometry



'DOGREES' and COMPASS POINTS COINCIDE

DO - COMPASS

THE WORLD CALENDAR

Jan. April July Oct.

O	1	2	3	4	5	6	7
	8	9	X	Ɛ	10	11	12
	13	14	15	16	17	18	19
	1X	1Ɛ	20	21	22	23	24
	25	26	27				

Feb. May Aug Nov.

			1	2	3	4
5	6	7	8	9	X	Ɛ
10	11	12	13	14	15	16
17	18	19	1X	1Ɛ	20	21
22	23	24	25	26		

Mar. June Sept. Dec.

					1	2
3	4	5	6	7	8	9
X	Ɛ	10	11	12	13	14
15	16	17	18	19	1X	1Ɛ
20	21	22	23	24	25	26

TAKE A HAND IN SCIENCE

by Paul Van Buskirk
18508 Manor Avenue, Detroit 21, Michigan

The evolution of the human brain would not have been possible without the hand. We marvel at the dexterity manifested by the fingers and opposed thumb, and rightly so. But we still fail to use the hand to its greatest capacity. It expresses a number system by its twelve phalanges, each of which can be enumerated by the opposed thumb. Each phalanx can be a unit, a dozen, or any power of twelve. Mathematicians know that these dozenal numbers are inherently vastly superior to decimal numbers. Twelve has the factors 2-3-4 and 6, repeated in 4-6-8-9 and *10*. Ten has the factors 2 and 5, and only 2 repeats. These act as "gears" in the counting machine.

The tip phalanges each measure about one inch and the total length of the twelve phalanges is about one foot. These standards were established to the Roman period and were passed on to the English. The cubic foot of water weighed 1000 ounces and it is their ounce we use today.

Unfortunately, the Hindu abacus only had ten places, so the zero concept for the empty space, sunya, became identified with ten numbers, though it is a universal concept, adaptable to any number as a base. It came to us through the Arabic revival, but the decimal fraction was not recognized until 1585. Simon Stevinus set forth the idea and in the same paper remarked that it was too bad there were not twelve numbers instead of ten!

Since his time decimal units have been proposed, adopted. discarded, reappeared, made compulsory by the French Revolutionists, by Hitler, by Stalin and lately by the Chinese. We are told that decimals are "Scientific" even though they originated with toe counting aborigines! But decimals had to be discarded in favor of the two figure binaries before an electronic computer could be produced. It is the place value concept that is scientific, not the limited use of it with only ten symbols.

This dozenal mathematics idea is being advanced by independent thinkers from several parts of the world. Creativity has always manifested its truths to many thinkers at about the same time. Victor Hugo once said "there is nothing so irresistible as an idea whose time has come."

The Free World could gain unquestioned scientific leadership by pushing place value up to twelve, evolving a superior weights and measures system in existing inches, ounces hours and months, thereby relegating the whole decimal system to the same position as is Gunthers Chain, the first decimal tool.

INCHES AND METERS HAVE NO QUARREL

Is It Possible Both May Be Going The Way Of Noah's Cubits?

by Henry Clarence Churchman
203 Wickham Bldg., Council Bluffs, Iowa

It is often said that music is God's language. Perhaps a dozen numerical symbols, so international is their accepted meaning, might be thought to be some part of a divine alphabet. Possibly the science of mathematics, which presented little that was new at the beginning of the 20th century, is determined to send more of its teachers back to school.

People the world over now write understandingly to each other about metric or English dimensions, using the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, X, and E in their own or another language to represent what we call zero, one, two, three, four, five, six, seven, eight, nine, ten, and eleven. Yes, ten and eleven in the dozenal base system of bunching all things by dozens instead of tens.

In place of a comma or period which represents the unit point in a decimal base system of numeration, these dozenal people accept a semi-colon (;) to indicate that any certain number of digits describe dozens and not tens. Thus, 12.3 is called, decimally, twelve and three-tenths. But *10;4* is recognized by all duodecimalists as equal to one dozen and four-twelfths of a unit, or by all duodecimalists as equal to one dozen and four-twelfths of a unit, or twelve and one-third units. What has this to do with inces and meters?

International Inch Agreement

Effective July 1, 1959, by international agreement of national standards laboratories in the United States, Canada, United Kingdom, South Africa, Australia, and New Zealand, the dimension of 2.54 centimeters and one international inch are equals. This had been so in Canada for some years by statutory law but slightly different in the United Kingdom, Australia, New Zealand, South Africa, and the United States officially, with certain exceptions in each nation.

That almost unmeasurable change in the length of the inch (proportionately about 30 feet in 3000 miles in the United States) has produced this universal advantage---that two gears, one containing 254 teeth and the other 100 teeth (or one containing 127 teeth and the other 50), when meshed and rotated, easily convert any number of centimeters to inches or inches to centimeters, with scientific precision. In fact the change was made in order to achieve exactness in scientific work and precision instruments.

Two Great Dimension Systems

As a direct result of these agreements, one international foot equals 30.48 centimeters precisely; and one international yard agrees with Canada's statutory yard and with 91.44 international centimeters exactly. One hundred centimeters, also by international agreement, equal one international meter of the French metric system.

Possibly the international inch now stands to advance in the metric areas of the earth even as the international character of the meter has aided the advance of the meter in the United States. Millions of Orientals whose second language is English will now meet the international inch and pound, and, later, the common "dogal" equal to twelve U.S. gallons, ten British Imperial gallons, 2772 international cubic inches, or one hundred international pounds of water under certain new conditions yet to be acted upon in international concert.

Over one-half of the school children of the world are taught no other system of weights and measurements today than those of the metric system. All of the English-speaking peoples are taught modern English weights and measurements in the primary grades, to wit, inches and feet, pounds, gallons, and their increases and well-know divisions. These empirical units, with modifications from time to time, have come down to us from the days of the Roman occupation of Britain, the Medieval English "inche" being developed from the Latin twelfth or "uncia" (oon' chee) part of any thing.

In England's early history twelve inches were said to be the length of the reigning king's foot and varied slightly from time to time, but there have been twelve inches in one foot always. The international inch is now fixed so long as the international meter remains immovable, and no effort is being made today by anyone to change the length of the meter as such.

Exactly 120 years before January 1, 1960, the metric system by the compulsory law of July 4, 1837, was substituted in France for a conglomeration of weights and measurements not particularly inferior to but at odds with English measurements and weights. Yet some ancient linear and land measurements dear to land owners and farmers survive in France to this day.

By Congressional act in 1866 permissive use of the metric system in the U. S. was made legal---but rapidly expanding U. S. industry has continued to use and depend on a system of weights and measurements based on inches, pounds, and gallons made legal only by acts of the several state legislatures. Until a common dogal (see above) is adopted by international agreement of English-speaking industrial nations some drift by pharmaceutical houses to liters must be anticipated, but their field is special. The M.D. heretofore writing prescriptions in Latin, and now also in liters or cubic centimeters, deepens the mystery of their contents to all but a trained pharmacist and that is perhaps as it should be.

The international meter was intended to equal one ten-millionth part of one quarter meridian circle of the earth when the system originated in the French Revolutionary explosion of the age of reason. Subsequent measurements, however, have proven that it is more than two kilometers in error---and that the shape of the earth itself is not stable. Therefore, it possesses no greater inherent stability than the English Imperial yard held before it was supplanted by an international yard.

Defects of Metric System

The international metric system possesses several constitutional defects now recognized in France, its place of birth.(1) Founded upon a ten-base system of arithmetic, it finds itself unable to subdivide either units or the common circle into the precise portions of one-twelfth, one-sixth, one-third, and a number of other most common and necessary exact divisions. That is to say, decimally, one-sixth part of one (0.1666) when multiplied by six does not quite equal unity or one cicle, but 0.9996 part of the whole. This defect is inherent in the decimal base. Its answers are nearly correct, but that is not good enough for U.S. industry in our technical age.

Recognition of this unfortunate metric lack of precision, in an age of precision, is now slowly rising to the surface to plague sincere friends of the metric system who would sweep aside the inch, pound, and gallon so deeply ingrained in the English-speaking industrial nations.

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(1) See DOUZE NOTRE DIX FUTUR, Dunod, Paris, 1955, published with a foreword of a member of the French institute by M. Jean Essig, while holding high place in the French national government.

In theory the metric system appears nearly perfect, but in practice it displays impracticable products. For instance take a gallon of table milk and package or bottle it in fifths and tenths in metric fashion. You may purchase two-tenths or three-tenths but you can not buy a quart of milk in original package form. You may buy three-tenths or four-tenths but not a third of a gallon. You may buy seven-tenths or eight-tenths but not three-quarters of the gallon. We are not helped by calling quarts liters, or liters quarts, for we meet the same difficulty in subdividing the liter.

But if you would divide the gallon of milk into fourths and twelfths in dozenal fashion, then you might buy in original packages three-quarters, two-thirds, one-half, one-third, one-sixth, one-twelfth, or just a plain quarter of a gallon of milk.

A New Dozenal System of Dimensions?

At this moment twelve inches imitate the length of a king's foot and are not a king's foot at all. And ten million meters imitate a meridian quarter circle of the earth but are not a meridian quarter circle and never will be.

An entirely new system of dozenal weights and measurements now in the discussion and blueprint stages is not only derived equally from both the international inch and the international meter as a foundation but is intended to unite both systems under one immovable dozenal base system of measurements so that both Englishmen and Frenchmen shall have "metric" quantities under a "dometric" classification and all English-speaking peoples may readily compare their inches.

It is proposed, in order to achieve a dometric system of measurements, that we ASSUME a great circle of the earth precisely equal to 40,045,628,620,800 microns and call it the "dominaire" dimension or one "dominate" unit. This grand distance when subdivided again and again by twelve lends itself readily to identification in wavelengths of certain rays of light in the English dimension of 44 international inches and the French equal dimension of 1.1176 meters precisely, a proposed standard unit of length which, with its precise number of wavelengths of light, might eventually replace the international metric platinum-iridium bar now carefully housed at Sevres, near Paris.

New Dimension Possibilities

What can scientists and common people do with the new dimension that we can not do with inches and centimeters?

In the first place, the length of one dominaire dimension is precisely equal to 131,383,296 feet, each foot being equal to 30.48 centimeters. If we think of this dimension as a great circle like the giant face of a clock divided into twelve equal segments, then each subdivision is equal to 30° of a circle or 10,948,608 international feet along the arc.

And if we subdivided 10,948,608 international feet into a dozen equal parts again, again, and once again, we shall reach the rather useful dimension of 6336 international feet or 1.9312128 kilometers precisely. This last product has been called an AIR MILE, one naire arc, one nante, one navinaut, or one duodecimal kilometer. You may take your choice or give it another name. It might become the new geophysical mile in metric and nonmetric areas alike.

An atlas map accompanying the National Geographic Magazine for September 1959 was limited only to the Western Soviet Union and compiled and drawn in the Cartographic Division of The National Geographic Society to a scale of 100 miles to one inch. This may be expressed as 1:6336000. That is to say, one foot equals 6336 thousand feet or *ONE THOUSAND AIR MILES*. The air mile is no longer a theory only. And it reconciles both international yards and meters.

Decimal and Duodecimal Kinship

Now if we divide this air mile into a dozen equal parts we shall find a length equal to one-tenth of the English land or statute mile, the smallest unit of length now measured in most American automobile speedometer windows--- a distance of 528 feet.

Thus, as English-speaking peoples move towards acceptance of the dominaire dimension they may fully retain their statute mile and one-tenth land mile, and therefore their "section of land," rods, yards, feet, inches, and their ten-millionth fraction of one inch, so long as they desire to do so. As new generations come to think only in terms of the dominaire dimension, they will be at home in describing a section of land, or one percent of a section of land called by some farmers a "garden" of land. Since 25 links equal 1 rod, and 4 rods equal 1 chain, a garden of land may be accurately compared not only to 6.4 acres, but to a square either 8 chains, 32 rods, 528 feet, 800 links, or one-twelfth of an air mile on every side.

Let us consider one other point as we close. If we divide 528 feet into a dozen equal parts again and again, we achieve a length of 44 international inches or 1.1176 meters precisely, a length to which we have already referred. This duodecimal dimension has been called one "do met ron" in the doremic scientists dimension system.

A distance equal to one dometron has been advanced by Charles S. Bagley, American geodesist of Alamogordo, in his book "Redivivus Reckoning," under the description of a half-navisec. One-half of the length of one air mile was advanced some years ago by Horatio W. Hallwright, dedicated duodecimalist of Victoria, B.C., equal to what is now 3168 international feet. See a resume of his position in The Duodecimal Bulletin, July 1956, published by The Duodecimal Society of America, 20 Carlton Place, Staten Island 4, N.Y. Before the international inch was agreed upon, a dimension equal to 1.116 326 588 934 62 meters was advocated in 1955 by M. Jean Essig under the name of "metre duodecimal." This would correspond with 43.95 international inches.

The English-speaking peoples, sitting a little firmer since July 1, 1959, in mutual agreement upon their empirical dimensions, now exemplify an indelible mark of comradeship with present statutory French dimension scales.

No longer will metric and nonmetric scientists be forced to move an indeterminate number of decimal or duodecimal places to the right of the unit point striving in vain to reach an exact relationship between meter and foot units. And both units now bear an equally precise relationship to the dometron.

One dometron (44 international inches) is said to equal 1,735,816.23 wavelengths of cadmium light under certain specified conditions. Other atomic wavelengths may be found even more suitable.

A.V. Astin, able director of the National Bureau of Standards in Washington, has been encouraging the search indefatigably for a suitable wavelength element to supplement the present platinum-iridium international bar now used as a dimension standard.

Excerpts from Dometron Table

Dimension (m) Symbol in Scientists Metronic Scale

Dozenal Value		Metronic Symbol		International Foot Values			Metric Symbol	
1 domimetron,	shown	ml0000;0,	equals	6336	feet,	or	1.9312128km	precisely.
1 mimetron,	"	ml000;0,	"	528	"	"	1.609344hm	"
1 remetron,	"	ml00;0	"	44	"	"	1.34112dam	"
1 dometron,	"	ml0;0	"	44	inches,	"	1.1176m	"

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LETTER TO THE EDITOR

by Alfonso Lomo
P. O. Box 156
Goldens Bridge, N.Y.

I wish to inform you that your Esperanto Translation of Andrews' "Excursion in Numbers" has been reviewed in NORDA PRISMO, Issue No. 4 of 1959. The reviewer is somewhat hostile to the idea of a duodecimal system and the hostility shows through in his review. His opposition, seems to be based on wrong concepts of what the duodecimal system is and what it proposes to do. Since I have read the English original, I can evaluate his comments on what was said in the text, and so I am able to perceive that he did not really understand the arguments.

Because I can see that you are trying to propagate the idea of dozenal counting in Esperanto circles, I feel that an Esperanto nomenclature should be devised to speed along the idea. To that end, I have devised such a name system and will pass it on to you further on in this letter. But before I do that, I believe a few comments on nomenclaure in general should not be amiss.

Andrews in his book "New Numbers" dismisses, rather cavalierly, the question of nomenclature as of secondary importance . The arguments he advances for his point of view regarding nomenclature are, curiously, very similar to those put forward on behalf of decimal counting by the opponents of the duodecimal system. If the change is ever made to duodecimals, the acceptance of the system may very well hinge on a suitable and apposite nomenclature.

The classic example of the influence of nomenclature on the adoption of a system is what happened when the Decimal System was adopted. At the time the French Revolutionary Convention was considering the change of the traditional units of measurement to a more rational system, there were advocates of a duodecimal system. These advocates, however, did not have anything resembling a logical system of terms to be used in the new system. On the other hand, some time before these deliberations, a French priest had worked out a system of nomenclature based on the decimal notation that was so complete and rounded out that with just a few, very few, modifications it is the one in force today. There is no doubt that the existence of such a system influenced in a large measure the decision to adopt the Decimal Metric System.

In choosing names for the quantities in the duodecimal system there is a consideration today that did not exist at the time of the adoption of the Metric System, even though the system admirably meets the requirements introduced by this consideration. There was no telephone or radio at the time of the adoption of the Metric System, and these two means of communication require that the names of the numbers be such as to be clearly apprehended and understood without confusion. One way to attain this goal is to have the names of the numbers be bisyllabic. When a name consists of at least two syllables it is not easily taken for another. That is why the military services have adopted two-syllable words to name the individual letters of the alphabet when spelling out over the phone, e.g. alpha, beta ... foxtrot ... roger ... zebra, for the letters A, B, F, R, and Z respectively.

The traditional names of the numbers from one to nine are mostly monosyllabic in English. However, the telephone company trains its operators to pronounce some of the numbers in a distinctly bisyllabic way, e.g. fo-wer--ni-yin, etc. in order to avoid misunderstandings. For that reason, I think the Society should review the nomenclature at present in use with a view of making it meet this requirement. For instance, the term "dozen" will be better understood over the telephone than "do", since this latter name may be apprehended as "oh" and so taken to mean zero.

All the above is to be understood as mere suggestions in case that this consideration of intelligibility over the phone or the radio had not been taken into account at the time of adopting the present nomenclature. But, regardless of what you may do about the English terminology, I believe the Esperanto nomenclature which follows will help you to talk intelligently about duodecimals to Esperantists.

ESPERANTO NOMENCLATURE FOR THE DUODECIMAL SYSTEM

X	dek		
E	undek		
10^1	dozen	0;1	dozenono
10^2	groc	0;01	grocono
10^3	megroc	0;001	megrocono
10^4	dozenmegroc	0;0001	dozenmegrocono
10^5	grocmegroc	0;00001	grocmegrocono
10^6	bimeg*	0;000001	bimegono
10^9	trimeg**	01000000001	trimegono

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*Notice that in English the term MEGOHM means MILLION ohms.
**The term MEG shall stand for a group of 3 zeros, the prefix indicating the actual number of groups, e.g. bimeg means 1 followed by 2 groups of 3 zeros and trimeg means 3 groups of 3 zeros and so on.

MATHEMATICAL NOTES

A Test for Divisibility, by George S. Terry.

It is useful to have a test for divisibility of any number N by a divisor D, decimally ending in 1, 3, 7, or 9 - or duodecimally ending in *1*, *5*, *7*, or £.

N may be reduced in size by eliminating the last figure and modifying the remaining number by adding or subtracting a multiple of the eliminated figure - until divisibility or indivisibility becomes obvious.

Decimal. Divisor	Multiple of Eliminated Figure
10n + 1	-n
10n + 3	+(3n 1) or -(7n + 2)
10n + 7	-(3n 2) or +(7n + 5)
10n + 9	+(n + 1)

Case A. Is 1793 divisible by 11?

11 = 10(1) + 1. Multiple (from table) is -1

1793. Eliminate 3 and first place.
Subtract 3 ... i.e. 3(-1) ... from 179 for 176
Eliminate 6 and second place.
Subtract 6 ... i.e. 6(-1) ... from 17 for 11.
Therefore 1793 is divisible by 11.

Case B. Is 459 divisible by 17?

17 = 10(1) + 7. Multiple from table is either -(3n + 2) or +(7n - 5)

-(3n + 2) = -(3 + 2) = -5.
459. Eliminate 9 and first place.
Subtract 5(9) from 45 for 0
Therefore 459 is divisible by 17.

+(7n + 5) = + 12.
Eliminate 9 and first place.
Add 12(9) to 45 for 153
Eliminate 3 and add 12(3) to 15 for 51.
Eliminate 1 and add 12(1) to 5 for 17.
Therefore 459 is divisible by 17.

Duodecimal.

Divisor	Multiple of Eliminated Figure
10n + 1	-n
10n + 5	+(7n + 3) or -(5n + 2)
10n + 7	-(7n + 4) or -(5n + 3)
10n + Ɛ	+(n + 1)

C Case C. Is 17Ɛ5 divisible by 15?

+(7n + 3) = +(7x1 + 3) = + Χ.
17Ɛ5. Eliminate 5 and first place.
Add Χ(5) or 42 to 17Ɛ for 201.
Eliminate 1 and add Χ(1) to 20 for 2Χ, which is divisible by 15.
Therefore 17Ɛ5 is divisible by 15.

-(5n + 2) = -(5x1 + 2) = -7.
17Ɛ5. Eliminate 5 and first place.
Subtract 7(5) or 2Ɛ from 17Ɛ for 150, which is divisible by 15.
Therefore 17Ɛ5 is divisible by 15.

Division from the Right, by George S. Terry.

Division from the right is often convenient with large numbers, especially when only end figures are required. In decimals, when the divisors end in 3, 7, or 9, - and in duodecimals, when the divisors end in 5, 7, or Ɛ, this is fairly simple. With other endings for the divisors this can become rather complicated. We must know that the number is divisible by these divisors. Also, we could divide the number completely, but in the situations cited the following is shorter.

Decimal example. $9^9 - 1$ = 387 420 488, and is divisible by 7. Say we need four end figures.

```
5 7 8 4
0 4 8 8
-------
    2 8
0 4 6
  5 6
9 9
4 9
5
```

Only 7(4) ends in 8. Therefore 4 is the last figure. Write the 4 above the last figure of the dividend. The product 28 gives us a carry of 2. Subtract it from 048, leaving 046. Only 7(8) ends in 6; write the 8 above the next figure of the dividend, and subtract the carry of 5 from 04, leaving 99. Only 7(7) ends in 9; write 7 above the next figure of the dividend, and subtract the carry of 4 from 9, leaving 5. Only 7(5) ends in 5; so our fourth figure is 5.

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SHOP TALK

In a recent letter, Kenneth C. McCulloch suggested that the principle of the Wheatstone Bridge could be used in a simple electrical device for converting decimal numbers to the duodecimal base (or any other), with two equal arms, a decimal decade resistance for the third arm, and a duodecimal for the fourth. The decimal unit can be readily purchased, but the duodecimal you would have to make.

It doesn't matter how deep the water is if it is over your head, and you can't swim. So we're sunk. But we thought that some one of our technicians might pick it up from there.

This happens to us frequently. Dozeners are rather unusual folk with fine imaginations, and a surprising array of abilities. Ken McCulloch is a meteorologist at the Radiosonde Station, Baker Lake, Northwest Territories, Canada. This location is about 100 miles inland from the western shore of Hudson Bay, and a little south of the Arctic Circle.

Ken is a fervent Baha'ist. He has served in his present assignment about four years now. On one of his rare flights back to the dangers of civilization in the Spring of '59, he caught a bad case of love. Now, he and his wife, Mary, issue the Baker Lake News from time to time, hectographing about 50 copies of each issue - replete with sketches and everything - for their friends all over this tiny world.

Kenneth C. McCulloch

The Baker Lake News makes you feel right comfortable exactly where you are. It speaks of snow banked over the eaves of their cabin, of arctic wolves as big as ponies, of daybright nights and nightdark days. And its gayety warms your heart and makes you proud. Sorry, we have no picture of Mary, yet.

. . . .

On the 1st of July, 1954, the United States adopted the International Nautical Mile for official use by agencies of the U.S. Government, in a general consortium with most nations of the world, at the instance of the International Bureau of Weights and Measures.

The length of the International Nautical Mile is 1852 meters, or 6076.10333 feet. This is in agreement with the definition of the International Foot as 30.48 cm. and the International Inch as 2.54 cm. which became effective July 1st, 1959.

. . . .

These steps to international uniformity provide a solid base for Charles Bagley's suggestion for a duodecimal micrometer. He proposes a modification of the inch micrometer for duodecimal use, with *40* threads to the inch for the spindle, and *30* divisions for the scale on the barrel. This would permit cursory readings to *1* emo inch.

A vernier scale could be arranged, with *Ɛ* divisions corresponding with *10* of the barrel divisions. Such a vernier would permit readings to *1* edomo inch, somewhat finer than 1/20,000 of an inch.

. . . .

While we are dropping ideas of things that we need to develop, in the hope of interesting the design engineer and the expert machinist, - there is a host of duodecimal size scales based on the inch to be devised: sizes for drills, screw threads, wire, sheet metal, and nails. And don't neglect the 6" machinist's steel rule.

There is no branch of Do-It-Yourself that does not involve dozenals. And the counsel of good men is besought for all of the crafts. If you believe in duodecimals, start doing your work in them.

Ye Ed.

LETTER TO THE EDITOR

(Continued from page 20)

As you will notice, these names are selected so that the numeral suffixes in Esperanto may be applied to them also in a regular manner. In the table you will have noticed that the fractional suffix "-on" has been applied to the duodecimals. Here is how the others may be applied: dozeno, groca, megrocope, bimegoble.

I hope you may find this contribution helpful in your endeavors to spread the dozenal gospel among Esperantists.

INCHES AND METERS HAVE NO QUARREL

(Continued from page 1X)

If time advances the new geophysical air mile and the metronic dimension scales, no one need forget either the centimeter or the inch, the meter or the yard, for all of them blend securely into this new universal system of measurements now appearing far on the horizon, less distant perhaps to air probers and space minded persons.

Assuming one great circle of the earth decimally equals 131,383,296 feet and if one foot is said to equal 30.48 centimeters, then this great circle of the earth is equal to 40,045.628 620 8 kilometers precisely. This assumed length of a great circle is not wholly unrealistic, a meridian great circle of the earth being presently estimated as equal to 40,009.15 kilometers and the equatorial great circle having an approximate value of 40,076.59 km.

Its desirability may be questioned but the existence of a great circle of the earth equal to 40,045,628,620,800 microns can not be doubted.

DIVISION FROM THE RIGHT

(Continued from page 22)

Duodecimal Example. $9^{9^9} - 1$ is divisible by *7*, because 9^9 has the remainder *1* when divided by *7*, and thus any power of 9^9 will also have a remainder of *1* when divided by *7*.

$9^{9^9} - 1$ ends .... *374 9X6 288.*

```
2 2 9 3 1 6 0 4 8
3 7 4 9 X 6 2 8 8
-----------------
              4 8
            2 4
            2 4
        X 6 0
        3 6
      9 7
      0 7
    4 9
    1 9
  7 3
  5 3
3 2
1 2
2
```

N.B. All contributions to Mathematical Notes will be welcomed.