The Duodecimal Bulletin

Whole Number *31;*

Volume *17;* No. *1*
December 1964 *(1178)*

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.

The Duodecimal Bulletin is the official publication of the Duodecimal Society of America, Inc., 20 Carlton Place, Staten Island, New York 10304. Kingsland Camp, Chairman of the Board of Directors; Charles S. Bagley, President; Tom B. Linton, Executive Secretary; Ralph H. Beard, Editor. Separate subscriptions $1.00 a copy.

TABLE OF CONTENTS

The Duodecimal Bulletin

All figures in italics are duodecimal.

DENVER MEETING OF THE MEMBERS AND BOARD OF DIRECTORS 10, 11, 12 APRIL, 1964

The 21st consecutive annual meeting of the Duodecimal Society of America was held at the Alameda Inn, Denver, on Friday, Saturday, and Sunday, April 10-12. The Inn provided our group with a fine meeting room for our exclusive and intensive use for the three days. The first day was occupied by informal discussions of the business to be taken up as well as other matters of Society interest, plus a visit to the U. S. Mint where the rythmic stamp of presses and the containers of shining new coins made for a fascinating experience.

Officers and members in attendance were:

Kingsland Camp, Chairman of the Board (New York City)
Charles S. Bagley, President, and Mrs. Bagley (Alamorgordo)
Henry C. Churchman, Vice-President and Mrs. Churchman (Council Bluffs)
H. K. Humphrey, Treasurer (Winnetka)
Tom Linton, Executive Secretary and Mrs. Linton (Garden Grove)
Jamison Handy, Jr., Editor (Pacific Palisades)
F. Emerson Andrews, Member of the Board, Past Chairman and President (Tenafly, N. J.)
George S. Terry, Member of the Board, Past Chairman and President, and Mrs. Terry (Sonoita, Arizona)
Eugene M. Scifres, Member of the Board, and Mrs. Scifres (Denver)
William S. Crosby, (Berkley, Calif., on temporary leave to the University of Colorado)
Robert W. Edelen and Mrs. Edelen (Gunnison, Colorado) (Western State College)
Ralph H. Beard and Mrs. Beard (New York City)

Mr. Edelen brought to the meeting his computor-derived dozenal value of pi carried out to some 1800 places. He compared notes with Ralph Beard who had converted the ENIAC decimal pi to dozenal notation (Duodecimal Bulletin v. *X;* n. 1, March 1954). More on this elsewhere.

Mr. Scifres pointed out his computing offices in the new 33-story insurance building in downtown Denver. From the Inn, more than a mile away, we could view the construction crane still atop the imposing structure. In another direction -- to the west -- toward the majestic Rocky Mountains, extending north and south to the horizon. While we discussed duodecimal matters our wives visited city places and approaches to the mountains. Too bad our few days precluded a more extended tour of that fascinating area. The Alameda Inn people made our stay most enjoyable,

with private meeting room, the cozy Gaslight Restaurant, and our private dining room for Saturday night, with most tasty food. The potent Denver Post had made note of our meeting in a surprisingly knowledgeable editorial (Sunday, March 22, 1964).

On Saturday afternoon, 11 April 1964, our nusiness meeting was convened. In attendance were Andrews, Bagley, Beard, Camp, Churchman, Edelen, Handy, Humphrey, Linton, Scifres and Terry.

1. Minutes of the 1963 New York meeting were reviewed by the then-acting secretary Jamison Handy, Jr.
2. The death of Harry Robert, Director and Past President was noted with sorrow. A resolution was adopted to extend sympathy to Mrs. Robert, and express deep appreciation for his valued services to our Society, as follows:

RESOLVED, that the Board of the Duodecimal Society of America record its deep sorrow over the passing of Harry Robert, and its appreciation of his long membership and services to the Society, including a term as president. The secretary is instructed to send a copy of this Resolution to Mrs. Robert, with the Board's sympathy.

3. Treasurer Humphrey gave his treasurer's report showing less than usual expenditures due to one Bulletin only being billed during the year.
4. Secretary Linton presented the membership roster showing a healthy continued growth of membership to a new high of 154, up 27 from a year ago.
5. Election of Board members for the class of 1967 resulted in the re-election of Camp, Linton, and Lyman. To Director Lyman goes our wishes for good health and the hope for attendance at our next meeting.

Note that the class of '66 consists of Andrews, Churchman, Handy, and Scifres; and the class of '65 is made up of Bagley, Beard, Humphrey, and Terry.

6. Election of officers resulted in re-election of:
   Kingsland Camp, Chairman of the Board.
   Charles S. Bagley, President.
   Henry C. Churchman, Vice President.
   H. K. Humphrey, Treasurer.
   Tom B. Linton, Secretary.

Mr. Humphrey asked that a new treasurer be elected as soon as can be conveniently accomplished. He was given a sincere vote of thanks for his many years of devoted service in the handling of Society funds. Mr. Beard was appointed to head a committee to nominate a new treasurer. A motion passed to leave active custody of the Society bonds with Mr. Humphrey, rather than shift that burden to the future new treasurer, pending different future Board action. Mr. Humphrey kindly accepted that assignment.

In another action, the Board authorized Treasurer Humphrey to provide for check signing on the Winnetka bank account by the President and the Secretary, such that either of the three officers of the Society may sign checks on the main checking account as well as on the satellite account in Garden Grove.

7. Mr. Handy affirmed his willingness to edit The Duodecimal Bulletin, referring to previous experience in that capacity for other societies. He expects to follow the next Bulletin (v *17;* n 1) with a Dozenal Doings (newsletter) to be circulated to only members of the Society. Such circulation would allow tryout and criticism of articles before appearing in the Bulletin of much wider circulation than just our membership.

Note: Since the annual meeting, pressure of other work on Mr. Handy has led to Mr. Beard accepting the editorship again, until Mr. Handy has time, or another editor can be found. In the meantime Mr. Handy is completing Addressograph plates and will provide Editor Beard with addressed Bulletin envelopes.

8. Vice-President Churchman was appointed chairman of a committee to produce a suggested membership change to provide for a new Board membership "Emeritus" position, without Board voting power, to recognize the work of officers and Board members, whose advice and help will continue to be of value to the Society, but who should not be burdened with active duties. Such "Emeritus" Board members would of course retain their Society membership voting privileges. Unanimous thanks were tendered Vice-President Churchman for his untiring and definitive work on our By-Laws, while producing extensive and valuable literature on duodecimals.

9. A motion was made and carried to discharge with thanks the past nominating committee.

10. A motion to change the fiscal year of the Society from calendar to July 1 – June 30, to better accommodate school people, failed to carry; see next item.
11. Board decision was unanimous to allow student membership fees paid in the last four months of the year to be applied to the whole of the following calendar year. The secretary was directed to so print the membership applications.
12. Next year's annual meeting is tentatively scheduled to be held in Omaha, Nebraska, across the Missouri River from Vice-President Churchman's home in Council Bluffs. Between the banks, on the broad Missouri, Lewis and Clark passed up in 1804 and back in 1806, having, by a bare six months, preceded the Britisher Thompson into the Columbia River basin, and thus secured for the fledgling United States the legal foothold to the Pacific Northwest. To this historic Missouri site we invite members whose gunpowder is dry, to make duodecimal thunder, come sometime around May of 1965 (1179;).
13. A motion was made and carried to accept the minutes of this meeting as read.
14. Additional points of interest were brought up for discussion but not action:

A. The secretary should attempt to arrange correspondence so that the president could be a more effective focal point of important data, letters, services, etc. Agreement was that in spite of some difficulty in doing this, the great value made it appear to be a mandatory action. The suggestion to combine the idea with Dozenal Doings was not seen to be feasible.

B. It was pointed out that most societies base elections of officers on a printed ballot containing a biographical sketch of the nominees, and should be considered by us. While all agreed to the value, such procedure would greatly formalize our meetings, possibly requiring separation of membership and directors meetings. A change would also be required in our Constitution wherein the Board, not membership in general, is required to elect officers.

C. The response to an accumulation of diverse suggestions to "adopt" new symbols for ten and eleven (in correspondence from members) was to point out that almost all of our literature uses the distinctive ↊ and ↋ as designed by the late type designer Dwiggins. On existing typewriters these can be approximated by X and E. The Society has suggested the use of these symbols in the interest of usability and easy recognition, while avoiding official adoption. Ultimately better symbols will evolve. In the meantime the British Society uses ↂ and ↉ (upside down 2 and 3), some of our members prefer the typewriter's lower case d or t for ten, and h or k for eleven, and as long as such symbols are used in clear context, we see no reason to arbitrate between them, or attempt regulation against their use, or adopt them as official. The ↊ and ↋ are not official beyond the maintenance of publishing uniformity.

D. The suggestion was made that the editor advise contributors of suggested format for articles, particularly to minimize receipt of work so badly done as to unduly burden the editor or to allow mistakes in reproduction. The editor was advised to use his perogative to return manuscripts that were below acceptable standards, with a request for better copy.

The membership and Board meeting adjourned at 5:30 PM, with an announcement to convene the evening dinner meeting at 7 PM. In the cozy Denver Room of the Gaslight Restaurant we enjoyed refreshments and dinner according to taste while impromptu speeches touched on the personalities, history, and future prospects of duodecimals. A most pleasant surprise was the appearance of William Crosby, and that of Robert Edelen, both in university computor work. Then some of us newer members were gratified to have founders Andrew, Beard, and Terry with their sagacity and humor, and Humphrey with everlasting encouragement. Not the least entertaining part of the evening was the spirit and beauty of the wives who provided a most welcomed and integral backdrop to the delightful and long-to-be remembered evening.

Chairman Camp gave us an account of his recent investigations of a scale designed to serve as a replacement for the "magnitude scale" at present used in astronomy. He discussed, "the advantages of a scale of brilliancies of stars, over the current use of magnitudes. If they are compared as percentages of the brilliancy of the sun at one light year's distance, the actual luminosity compared with the sun is easily found as the comparative brilliance multiplied by the square of the distance in light years. This is much simpler than working through logarithms or magnitudes.

"Owing to the basis of the magnitude scale, 2.5 magnitudes represent a factor of ten in luminosity, while 2.7 magnitudes correspond very closely with a factor of twelve. Thus, transition to a duodecimal scale of brilliance should be easy." Afterward, in the clear Colorado air, against the backdrop of the Rockies, sounded pleasant good-nights.

Sunday was the day for goodby's, some sightseeing (such as the Air Force Academy near Colorado Springs in a fabulous mountain backdrop setting), then homeward bound to New York, New Jersey, Illinois, Colorado, New Mexico, Arizona, and California. Your secretary took a short cut via meetings at Philadelphia and Skaneateles on his way back to Garden Grove, and arrived with renewed faith and pride in this great country and the fine people in it. From here to our members and friends in other lands we extend cordial greetings and hope for increasing mutual interest. Bless you all.

OFFICIAL ADDRESSES

General Address	Duodecimal Society of America 20 Carlton Place Staten Island, N. Y. 10304
Board Chairman	Kingsland Camp Shelton Towers Hotel New York, N. Y. 10017
President	Charles S. Bagley 1314 Ohio Avenue Alamogordo, N. M. 88310
Vice-president	Henry C. Churchman 403 Wickham Bldg. Council Bluffs, Iowa 51501
Secretary	Tom Linton 11561 Candy Lane Garden Grove, Calif. 92640
Treasurer	H. K. Humphrey Box 246 Winnetka, Ill. 60093
Editor, Duodecimal Bulletin	Ralph H. Beard 20 Carlton Place Staten Island, N. Y. 10304
Editor, Dozenal Doings	Jamison Handy, Jr. Box 90666-Airport Sta. Los Angeles, Calif. 90009

The 1963 Annual Meeting of the membership took place again on the attractive Roof Terrace of the Carnegie International Center, at 1st Avenue and United Nations Plaza, New York City, but this time on Thursday, May 30, at 8:30 in the evening.

Because of the wide scattering of our membership, and various other responsibilities of our directors, experimentation with times and places for meetings will continue and suggestions are invited. However, for the annual official membership meeting, the facilities and attractive surroundings of the International Center have so far one factor that enabled a long-time director from California to attend the annual membership meeting for the first time, but on the other hand interfered with the plans of many others, evidently, because attendance was much smaller than recent past annual meetings.

At the director's meeting held at 1:30 in the afternoon prior, the officers elected among them for the coming term were announced as follows:

Chairman:	Kingsland Camp
President:	Charles Bagley
Secretary:	Tom Linton
Treasurer:	H. K. Humphrey

"Ralph Beard reported on the activities of 1962 as follows:"

The basic changes in the constitution and the structure of the Duodecimal Society of America, determined at last year's meeting of the Board of Directors at Alamogordo, involved the progressive revision of most of our literature, and of our operating practices.

These tasks have absorbed so much of the Secretary's time and attention that the fulfillment of his other official responsibilities has not been up to standard.

Only one issue of the DUODECIMAL BULLETIN has been printed this year. Since the Bulletin always stimulates activity, the volume of our daily mail is noticeably less, as well as our general publicity. Sales of the Manual of the Dozen System have tapered off, and total sales thus far approximate 500 copies.

We report with regret that decimalization of their currency is proceeding in India and some parts of Africa, and now is getting under way in Australia. The Duodecimal Society of Great Britain continues to grow under the able guidance of its Honourable Secretary, Brian R. Bishop, and has at this writing about forty members, and a hundred and forty pounds in its Treasury. The thirteenth issue of its DUODECIMAL NEWSCAST has recently been released, copies of which have been mailed to our Directors. There has been little further development in the idea of a Society Duodecimale Internationale, but gestation continues.

Reporting as to the rearrangements and revisions in our own affairs, copies of the revised Constitution have been produced and furnished to each member of the Board of Directors.

AN EXCURSION IN NUMBERS, Mr. Andrews's excellent article reproduced from the ATLANTIC MONTHLY of October, 1934, as the basic introductory pamphlet in our literature, has required another reprinting, – its eleventh. As certain changes in the supplemental text of the pamphlet were necessary, we used this occasion to have the text set by hand, and the format revised to improve its dress. This has involved some additional expense, but subsequent reprintings will cost us the same as formerly.

Mr. Beard was given a commemorative resolution as our past Secretary by his fellow directors. He has been the "dynamo" of our society for some two dozen years. He will continue to act as a corresponding secretary for a transition period. Mr. Beard, on top of this, has been editor of the DUODECIMAL BULLETIN and other publications. In view of Jamison Handy's venture of three issues of DOZENAL DOINGS some time ago, he has been asked to assume editorship of our BULLETIN.

F. Emerson Andrews, whose article and book of the mid 'thirties sparked our society, has repeatedly asked us to find a successor for his job as Board Chairman as he finds it increasingly difficult to give it the time it deserves on top of his many other responsibilities and duties. We have repeatedly made every effort to reduce our demands of his time and at the same time prevailed on him to go on one more year. He accepted again, and we have continued to benefit by his balance of experience, contacts, and background . . . . particularly as a writer and foundation director . . . . and it is only fair to him that we finally accede to his wishes.

Nominations for Directors of the Class of 1966 were proposed by the Nominating Committee as follows:

F. Emerson Andrews
Henry C. Churchman
Jamison Handy, Jr.,
Eugene Scifres

Hearing no new nominations presented by others, Richard Stern moved and Louis Francis seconded that the report be accepted with these members elected by acclamation. This was done.

In addition, Henry Churchman will continue in his job as Vice President and head of a committee responsible for the by-laws. In the past we had operated on the basis of our New York state charter and simple resolutions by the board. Our original constitution was burdened by many items that could be more expeditiously handled by by-laws. The 1962 directors' and membership meetings adopted our new constitution with the reservation that appropriate by-laws be instituted. Accordingly, this was done in preparation for the 1963 meeting.

It was our disappointment, of course, that Mr. Churchman was unable to come to this meeting, but he sent his committee's draft ahead for comment and any necessary revision by the board and thence submission to the membership by the directors. They were carefully read with pointed note and comment that they contain within them well considered provisions for further revision or change, should this be found needed. Their adoption was formally moved by Bro. Francis and seconded by Mrs. Beard and carried unanimously by the membership present.

The changes in the grades of membership have entailed the reclassification of our people into the new grades, and the issuance of new membership lists on this basis. This has been done, and copies of the new lists have been sent to each of the Directors. The present distribution is: Fellows 28, Senior Members 43, Members 15, Student Members 17, Student Aspirants 27. Total Membership; 130.

This is our largest total so far, and represents a gain for the year of 14. Sorrowfully, we report that it also includes one serious loss . . . . the death of Paul Van Buskirk, who for more than 16 years has constantly endeavored to publicize duodecimals through papers in the technical journals, and original work on symbols, nomenclature, and measures. His name is now added to the Long Roll of the Pioneers of Duodecimals.

Some items of our literature will need to be revised under the approved changes, when present supplies become exhausted. Among these are our application blank, and the Society's folder. The text of the present folder presents certain elements of the Do-Metric System as illustrating the possibilities of a duodecimal metric system. Henry Churchman has proposed that elements of the Doremic System be substituted for this material when the folder is revised. Copies of his letter of February 1st, containing this proposal have been supplied to each of the Directors, and his proposal has been made as item on the agenda for further consideration.

Another item requiring revision is the membership card. This should now provide identification as Member, Senior Member, or Fellow, and also of life membership as well.

One of our actions should be especially called to your attention. The action of the Board at the Alamogordo Meeting clearly indicated the intention to eliminate the grade of Aspirant, and the practice of requiring entrants to pass satisfactorily a series of tests to ensure their competence in duodecimal calculations, before advancement to membership. In our opinion this action gave inadequate consideration to the student grades, and the tests have been continued for them for the present. These grades include many secondary school and high-school students, as well as collegiates. This item has been placed on the agenda for the 1964 meeting.

There being no further business, the meeting was adjourned for more of the informal gatherings and discussions that so pleasantly characterize our get-togethers, which were made even more enjoyable by the pleasant weather and clear view over the East River from the open roof deck outside the Terrace Lounge.

THE (NEW) SECRETARY'S REPORT
June 1963 to March 1964

The move of secretary's files from Staten Island to Garden Grove was accomplished after the annual meeting (1963) with relatively little mixed-up data – – we hope. By September new files, journals, and printed forms were in use, and your new secretary was realizing what a tremendous job had been done by outgoing secretary-editor Ralph Beard. His lively correspondence capped an immense work on the Bulletin and on the Manual of the Dozen System, all the while contributing to fundamental dozenal mathematics.

With more humility than net worth your new secretary proceeds . . . . .

The School Mathematics Study Group (SMSG) "New Mathematics" programs in the schools creates a welcomed burgeoning interest by school people in number systems generally and our duodecimals in particular. For these delightful students and their wonderful teachers we are privileged to supply Andrews' Excursion in Numbers reprint, Beard's Manual of the Dozen System, plus membership to many of them. To the student members and their teachers also go the Lessons and Tests. An example of the response comes from Palo Alto, California: Miss Jo Anne Stickrod, 7th grade math teacher, Terman Junior H. S., writes: ". . . we have been engaged in several fund raising events in order to cover all cost of participation . . ." How about that?

Correspondents exhibit a healthy forward-looking interest in new symbols and units and measures to make effective the values of twelve-base in the arts and sciences. Most of the suggestions are similar to material already published in past issues of the Bulletin. Of interest and value would be a summary of such suggestions in monograph form in order to promote orderly development of ideas. In the meantime, the Do-Metric units and measures were introduced into our literature many years ago, and furnish a usable and coherent base for duodecimal work. These are documented in our Manual of the Dozen System. Until such time as truly fundamental units are found (if such exist) it is thought by some of us that the work of developing conversions of today's constants from decimal to duodecimal and the reverse would be a more productive effort than the search for a nebulous system of new units from the infinite variety of possibilities. We quote from page *27;* of the Manual:

> For present applications, the use of the Do-Metric System is suggested. It adapts many of the conventional units into

> acceptable integration on the duodecimal base. Its inch and yard conform to the recent international standardized ratio of 25.4 millimeters to the inch.

Note that *any* existing or new unit *can* be used; for instance, if working in decimal Metric units, the centimeter can be used by relating it to other lengths and units via the twelve-base methods. Then there would be χ millimeters to the centimeter, and 0;1 centimeter would be, not a decimal millimeter, but a twelfth of the centimeter.

Correspondents are also interested in "speed calculations", dozenal investigation of the twelve-tone music scale, dozenal math tables[1], and our dozenal slide rule[2].

From the San Diego office of the U. S. Internal Revenue Service we have confirmation of our tax status:

> The Duodecimal Society of America Inc. of Winnetka, Illinois [office of the Treasurer], is listed on page 99 of U. S. Treasury Dept. "Publication No. 78" which is the "Cumulative List" of all organizations described in Section 170(c) of the 1954 Internal Revenue Code, contributions to which are deductible by donors for Federal Income Tax purposes.

So to those who are "bitten" each year by the income tax collector we gratefully acknowledge past donations and urge others to donate to our pioneering work. Officers and members gladly donate services and money, but we are looking toward the day when major funding will provide us with a paid staff of about one-half time or full time person who can maintain continuity and depth to the work available but not exploited from members and friends of the Society.

A new information folder is being written; the supply of the old one is exhausted after thousands of mailings and it is felt a general updating is needed.

****

1. Terry's Duodecimal Arithmetic is now available as a microfilm reprint from University Microfilms, Inc., 313 N. 1st St., Ann Arbor, Mich. Price $31.25 Cloth; $27.75 paper, both postpaid.

2. A slide rule new production is being arranged; price $8 postpaid, with case and instructions. Available about July 1964.

The annual meeting is scheduled to be held in Denver, April 12, 13, and 14, with the principal business scheduled for Saturday and Sunday. Place: Alameda Inn, where we are to have exclusive use of their meeting room. Response to mailings indicate attendance by all the board members with exception of one or two, and some regular members are planning to attend. A productive and enjoyable meeting is anticipated, reminiscent, we think, of the fine meeting at Alamogordo so pleasantly conducted by President Bagley.

A modest but healthy membership growth continues:

27	Fellows
48	Senior Members
15	Members
64	Student Members
154	Total; an increase of 27.

This represents a growth membership-wise of 21. percent.

The Duodecimal Society of Great Britain through its Secretary-Treasurer Brian Bishop, extends best wishes for our annual meeting in Denver, as does Mr. Jean Essig of France, and Professor Theodore Baumeister of Columbia University, and others. We are most grateful for their support.

Mr. Bishop offers all possible cooperation between his group and ours, and looks toward continuing efforts in the international area, so ably initiated in the 1960 meeting in Normandie attended by Messrs. Essig, Baillancourt, Bishop, and our then-president Camp, who made another trip in 1962. We heartily reciprocate Mr. Bishop's offer. 'Tis a sad thing that both our societies have very limited means to exploit the fertile international area, but expanding international membership is helping in that direction.

Membership in our sister society of Great Britain is suggested to be well worth considering by our members, Bulletin readers, and friends; the

Duodecimal Newscast alone is worth the modest membership fee. Address:

The Duodecimal Society of Great Britain
106, Leigham Court Drive
Leigh-on-Sea, Essex, England
Attention Mr. Brian Bishop, Secretary-Treasurer
Fees: Life Member 14£ - 8s ($40.32, say $50*)
Ordinary Member 12s ($1.68, say $3*)

In cooperation with The Duodecimal Society of Great Britain we purchased a modest supply of Dr. Gilles' article Lets Not Go Metric, as reprinted from the Journal of British Industries. Dr. Gilles (Berlin) examines European Metric usage and finds something less than universal acceptance even in the "Metric nations" of Europe. While the Metric† system has value in its systemization, non-Metric measures have logical values of their own. A *dozenal metric system* would avoid many problems of existing systems by replacing the inflexible base ten with the more powerful twelve base. Dr. Gilles has presented a constructive sidelight on the metric situation.

In the course of spreading dozenal education we see a striking parallel to the introduction of Hindu-Arabic numerals into Europe. Almost purely emotional opposition by uninformed populations slowed acceptance to a five-century pace. Without the dedicated perseverance of a very few, the time of acceptance could have been much longer. Leonardo's *Liber Abacii* of 1202 was the outstanding milestone, but some three hundred years more were required for general (but not complete) acceptance of the new numerals. In this Duodecimal Society today we have a comparable milestone of the twentieth century: Terry's *Duodecimal Arithmetic*, distributed to many libraries over the world. In the generations to come this book of tables and data in the base twelve will serve as the definitive work from which will continue to spring an expanding body of duodecimal knowledge, as has already been demonstrated in small part.

And that is your secretary's "30" for now, as we prepare to don Continental Airlines' multi-league boots, Denver bound.

*We suggest the higher figures to help pay for the overseas postage. Note that the British pound is currently quoted (1964) at $2.80 to the nearest cent. That makes the shilling 14¢ (twenty to the pound), and the pence 14/12 = 1-1/6¢ (twelve to the shilling).

†We capitalize Metric when talking of the specific International Metric System, and and use uncapitalized metric system when speaking of measuring systems in general.

PATTERNS FOR £

by F. Emerson Andrews

The number 9 has been called "the most mysterious and mystifying of all numbers," "the irrepressible number," and it develops many fascinating number series. But of course it is not the quantity nine which possesses these powers. They are developed in any place-value number system by that number which represents base-minus-one.

It is a useful and sometimes amusing exercise in duodecimal arithmetic to develop some of these series for £. For example:

£ x 1 = £	0 + £	= £		
£ x 2 = 1X	1 + X	= £		
£ x 3 = 29	2 + 9	= £		
£ x 4 = 38	3 + 8	= £		
£ x 5 = 47	4 + 7	= £		
£ x 6 = 56	5 + 6	= £		
£ x 7 = 65	6 + 5	= £		
£ x 8 = 74	7 + 4	= £		
£ x 9 = 83	8 + 3	= £		
£ x X = 92	9 + 2	= £		
£ x £ = X1	X + 1	= £		
£ x 10 = £0	£ + 0	= £		
£ x 11 = ££	£ + £	= 1X	1 + X = £	
£ x 12 = 10X	1 + 0 + X	= £		
£ x 13 = 119	1 + 1 + 9	= £		
£ x 14 = 128	1 + 2 + 8	= £		
£ x 15 = 137	1 + 3 + 7	= £		
£ x 16 = 146	1 + 4 + 6	= £		
£ x 17 = 155	1 + 5 + 5	= £		
£ x 18 = 164	1 + 6 + 4	= £		
£ x 19 = 173	1 + 7 + 3	= £		
£ x 1X = 182	1 + 8 + 2	= £		
£ x 1£ = 191	1 + 9 + 1	= £		

and we can carry this as far as we like:

£ x 25 = 227	2 + 2 + 7 +	= £
£ x 38 = 344	3 + 4 + 4	= £
£ x 6X = 632	6 + 3 + 2	= £
£ x 169 = 1523	1 + 5 + 2 + 3	= £
£ x 37£ = 3431	3 + 4 + 3 + 1	= £
£ x 58X = 5312	5 + 3 + 1 + 2	= £

```
      1 x Ɛ +  2 = 11
     12 x Ɛ +  3 = 111
    123 x Ɛ +  4 = 1111
   1234 x Ɛ +  5 = 11111
  12345 x Ɛ +  6 = 111111
 123456 x Ɛ +  7 = 1111111
1234567 x Ɛ +  8 = 11111111
12345678 x Ɛ +  9 = 111111111
123456789 x Ɛ +  X = 1111111111
123456789X x Ɛ + ƐƐ = 11111111111
123456789XƐ x Ɛ + 10 = 111111111111

      1 x X +  1 = Ɛ
     12 x X +  2 = ƐX
    123 x X +  3 = ƐX9
   1234 x X +  4 = ƐX98
  12345 x X +  5 = ƐX987
 123456 x X +  6 = ƐX9876
1234567 x X +  7 = ƐX98765
12345678 x X +  8 = ƐX987654
123456789 x X +  9 = ƐX9876543
123456789X x X +  X = ƐX98765432
123456789XƐ x X +  Ɛ = ƐX987654321

     123456789Ɛ (Note omission of X)
   x ƐƐƐƐƐƐƐƐƐƐ
   ------------
    11111111111
   11111111111
  11111111111
 11111111111
11111111111
 11111111111
  11111111111
   11111111111
    11111111111
     11111111111
   ------------
123456789XƐX987654321
```



```
      1 ÷ Ɛ = .1111 ...
      2 ÷ Ɛ = .2222 ...
      3 ÷ Ɛ = .3333 ...
      4 ÷ Ɛ = .4444 ...
      5 ÷ Ɛ = .5555 ...
      6 ÷ Ɛ = .6666 ...
      7 ÷ Ɛ = .7777 ...
      8 ÷ Ɛ = .8888 ...
      9 ÷ Ɛ = .9999 ...
      X ÷ Ɛ = .XXXX ...

ƐX987654321 x  Ɛ =  XXXXXXXXXXƐ
ƐX987654321 x 1X = 199999999999X
ƐX987654321 x 29 = 2888888888889
ƐX987654321 x 38 = 3777777777778
ƐX987654321 x 47 = 4666666666667
ƐX987654321 x 56 = 5555555555556
ƐX987654321 x 65 = 6444444444445
ƐX987654321 x 74 = 7333333333334
ƐX987654321 x 83 = 8222222222223
ƐX987654321 x 92 = 9111111111112
ƐX987654321 x X1 = X000000000001

      ƐƐƐƐ ƐƐƐƐ ƐƐƐƐ ƐƐƐƐ
÷ 15 = 0857 9214 Ɛ364 29X7

x 10 =  857 9214 Ɛ364 29X7 0
x  8 =   57 9214 Ɛ364 29X7 08
x  Ɛ =    7 9214 Ɛ364 29X7 085
x 11 =      9214 Ɛ364 29X7 0857
x  3 =       214 Ɛ364 29X7 0857 9
x  2 =        14 Ɛ364 29X7 0857 92
x  7 =         4 Ɛ364 29X7 0857 921
x 14 =           Ɛ364 29X7 0857 9214
x  5 =            364 29X7 0857 9214 Ɛ
x  9 =             64 29X7 0857 9214 Ɛ3
x  6 =              4 29X7 0857 9214 Ɛ36
x  4 =                29X7 0857 9214 Ɛ364
x 12 =                 9X7 0857 9214 Ɛ364 2
x 13 =                  X7 0857 9214 Ɛ364 29
x  Ɛ =                   7 0857 9214 Ɛ364 29X
```

Of course .0857 9214 Ɛ364 2987 is the endlessly repeating reciprocal of prime number 15. The interesting repeating characteristics of these reciprocals are discussed extensively in George S. Terry's *The Dozen System* and in the *Manual of the Dozen System*, p. 17 ff.

AN EXERCISE IN DUODECIMAL GEOMETRY

by Kingsland Camp

Construct a fairly large regular dodecagon, with two of its sides horizontal.

Join the midpoints of every alternate side, choosing them to make a regular hexagon with two of its sides horizontal.

Within the hexagon construct a smaller dodecagon, using a middle part of each side of the hexagon. Every side of this second dodecagon parallels a side of the first one.

Join every corner of this second dodecagon, choosing the corners to make a square with two sides horizontal.

Within the square construct a still smaller dodecagon, using a middle part of each side of the square. Every side of this third dodecagon parallels the corresponding sides of the first two.

Join the midpoints of every fourth side of this third dodecagon to make an equilateral triangle with its lower base horizontal.

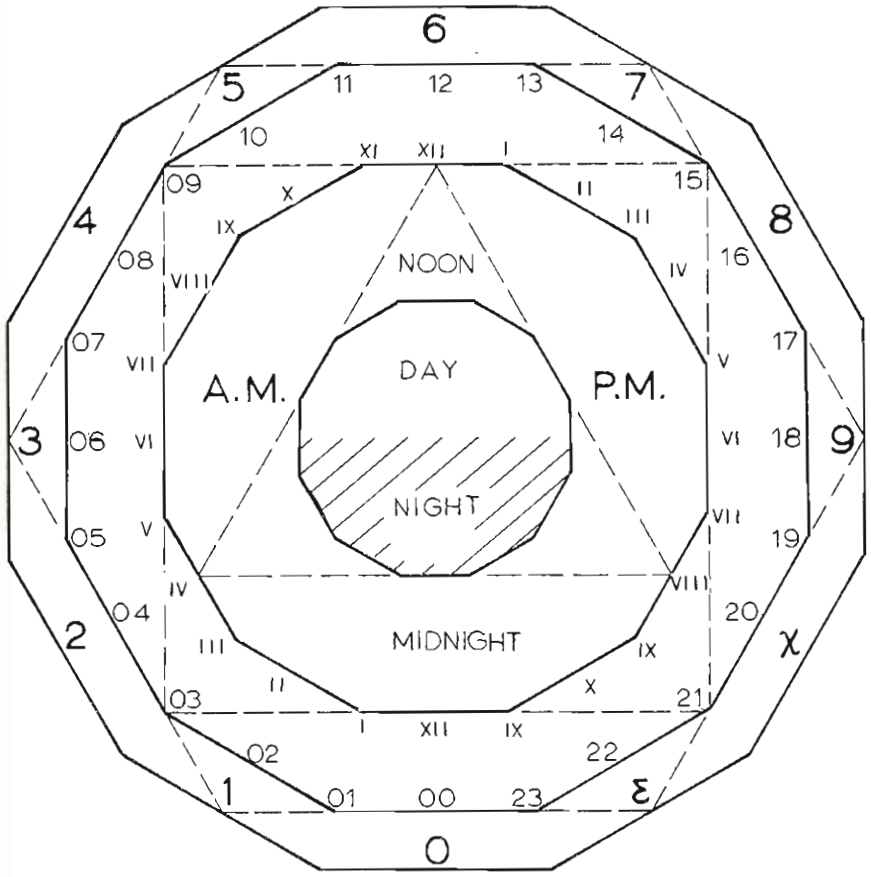
Using a middle part of each side of this triangle, it is possible to inscribe a fourth dodecagon, a miniature of the first three.

Comments: Part I

1. Evidently another regular hexagon, or two other squares, or three other equilateral triangles could have been inscribed in similar fashion, but without horizontal bases. They would have produced unpleasant networks of intersecting lines, but the middle parts of their sides would have formed all the remaining sides of the last three dodecagons.

2. Every angle in the diagram is a simple multiple of a duor (short for duothora, a suitable name for a two-hour time zone, therefore for one twelfth of a circumference, or for 30° in current sexagesimal measure).

Thus, the obtuse angle included between adjacent sides of a regular dodecagon equals five duors.



The obtuse angle included between adjacent sides of a regular hexagon equals four duors.

The right angle at each corner of a square equals three duors.

The acute angle at each corner of an equilateral triangle equals two duors; and the other two angles at the same point, with a side of the enclosing dodecagon, also equals two duors.

Finally, all other angles in the diagram are equal to one duor each.

Geometrical conclusion: The duor is the natural subdivision of a circumference.

Comments: Part II

It will be entertaining and instructive to make the four dodecagons suggest successive ways of reckoning time.

Shade the lower half of the fourth (or innermost) dodecagon, and illustrate the most primitive subdivision of time by entitiling the lower half NIGHT and the upper half DAY.

Let the next (the third) dodecagon show the Roman numerals used on early clocks and watches, but put the whole two dozen hours on one circuit: XII for midnight at midpoint of lowest side; then the A.M. hours I, II, III, etc., clockwise at corners and midpoints up to XII for noon at midpoint of uppermost side; then continue I, II, III, etc., down the right-hand side for the P.M. hours.

Let the second dodecagon in similar fashion show the Arabic numerals as now used to indicate army time.

Then let the first (outermost) dodecagon exhibit time in duors, *0, 1, 2, to* ↊ inclusive, at midpoints of the sides.

There are clocks (and probably also watches) whose hour-hands make one circuit from midnight to midnight; the minute-hand, however, makes one circuit per hour, or two circuits per duor. The alternate fractions of a duor, in duodecimal notation, would therefore have to be indicated twice around the dial. Although such a timepiece is not called for at present, it eventually could be, in the course of transition to logical duodecimal time zones and time-keeping.

MORE ABACUS AVAILABLE!

A good large desk-size abacus (or soroban) is available for $1.50 postpaid from Mr. Joe Celko, 954 Katherwood Drive, S. W., Atlanta, Georgia 30310. This 13½'' x 5½'' model is well-suited to duodecimal work, as well as usable in decimals, with a two-up, five down arrangement of the beads. The five down beads have the value of unity while the two up beads can have either three or six value in accordance with your own whim. In decimal work the two up beads would need to have the value of five, each. Joe is a new student member; maybe that is why he did not tell us whether instructions came with the digital memory called abacus.

DUODECIMAL PERSPECTIVES

by Ralph H. Beard

The development of an hiatus in the presentation of the Duodecimal Bulletin, renders this an appropriate occasion for an appraisal of the present status of duodecimals, and their prospect of general use.

My own close involvement with the active development of the dozen base spans a period of about two dozen years. As that period began, a surge of creative activity had been under way among a small group of duodecimal enthusiasts for a little more than six years. But the general mathematical literature held little comment about duodecimals, and they were largely disregarded in mathematical instruction.

The picture is far different today. We can appropriate credit for a considerable portion of the enlarged public acquaintance with the 12-base to ourselves. But most of the intensified emphasis on the preferred bases for numeration is clearly traceable to the fantastic development and growth of the calculating machines. They resort most generally to the use of the binary base in their functioning; but, since that base is not well suited to handle the calculations of "the man in the street," the possible use of other bases, – including especially the duodecimal, – has been thoroughly scrutinized.

Occasionally, in special situations or problems, it is found advantageous to work in some base other than ten. This is especially true for the duodecimal base when engaged in problems in the theory of numbers. The remarkable characteristic ability of the twelve-base to develop underlying patterns, and by their display to reveal fundamental elements or structure, is often exciting.

Offsetting this type of recognition, is the noticeable trend to decimalization of the national currencies. Many of the newer governments, in addition to India, Australia and South Africa, evidence such a tendency. We dozenophiles are quick to react to this as a regrettable error that will some day need to be corrected. It is a change in the wrong direction, but what can be done about it? The source of the error lies in the gigantic miseducation of the general public in the idea that the decimal base has some scientific advantage of its own. And this applies to the French Decimetric System as well. The only advantage lies in the unification of the system of numbers and the system of measures. And coins really are only counters. A duodecimal currency can, in general, make change with fewer coins than the decimal. But to avail ourselves of this advantage, we need to count by twelves.

In metric systems, (i.e., in *systems* of weights and measures), this requirement is predominant. The scales and multiples of their divisions must accord with the number base.

And this is the mountain that we must move. Until the public uses the dozenal number system, there is no prospect of the adoption of the dozenal metric system. Naturally, as and when the popularity of duodecimals becomes relatively more general, it would be only wise to arrange official approval for permissive use of those modified common measures that would put to fullest use the advantages of the twelve-base.

To illustrate this, it would reasonable to arrange official approval for public use of the Duodecimal Pint of twelve ounces, to make this Duodecimal Pint embody a volume equal to a 3" cube, (27 cubic inches instead of the present 28.875), and to make this volume of water define the weight of the Duodecimal Pound, (.975 pound avoirdupois). The Duodecimal Pound would be divided into twelve ounces.

The importance of this relationship lies in the fact that the 3" unit is one-twelfth *(;1)* of a yard.

A considerable acceptance and use of these measures might be expected even by those who continued to count by tens, – since they are slightly smaller sizes. Beyond this, those who were finding the twelve-base preferable could at once put to use all the benefits of the duodecimal metric system, – using the dozenal numbers and the dozenal measures together.

This course of action exactly parallels the official recognition of the units of the French decimetric system for permissive use, which is available today. It involves only minor changes. The simplicity of the proposed suggestion brings it within possibility, and renders it attractive. It is conceivable that the benefits of having our accustomed units slip into exact system relations, (with only these minor changes), might assist the progress of duodecimals into public preference. The integrating world is impatient for a systemization of the Anglo-American measures, – without clear realization of what it is that is lacking.

Of course the time for this action has not yet arrived. This is only to be contemplated after there exists a considerable volume of computation in duodecimals. And there is too little of this even among ourselves, the advocates of the advantages of duodecimals. Within our own circle, we should make it customary to test every numerical peculiarity, every

numerical anomaly, every numerical phenomenon in duodecimal arithmetic. Duodecimals will more readily evidence the basic pattern involved in these arresting oddities.

Having clarified their structure in your own mind, it will be a pleasure to call this to the attention of other dozeners. The Bulletin is hungry for papers of this type. And you will be adding another page to the manuals of the dozenal tools, algorithms and tables.

We have recently had an excellent illustration of work of this sort. One of the earlier instances of using the electronic computers was the calculation of Pi to more than 2000 decimal places on the ENIAC at Aberdeen. In the report of the results obtained, a singularity was noticeable in the occurrence of the series . . . . 49999998 . . . . in places 761 to 768 inclusive. This close approach to a finite result was sufficiently intriguing to induce an investigation of similar oddities in the duodecimal statement of Pi. This study was reported in the Duodecimal Bulletin, in 1954, publishing the conversion of the decimal ENIAC Pi for 768 duodecimal places. No such numerical curiosity was discovered in the duodecimal figures.

However, at Denver, this year, Robert W. Edelen announced that he had worked out the duodecimal value of Pi on an IBM 1620 computer to about 2000 places. His comparison of this original computation of Pi with the conversion value mentioned above showed a difference at the 1715t place, et seq.

While we have pressed Mr. Edelen to let us have a paper on his results, – for the Bulletin, – he has not yet been able to give it to us.

Naturally we are avidly interested in his work. We are even more eager to examine his figures in search for numerical peculiarities, and good duodecimal abbreviations.

One of the items of profit deriving from these labors is a confirmed duodecimal value for Pi to 170 places, – and excellent abbreviated values of 24 places, and of 143 places. These are in addition to our praiseworthy value of *3;1848*, which, in four places of fractionals, is about as close a value as 3.14159. We may state their relative departure from the exact value as follows:

3.1416	is in excess by	*;000 019 E*
3.14159	is in defect by	*;000 007 E*
3;1848	is in defect by	*;000 009 5*

In general, a defect is a safer usage than an excess, though that depends upon the specific conditions present. The degree to which the decimal π departs from a finite value at this place, can be represented by the figure $.17 \times 10^{-768}$. The equivalent duodecimal statement might be *;2 M-12X*.

It is good basic strategy to keep the world well informed of the refinements offered by duodecimals. The repetition of veracious statements makes an impression on the mind of the public. A field of inner conviction is formed in which further facts about duodecimals will grow prolifically. It is for this reason that indisputable facts like the foregoing must be restated from time to time.

There has been no great flood of publicity for duodecimals recently. But what there was constituted powerful acknowledgement. This is the fruit of careful correctness in all that we say. There is some resemblance to the working of the ion jet in space propulsion. The force of the accelerant is small, but it is constant and continuous.

Perhaps it would be well to state here a caution about any unnecessary employment of duodecimal figures. Very often we follow the statement of a quantity in decimal figures, with the equivalent in duodecimals. This seems to be poor policy unless there is a real advantage apparent in the dozenal comparison. Some of us know the twelve base well enough to be comfortable when using it in our thinking. For many people, however, this is not true. For them, there will be an avoidance of the comparative statement unless – in each case of its use, – one of the evident advantages of duodecimals is displayed. Then the reader is induced to agree, and will continue to read the dozenal figures and to seek the cause of their employment.

Because the Society and its purposes would be greatly benefited by more publicity of the same quality that we have had, it is important that we actively call attention to duodecimals in the public papers and the technical journals. Today, there is keen scrutiny of every proposed refinement of method or means. And if our statements are beyond dispute, the reaction will be of benefit to us.

We need your voluntary support and your initiative in the production of original ideas.

COUNTING IN DOZENS

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*X*	*E*	*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	*3E2*	Two ft. eight in.	*2;8'*
19E	*1000*	Eleven ft. seven in.	*E;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 *2E*, which is two dozen and eleven. For larger numbers, keep dividing by 12, and the successive remainders are the desired dozenal numbers.

$$12 \overline{)\,365}$$
$$12 \overline{)\,30} + 5$$
$$12 \overline{)\,2} + 6$$
$$0 + 2$$

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