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PART H

NOTATIONAL PLANE

CHAPTER HA

NEED FOR NOTATIONAL SYSTEM

0 Introduction

From this chapter onwards, we shall have in mind the Universe of Subjects. In Sec CL1 the possibility has been mentioned of considering

1 Either a Universe of Entities;

2 Or Universe of Classes formed by these entities in the successive stages in the progression towards their complete assortment.

In fact, it has been stated that a scheme of classes masks the entities at the various stages in the progression from the original universe during its classification (*See* Sec CL1). Further, we are more interested in the Universe of Subjects than in any other Entities. The Subjects should be arranged in a helpful filiatory sequence on the basis of a scheme of successive characteristics. There is also the need to mechanise the arrangement as shown in Sec CM2.

1 Unhelpfulness of Alphabetical Sequence

Alphabetical Arrangement of subjects by their names, as a means of mechanising their arrangement, must be Ruled Out, as the sequence it gives is Not Helpful.

11 EXAMPLE 1

Let us take the ten Main Classes of DC. Alphabetical Arrangement by their names throws them in the unhelpful sequence:

Arts	Philosophy and Related
General Geography	Disciplines
History, etc	Pure Sciences
Generalities	Religion
Language	Social sciences
Literature and Rhetoric	Technology (Applied sciences)

It can be seen at a glance that 'Pure sciences' is an unwanted wedge between 'Philosophy' and 'Religion'. So also are 'Religion' and 'Sociology' between 'Pure sciences' and 'Technology'. It would be helpful if 'Fine arts' and 'Literature', the highest Fine Art, could be together.

12 EXAMPLE 2

Let us take the following Main Classes of CC. Alphabetical Arrangement by their names throws them in the unhelpful sequence:

Agriculture	Geology	Philosophy
Biology	History	Physics

Botany	Law	Political science
Chemistry	Linguistics	Psychology
Economics	Literature	Religion
Education	Mathematics	Sociology
Engineering	Medicine	Technology
Fine arts	Mysticism & Spiritual Experience	Useful arts
Generalia		Zoology
Geography		

13 EXAMPLE 3

Consider the following 22 topics in Theology:

God	Faith	Judgement
Angels and devils	Repentance	Heaven and hell
Founders of religion	Regeneration	Rebirth
Saints	Grace	Eternity
Men and soul	Eschatology	Immortality
Salvation	Death	Universe
Predestination	Intermediate stage	Revelation
Free will		

The sequence as listed above is fairly helpful. But alphabetisation will throw them in the following utterly unhelpful sequence:

Angels and devils	Grace	Regeneration
Death	Heaven and hell	Repentance
Eschatology	Immortality	Revelation
Eternity	Intermediate stage	Saints
Faith	Judgement	Salvation
Founders of religion	Men and soul	Theology (general)
Free will	Predestination	Universe
God	Rebirth	

14 EXAMPLE 4

The parts of a government, as arranged in a helpful sequence, will be:

Head of the State	Party	Civil service
Executive	Local body	
Legislature	Judiciary	

But alphabetisation will arrange them in a wholly unhelpful sequence as follows:

Civil service	Judiciary	Party
Head of the State	Legislature	
Executive	Local body	

Any slice may be taken out of the schedule of CC or DC or any other scheme for classification, and the classes or the ranked isolates alphabetised by their names. It will demonstrate the utter

destruction of helpful sequence by alphabetisation by the names of subjects or of isolates.

Indeed, the term 'Alphabetical scattering' clinches the substance of the statement in Sec HA1 and rules out alphabetisation as a means of mechanising helpful arrangement.

2 Effect of Change in Name of Subject

Alphabetical Arrangement of subjects by their names, as a means of mechanising their arrangement, must be Ruled Out, as the names of subjects are Not Stable.

Semantic changes are continually going on. They cannot be stopped by the library profession. Apart from subtle changes of meaning in a word, the name of subject is often changed from time to time. Within the last century, 'Natural philosophy' has given place to 'Physics'. If we had depended for the position of this subject on alphabetical arrangement by its name, it should have been shifted from the 'N' group of subjects to the 'P' group, when the change was complete—with an awkward transition period until the new name was universally accepted. Another change during the last hundred years has been from 'Political economy' to 'Economics'. Alphabetical Arrangement of subjects by their names would have shifted this subject from among Peas, Poultry, and Pyorrhoea to another set of equally heterogeneous neighbours—Eagles, Eczema, and Eggs. At this rate, the arrangement of subjects in a library would be disturbed continually.

On the ground, then, of Lack of Stability in Names of Subjects, the statement in Sec HA2 rules out alphabetisation as a means of mechanising helpful arrangement.

3 Effect of Synonyms on Alphabetical Sequence

Alphabetical arrangement of subjects by their names, as a means of mechanising their arrangement, must be Ruled Out, as the names of subjects are Not Unique.

The name of each subject is by no means unique, even at any one moment, in any natural language. This again will make its position uncertain. For example, 'Fuse' and 'Cut out' are equivalent words for the same idea; one takes it to the 'F' group and the other to the 'C' group. 'Acoustics' and 'Sound' are equivalent terms denoting the same branch of Physics; one takes it to the 'A' group and the other to the 'S' group. Again, the two words 'Homiletics' and 'Preaching' are used to denote the same idea; one will take it to the 'H' group and the other to the 'P' group. Witness, in short, the myriads of '*See*' references recommended by the *Subject headings for a dictionary catalogue* issued by the American Library Association [4] or by the *Subject headings* issued by the Library of

Congress [81]. Further, the name of a subject sometimes consists of two or more words. These may be taken in different sequences, and each such sequence will give a different position to the subject. For example, is it to be 'History of Great Britain' (under 'H') or British History (under 'B') or Great Britain, History (under 'G')?

On the ground, then, of lack of uniqueness in the terms used to denote a subject, the statement in Sec HA3 rules out alphabetisation as a means of mechanising arrangement.

4 Effect of Multiplicity of Languages on Alphabetical Sequence

Alphabetical arrangement of subjects by their names, as a means of mechanising their arrangement, must be Ruled Out, as the alphabetical position of a subject would vary with the Language from which the name is taken.

For example, in English 'Dry cell' would go to the 'D' group and 'Tuning fork' to the 'T' group. But in German, the former, (Trocken element), goes to the 'T' group and the latter (Stimmgabel) to the 'S' group. In French, the former (Pile seche) will go to the 'P' group and the latter (Diapason) to the 'D' group.

5 Effect of Homonyms on Alphabetical Sequence

Alphabetical arrangement of subjects by their names, as a means of mechanising their arrangement, must be Ruled Out, as the subjects denoted by a term are Not Unique.

The subject denoted by a term is by no means unique in any natural language. It is notorious what havoc Homonym can play in a natural language, where there is hardly a word with a unique meaning. What a variety of ideas, for example, the noun (let alone verbal use) 'Number' itself represents!—integer, rational number, irrational number, transcendental number, imaginary and complex number, and so on. The term 'Cotton' may mean either the cotton-plant, or the cotton-fibre, or the woven cotton cloth. The term 'Prayer' may mean public or private supplication, or ritual duty, or (with the Christian mystics) a process of union with God; it may refer to widely varying contexts, intentions, traditions, and experiences. It is doubtful if there would be so many schools of philosophy but for lack of uniqueness in the meaning of expressions. Politics seems to be the field *par excellence* for quibbling of all kinds. One of the things that delays the development of Economics into a full-blown science is no doubt lack of uniqueness and stability of the meaning of its terms. The fact that some of the best brains of a community can be engaged in a most lucrative way by the Bench and Bar is perhaps the most significant of all in this connection. For other examples, *See* Sec GA4.

6 Necessity for Ordinal Numbers

Since Alphabetical Arrangement fails as a means of mechanising the arrangement of subjects in the preferred helpful sequence, we must use Ordinal Numbers.

61 FUNCTION OF ORDINAL NUMBERS

The dictionary lays down that the use of an ordinal number is for "defining thing's position in series". One can recall several ways in which it is used for mechanising arrangement—among guests at a big dinner, among students in a class, and among patients awaiting their turn for the physician. They are used for arranging withdrawal claims pending enquiry in a court. The logical French in Paris have numbered-slips at bus-stops which prospective passengers tear off as soon as they arrive there. When the bus appears the conductor has a means of seeing that each man enters the bus in his proper turn.

62 MECHANISATION OF ARRANGEMENT BY ORDINAL NUMBER

In all such cases the desired sequence is fixed on some suitable principle and then mechanised by means of ordinal numbers. Melvil Dewey was the first to popularise the application of this practice to the arrangement of subjects. He is therefore rightly referred to as the Father of modern library classification. Since his time, the system of ordinal numbers used for arrangement of subjects—the notational system as it is called—has been brought to the fore-front in evaluating the usefulness of schemes for classification.

63 FREEDOM OF ORDINAL NUMBER FROM CARDINAL NUMBER

The ordinal numbers are different from the cardinal numbers with which we count. The same symbols—0, 1, 2, 3, 4, 5, 6, 7, 8, 9—are, however, used for both. Since in practice numbers are most often used for counting, the popular mind is less accustomed to their purely ordinal values. Moreover, it often happens that numbers are used at the same time both for arranging and for counting. This also stands in the way of the purely ordinal values being distinguished from the purely cardinal ones. It appears that even among mathematicians, the properties of ordinals have not yet been investigated and exploited as much as those of cardinals. Ordinal numbers will receive proper attention, only if they are used by themselves and independently of cardinals in as many contexts as possible. They should not be linked up with one another. In this and other books of mine, it is pure ordinals that are used to number chapters, sections, and sub-sections (*See* Sec AE8). They give no information about the total number of chapters. To find

it, one must actually count them. The use of ordinal numbers to mechanise the arrangement of subjects provides a splendid opportunity to declare, so to speak, the independence of ordinals. The students of classification should, therefore, clear their mind completely of the shackles induced by the long linkage of ordinals with cardinals. They should not hesitate to use all the freedom they gain by so doing. We shall mention here one such freedom which is being already exercised to some extent.

64 IMPROVISATION OF ORDINAL NUMBERS

The scope of cardinal numbers is limited by the attachment to each of them of a quantitative value. No basic cardinal numbers can be invented easily. But new basic ordinal numbers can be improvised by using any symbol or digit and defining its sequence relative to the already existing ordinal numbers—conventional or improvised. The extent to which ordinal numbers have been improvised by different schemes for classification is shown in Sec HC911 to HC918.

7 Restraint in the Improvisation of Ordinal Number

That we have freed ourselves from the limitations of cardinal numbers should not lead us to improvise ordinal numbers at every turn. Then we might find ourselves in the position of Midas. Our freedom must be used with circumspection and restraint. Okham's Razor should be freely used to prevent the unnecessary overgrowth of basic ordinal numbers. No basic ordinal number should be improvised unless the existing set is definitely proved to be inadequate to meet the situation.

71 UNIVERSAL DECIMAL CLASSIFICATION

Perhaps UDC need not have introduced the Analytical Subdivision Digit Hyphen (-) while it concedes that the same purpose can be served by the digit-group Point Zero (.0).

72/77 COLON CLASSIFICATION

72 USE OF HYPHEN

In 1924, the punctuation mark " : " (Colon) alone was added to the basic stock of ordinal numbers of CC. From 1933 onwards, necessity was experienced to combine two or more isolate numbers in one and the same schedule and form a superimposed isolate number. The connecting digit to be used for this purpose needed an ordinal value less than that of "1" but greater than that of " : ". Therefore, the digit "-" (Hyphen) was improvised for the purpose. This new improvised connecting digit was finally included in CC in Edition 2 (1939).

73 USE OF ALL THE PUNCTUATION MARKS

The rigidity caused by using the puncutation mark ":" (Colon) alone was experienced after 1933. For nearly a quarter of a century, various attempts were made to overcome this rigidity, if possible, with the existing stock of basic ordinal numbers. But it proved a failure. The cause of the failure was finally traced out in the Idea Plane. This led to the need for the addition of the other punctuation marks to the stock. This was done in 1949 [143]. However, these improvised additional basic ordinal numbers were included only in Ed 4 of CC (1952). Arranged in the ascending sequence of ordinal value, the improvised ordinal numbers fall in the following sequence:

"." ":" ";" "," "-"

74 USE OF CIRCULAR BRACKETS

The use of Subject Device (*See* Chap ND) led to homonyms. Consider the CC number T : 3, U 44. It meant both

1 Teaching of Geography in India; and

2 Teaching of the Geography of India.

Thus, the class number became a homonym. In CC, there was no means of indicating whether the last facet—Space Facet—belonged to the entire number preceding it or to its latter part got by the Subject Device. This kind of homonym had been challenging us for over thirty years. Various makeshifts were made. In every case, the cure appeared worse than the disease. One summer night in 1950, in a deep discussion with S Parthasarathy, the idea occurred that the Subject Device part of a class number might be enclosed in circular brackets—that is, "packeted". Thus we decided to call it Packet Notation. But there was mental resistance to the adoption of this notation. Part of this resistance was due to the unexpressed sub-conscious question, "Are we to add further to the mixedness of the notation?" There were also a few other difficulties. The question was taken up again and again in the Library Research Circle in Delhi; and every time it was abandoned without coming to a firm decision.

In June 1954, it was again brought up at a meeting of the Classification Research Group in London. There, experiences of specialist librarians, working in libraries of industries and government departments, brought up a number of problems, many of which admitted of a neat solution with Packet Notation. The brackets do the same work here as they do in mathematical language, where, as well as in classificatory language, they transform a complex of two or more digits into a single digit for the purposes on hand. This is indeed a very helpful transformation called "Association" in Mathematics. Whatever be the number of digits, including con-

necting digits, whatever be the number of facets or phases, in the number within the brackets, it has only the status of a single-digited isolate number in the entire class number. It has actually only the status of a part of a facet number—that is, the status of a Isolate number in an array, not necessarily amounting to a complete facet number.

Having decided to accept the improvised brackets, as a basic ordinal digit, it was easily realised that the ordinal value of "(" (Starter Bracket) should be greater than that of "Z" and that the ordinal value of ")" (Arrester Bracket) should be smaller than that of "0" (Zero). Though this decision was made in 1954, these improvised digits were finally included in the stock of basic ordinal digits of CC only in Ed 5 (1957).

75 Use of Single Inverted Comma

From 1952 onwards, the rigidity caused by the use of the same connecting digit for Space Facet as well as Time Facet came to be experienced. This was a result of realising, in the Idea Plane, the need for providing two or more levels of Space and Time Facets. But various attempts were made to remove this rigidity with the existing stock of basic ordinal digits alone. But, the rigidity could not be altogether removed. In 1960, it was realised that the rigidity could be removed only by improvising the digit "'" (Single Inverted Comma) as a distinctive connecting digit for Time Facet. Even after that, three years were allowed to lapse before adding this newly improvised digit to the stock of connecting digits in the reprint of Ed 6 of CC (1963). The ordinal value of "'" (Single Inverted Comma) is less than that of "." (Dot).

76 Use of "Equal to" Sign

All along, the Works of a poet, a dramatist, etc were given Isolate Numbers by enumeration. For this purpose, the Works were all arranged chronologically, if practicable, or in any other way and then numbered either 1, 2, 3, or with the use of the group notation of two or three digits, depending upon the total number of Works to be accommodated in the array [107]. The same practice was also followed in giving Isolate Numbers to the individual Works of Classical Authors, as shown in Part 3 of CC. This was involving much work on the part of the Classificationist and the Classifier, without a corresponding increase in help to the users. This problem was investigated in 1963. It was finally decided to use the Alphabetical Device to construct the Isolate Numbers for Works. It turned out that, in some cases, Binomial Alphabetical Numbers were necessary. This was also experienced in the Classification of Virus and Bacteria, and of Cultivars in Agriculture. At

first, "-" (Hyphen) was used as the Connecting Digit to connect together the two members of a Binomial [97]. The Research Cell of DRTC applied this device elaborately not only in the case of the Works, Cultivars, Bacteria, Virus, but also in the case of different Brands of Machinery. It was discovered that homonyms were created in the Notational Language—that is, in the Notational Plane—by the use of the same Connecting Digit "-" in the case of both Superimposed Isolate Numbers and Binomial Isolate Numbers got by Alphabetical Device. Then came the brilliant suggestion of S Seetharama that the "="—looking like "Equal to" sign—might be used as the Connecting Digit in the case of Binomial Isolate Numbers got by Alphabetical Device [59]. This means adding one more digit to the Notational System of CC. The general policy is not to introduce new digits in a light-hearted way. After a good deal of thought, the newcomer has been provisionally admitted. It will be incorporated in the forthcoming Edition 7 of CC.

77 USE OF A DIGIT OF NEW SPECIES

By 1952, the need was felt to interpolate new class numbers in the array of Main Class Numbers. This was urgent. Therefore, as a temporary expedient, the new species of the letters of the Greek Alphabet were improvised as a new species of ordinal digits for use in CC. This hasty introduction of new digits had been all along felt to be wrong. It was therefore done only as a temporary measure. By 1963, the postulation of the digits T to Z as Emptying Digits made it possible to meet the problem without improvising any such new species of digits. The only risk was of this use of the digits T to Z coming into conflict with the use of same digits for Alphabetical Device in the array of the next order. However, this conflict will not arise in the case of the array of Main Classes, or in the case of any array in the Time Facet or Space Facet. Perhaps, it may be so even in the case of an array of any Energy Facet. But, conflict will arise in the arrays of Personality Facet and perhaps also of Matter Facet. Even here, it is likely to be occasional. But even then it needs attention. In view of this, it is being considered whether a new species of ordinal digit might be improvised for use in interpolation in Personality and Matter Facets only. Its ordinal value should be greater than that of the starter bracket. It is being considered whether inverted V—that is, "Λ"—may be improvised as a basic ordinal digit for this purpose. The need for interpolation will be far greater in the array of Main Classes and Geographical Facets than in the Array of Personality or Matter Facets. Therefore, the new improvised digit will appear only in a very few cases. This case illustrates the extreme restraint with which any new digit should be improvised as a basic ordinal number.

CHAPTER HB

QUALITIES OF NOTATIONAL SYSTEM

1 Brevity of Class Number

Brevity is a desirable quality in a Class Number. Classification is a means of mechanising the arrangement of books in a helpful sequence according to their respective subjects. Here, we look upon books as embodied subjects. Books are comparatively small in size. For compactness, they are usually made to stand side by side on their lower edges with only the spines visible. The class number of a book must, therefore, be written on its spine. Convenience suggests its being written across the spine at a distance of one inch from the bottom. Since an average book is only one inch thick, the digits of the class number should form a line not longer than an inch and preferably shorter.

2 Brevity not a Necessity

Till about a generation ago, the library profession confined itself to the classification and service of whole books and periodicals. This established the tradition that a Class Number should be brief. Unfortunately, bad traditions die hard. Today, the library profession has begun to classify even articles in periodicals in order to serve specialist readers. This is a part of the Documentation Work and Service now demanded of libraries. The question of writing the class number on the spine does not arise here. The Class Numbers of all the millions of narrow subjects embodied in articles—micro subjects—cannot be brief. Those without the experience of documentation may still harp on "Brevity in Class Number".

3 Speed of Writing

Brevity spatially considered (compactness) does not necessarily imply speed of writing. Tiny pictures full of microscopic details might take weeks to paint. For speed as well as brevity, the basic characters of a classificatory language and the method of combining them into class numbers should be simple.

Speed of writing is important since the class number of each book must be entered in several places in the book itself—on the spine, the date-label, the back of the title-page, some prescribed page inside the book, and the book-cards—and in the accession register, in the shelf-register, and in the main and the numerous added entries in the catalogue. However brief a class number may be, since it has to be written in more than a dozen places, the effect of brevity will be frustrated unless it admits of speedy writing.

4 Pronouncibility

Some French classifiers speak of pronouncibility as a useful quality of a class number. This will be possible only if the notation is a literal one. Even then, there should be a certain alternation of consonants and vowels in a class number. The limited number of consonants in the Roman alphabet and the very few vowels make it impracticable to construct millions of pronouncible class numbers to represent millions of subjects co-extensively. The tendency will be then throw "co-extensiveness in class numbers" to the winds. If we do that, there would soon be chaos-in-little at several spots in classified arrangement. Thus, the issue reduces itself to "Are we to uphold 'co-extensiveness' against 'Pronouncibility' or vice-versa?" In this connection, it must be remembered that a class number is not going to be read out more often than being written down, seen, and temporarily retained in memory. In practice, we have found that pronouncibility is not necessary for this purpose.

5 Difference in Users

A scheme for classification may be only for temporary private use by a definite small group of persons or for permanent use by the public. This difference in use also weighs while determining the qualities necessary and desirable in the notational system of a scheme for classification.

51 Temporary Use by a Definite Small Group

A scheme for classification may be only for use by a single person or by one and the same small group of persons collaborating with one another in business. For example, the Class Numbers put on baggages by transport companies are temporary and are used only by those who handle the transport. These form a small number. Again, the numbers, put on the articles of commodities for Customs purposes, are temporary and are used only by the Customs Authorities at certain points in the world. Similarly, the Class Numbers put on motor cars are used only by a small group of persons.

52 Permanent Use by the Public

On the other hand, the Class Numbers of documents are to be used for an indefinitely long period. They have, therefore, to be used by changing sets of library staff through many generations. To facilitate use by the public, the Class Numbers are written on the backs of books, the tops of main entries, the last lines of many of the alphabetical index entries, the guide cards in the classified part of the catalogue, the tier guides, the gangway guides, the bay-guides, and the shelf-guides. While searching for a book or a document, the Class Number is picked up from the catalogue by the

public and either it is noted on a slip of paper or is carried in memory, until they have scanned the various guides in the stack-room. Thus, the Class Numbers make a frequent impact on an ever-varying public. This factor should be remembered in designing the Class Numbers in a scheme for library classification.

6 Block Formation

The following assumptions are based on conjecture:

1 According to the physiology of the eye, the optimum number of consecutive digits, that can be comfortably picked up in a single sweep of the eye, is three; and the maximum is six.

2 According to the psychology of memory, the optimum number of digits, that can be picked up in one instalment and stored in memory for a short while, is three; and the maximum is six. In the case of a number with a long string of digits, this conjecture would suggest the partitioning of it into blocks of digits, the partition being done either by space or by a digit of a different species improvised for this purpose alone or for other purposes also.

61 Decimal Classification

In DC, a dot is put after the first three digits. This has no Function other than giving relief to the eye and memory. Up to Ed 14 of DC (1942), all the digits after the third were put in a continuous string irrespective of their number. This causes inconvenience. But from Ed 16 (1958) onwards, from the second block onwards, a blank space is left after every block of three digits. This makes it structured though not as sharply as the insertion of a dot.

Example

1 In DC, 621.3876 of Ed 14 has been changed into 621.387 6 in Ed 16.

2 In UDC, the mode of writing is as in 621.791.75

7 Facet Formation

The class number can be made to reflect the distinguishing qualities of the blocks into which it is partitioned, if the partitioning digits can be made meaningful so as to serve as signposts or indicators of the quality of the succeeding blocks. Each block is called a Facet.

71 Universal Decimal Classification

In UDC, the following meaningful connecting digits are used. Besides giving relief to the eye and memory, a connecting digit also signified the character of the ideas represented by the facet succeeding it in accordance with the following scheme.

SN	Connecting Digit	Signifies
1	(0 . . .)	Form Division
2	". . ."	Time Division
3	(. . .)	Geographical Division
4	- (Hyphen)	Analytical Division

711 EXAMPLE

SN	UDCN	Subject
1	338.011 (410) "195"	Productivity in industries of United Kingdom in 1950s
2	53.(051)	Periodicals on Physics
3	535.33–3	Ultra-Violet spectrum

72 COLON CLASSIFICATION

In CC, the following meaningful connecting digits are used. Besides giving relief to the eye and the memory, a connecting digit also signifies the kind of ideas represented by the facet succeeding it, in accordance with the following scheme.

SN	Connecting Digit	Signifies
1	' (Single inverted comma)	Time Facet
2	. (Dot)	Space Facet
3	: (Colon)	Energy Facet
4	; (Semi-colon)	Property Facet and Material Facet
5	, (Comma)	Personality Facet
6	- (Hyphen)	Super-imposed Facet
7	= (Equal to)	Super-imposed Multinomial Facet

721 EXAMPLE

SN	CCN	Subject
1	T15.56 'N5	Elementary Education. United Kingdom. 1950.
2	T15:8.56 'N5	Elementary Education. Management. United Kingdom. 1950s.
3	J381, 15;2	Anatomy. Leaf. Rice plant.

CHAPTER HC

TERMINOLOGY FOR NOTATIONAL SYSTEM

0 Notational System

System of ordinal numbers used to represent the classes in a scheme for classification.

The term 'Numbers' brings to one's mind the ten Indo-Arabic numerals only and the use of them as integers. With a slight effort we can realise that neither of these restrictions is essential. To deal with this question, it will be convenient to introduce terms.

01 NOTATION

A number forming a member of a notational system.

1 Digit and Base

11 DIGIT

A single, isolated, primary symbol occurring in a notational system.

12 BASE

A Set of Digits used by a notational system.

13 LENGTH OF BASE

The number of digits in the base of a notational system.

The length of the Base of a notational system using Indo-Arabic numerals alone is 10; Roman capitals alone is 26; using both of them is 36; and so on.

2 By Shape

20 SHAPE OF NUMBER

Pattern formed by the digits in the class number.

21 LINEAR NOTATION

Notation with the digits in the class number arranged in a straight line.

22 HORIZONTAL NOTATION

Notation with the digits in the class number arranged in a horizontal straight line.

221 RIGHT-HANDED NOTATION

Notation with the digits in the class number arranged from left to right in a horizontal straight line.

Example.—73157

222 LEFT-HANDED NOTATION

Notation in the class number arranged from right to left in a horizontal straight line.

Example.—The above number written as 75137

23 VERTICAL NOTATION

Notation with the digits in the class number arranged in a vertical straight line.

231 DOWNWARD NOTATION

Notation with the digits in the class number arranged from top downwards in a vertical straight line.

Example.— 7
3
1
5
7

232 UPWARD NOTATION

Notation with the digits in the class number arranged from bottom upwards in a vertical straight line.

Example.—The above number written as 7
5
1
3
7

24 CURVED NOTATION

Notation with the digits in the class number arranged along a curve.

A Curved Notation takes the name of the curve formed by the digits.

Example.—Circular Notation; Elliptic Notation; Parabolic Notation.

25 PLANE NOTATION

Notation with the digits in the class number arranged in a plane—that is, in two dimensions.

Example.— 7345
6231
9586

251 SUFFIX NOTATION

Right-handed horizontal notation with one or more digits having a suffix digit added.

Example.—$2_8 40_1$

252 SUPERIOR NOTATION

Right-handed horizontal notation with one or more digits having a superior digit—that is, an index digit—added.

Example.—2_s40_i

26 PRACTICE IN LIBRARY CLASSIFICATION

The notation usually preferred in library classification is Right-handed, Linear Notation—without suffixes or superiors. When a class number has to be written along the spine of a thin book, Downward Notation may be used. The other kinds of notation have not yet been exploited in library classification.

3 Place Value

In Right-handed Notation, two subdivisions can be recognised by the effect produced on the host number by the addition of a digit at its right end.

31 INTEGER NOTATION

In Integer Notation the place value of each digit in the host number is changed by adding an extra digit at its right end.

Example

Begin with 346 as host number. Let us add the digit 5 at its right end; then we derive the number 3465. Reading the numbers as integers, in the host number 346, the place value of 3 is 300; that of 4 is 40; and that of 6 is 6. But in the derived number 3465, the place value of 3 is 3000; that of 4 is 400; and that of 6 is 60.

310 On the other hand, in Integer Notation, the addition of an extra digit at the left end does not change the place value of any digit in the host number.

Example

Let us begin with 346 as host number. Let us add the digit 5 at the left end; then we derive the number 5346. Reading the numbers as integers, both in the host number 346 and in the derived number 5346, the place value of 3 is 300; that of 4 is 40; and that of 6 is 6.

32 DECIMAL FRACTION NOTATION

In Decimal Fraction Notation the place value of each digit in the host number remains unchanged by adding an extra digit at its right end.

Example

Let us begin with host number 346 given as example under Sec HC31. Let us add the digit 5 at its right end; then we derive the number 3465. Let us read the number as decimal fraction—that is, take a decimal point to stand understood before each of the

Ranganathan, Shiyali Ramamrita.
Prolegomena to Library Classification. Assisted by M.A. Gopinath. 3rd edition.
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numbers. Then in both the numbers, the place value of 3 is 3/10; that of 4 is 4/100; and that of 6 is 6/1000.

320 In Decimal Fraction Notation, the addition of an extra digit at the left end changes the place value of each digit in the host number.

Example

Let us begin with 346 as host number. Let us add the digit 5 at the left end. We derive the number 5346. Reading the numbers as decimal fraction, in the host number 346, the place value of 3 is 3/100; that of 4 is 4/1000; and that of 6 is 6/10,000.

4 Digits used in Notation

40 SPECIES OF DIGITS

A conventional set of digits.

Example

1 Indo-Arabic numerals.
2 Capital letters of the Roman alphabet.
3 Small letters of the Roman alphabet.
4 Letters of the Greek alphabet.
5 Letters of the Sanskrit alphabet.
6 Punctuation marks.

41 PURE BASE

Base containing one and only one species of digits.

Example

Arabic numerals alone. Roman capitals alone. Roman smalls alone.

42 MIXED BASE

Base containing two or more species of digits.

Example

Indo-Arabic numerals and Roman capitals. Roman capitals and Roman smalls. Indo-Arabic numerals, Roman capitals, and Roman smalls.

43 PURE NOTATIONAL SYSTEM

A notational system in which no class number contains more than one species of digits.

Example.—365 HOG ape

44 MIXED NOTATIONAL SYSTEM

A notational system in which a class number may have two or more species of digits.

Example.—N24 Q,22 XM,8,D:w

45 Scale of Absolute Value

Regarding the absolute ordinal values of the digits, they are conventionally fixed in Indo-Arabic numerals as of increasing sequence while progressing from 0 towards 9. The scale may be similarly fixed for other species of digits. So also any convenient scale may be fixed for the relative values of different species. For example, the Roman capitals are taken to be of higher ordinal value than the Indo-Arabic numerals in both CC and BC. But it is the reverse in DC.

46 Extension of the Idea of Place Value

The concept of 'Decimal Fraction Notation' can be applied also when the base is a mixed one. The place value of a digit in a class number consisting of two or more species of digits should be determined on the analogy of the Rule given in Sec HC3.

5 Notation in Blocks

51 Unipartite Notation

Linear, horizontal, right-handed notation with all the digits written closely so as to form one block.

Example.—In LC, RC372 Epilepsy in Medicine

52 Multipartite Notation

Linear, horizontal, right-handed notation, with the digits separated into blocks of 3 to 6 digits by a space or by a semantically poor (not meaningful) digit—usually a dot.

Example.—In DC Ed 16,

621.38932 Records and recorders (Cylinder, disc, wire, tape, film records and recorders)

In UDC, 621.791.75 Arc welding

6 Notation in Facets

61 Non-Faceted Notation

Alternative name for Unipartite Notation.

62 Faceted Notation

Multipartite notation with the blocks of digits connected by a meaningful connecting digit, analogous to punctuation marks, each connecting digit indicating the distinctive character of the idea represented by the succeeding block of digits.

621 Facet Number

The number forming a block in a class number in a faceted notation (*See also* Sec CR7).

622 Connecting Digit

Any digit in a class number prefixed to a facet number other than the Basic Number (For examples, *See* Sec HC63).

63 EXAMPLES

631 Universal Decimal Classification

SN	UDCN	Subject
1	338.011(410)"195"	Economics. Industry. Productivity. United Kingdom. 1950s.
2	53.(051)	Physics. Periodicals.
3	535.33-3	Physics. Optics. Emission Spectra. Ultraviolet Rays.

Note.—In example 1 there are five facets. The facet number "11", succeeding the connecting digit "0" represents "Productivity". The facet number "410", enclosed within the brackets which serve as a connecting digit-pair, represents "United Kingdom". Similarly, the facet number "195" enclosed within quote symbols which serve as a connecting digit-pair, represents "1950s". All these are Facet Numbers. The digit "8" is also a facet number, though it has no connecting digit. By convention the connecting digit is taken as understood. The reason for its not being written is due to the number "338" having been taken from DC whose notation is not faceted. If this is remembered, "8" (=Industry) is a facet number; and "33" is the Basic Facet Number—that is, the First Facet Number.

632 Colon Classification

SN	CCN	Subject
1	T15.56 'N5	Elementary Education. United Kingdom. 1950s.
2	T15:8.56 'N5	Elementary Education. Management. United Kingdom. 1950s.
3	J381,15;2	Anatomy. Leaf. Rice plant.

Note.—In Example 3, there are four facets. The facet number "J" represents "Agriculture"; it is the Basic or First Facet. The facet number "381" represents "Rice plant"; the facet number "15" represents "Leaf"; the facet number "2" represents "Anatomy". It can be seen that punctuation marks are used as connecting

digits. Although there is no connecting digit between the digit "J" and the digit-group "381", they are taken as two facet numbers. By convention, the connecting digit is taken as understood.

7 Array in Notational Plane

70 Array

The set of class numbers or isolate numbers used to represent the classes or the ranked isolates, as the case may be, in an array (*See* Sec CE1) and taken in the sequence of the classes or of the ranked isolates.

71 Capacity of Array

The maximum number of distinct class numbers or isolate numbers that can be accommodated in an array.

72 Empty Digit

A digit with ordinal value but without semantic value.

Usually, the last digit of a species of digits is made an Empty Digit. In DC and UDC, the digit 9 is often used as an Empty Digit. In CC, the digits z, 9, and Z are used as Empty Digits, except in very few cases. The digit 0 (Zero) also is used as Empty Digit, when it is not used as a connecting digit for Phase and not used as a numeral in a Chronological Number [91]. This multiple use of the digit "0" is analogous to the special properties of "0" in Arithmetic—such as

1 Zero can be taken as both positive and negative;

2 The result of multiplying zero is zero whatever be the number multiplied; as a consequence

3 The quotient of dividing zero by zero may be taken as any number. In other words, it is indeterminate; and

4 Division of any number other than zero by zero is not permitted.

In CC, the digit "(" (Starter bracket) is also used as an Empty Digit.

73 Sector Device

A device used for increasing the capacity of an array with the aid of an Empty Digit.

74 Sector Notation

741 Pure Base of Indo-Arabic Numerals

Consider the sequence 1 ... 8 91 ... 98 991 ... 998 etc. Here, though the number 91 has two digits, 9 by itself has no meaning. But 91 is meaningful. It is used to represent a class co-ordinate with the classes represented respectively by the digits 1 to 8. So it is with

the numbers 92 to 98, and 991 to 998 etc. Thus the digits 1 ... 8 91 ... 98 991 ... 998 etc form a single array. The numbers 91 ... 991 are treated as if each formed a single digit. It may also be said that the array 1 to 8 has been lengthened by Sector Device, with the help of the Empty Digit 9.

1 The range 1 to 8 of the array is denoted by the symbol (S — 1) and it is read as "Sector (S — 1)";

2 The range 91 to 98 of the array is denoted by the symbol (S—91) and it is read as "Sector (S—91)"; each number in it is a Sector Notation.

3 The range 991 to 998 of the array is denoted by the symbol (S — 991) and it is read as "Sector (S — 991)"; and so on. Each number in each of them, is a Sector Notation.

742 PURE BASE OF ROMAN CAPITALS

Similarly, the array A ... Y can be lengthened with the use of Z as Empty Digit, into the array A ... Y ZA ... ZY ZZA ... ZZY etc. Where each one of the numbers ZA etc is treated as if it formed a single digit.

743 PURE BASE OF ROMAN SMALLS

Similarly, the array a ... y can be lengthened with the use of z as Empty Digit, into the array a ... y za ... zy zza ... zzy etc.

744 MIXED BASE

Consider the mixed base consisting of Roman smalls, Indo-Arabic numerals, and Roman capitals. Let us take the above sequence to be the sequence of their ascending value. Let us make the digits z, 9, Z Empty Digits. Let us also use the digit "0" as an Empty Digit and with its ordinal value less than the digit "a". Then the sectors produced with their aid will be as given in Table 4 in Sec HD4. The Table gives also the number of sectors when the number of digits in a number—class number or an isolate number—is restricted to 3. It also gives the number of numbers in the lengthened array. Thus we see that, with a base of 56 digits, we are able to increase the capacity of the array. Instead of holding only 56 numbers it is able to hold 1,113 numbers. The capacity of the array is increased nearly 19 times. This we have got by sacrificing the four digits 0, z, 9, Z and abstaining from using them by themselves as class numbers or as isolate numbers. This is a splendid demonstration of the time-honoured saw "Sacrifice begets plenty".

745 SECTOR NOTATIONAL SYSTEM

A notational system using sector notation.

746 FURTHER INCREASE IN THE CAPACITY OF ARRAY

Sec HD5 shows how much further the capacity of the array can be increased with the use of Packet Notation. It adds 53 more numbers to the array, bringing the total to 1,166.

75 ZONE IN NOTATIONAL PLANE

751 ZONE

The range of an array made of class numbers beginning with one or other of the digits of one and the same species of digits.

1 Zone (Z—0), written simply as (Z—0), consists of all the numbers in an array beginning with the digit 0;

2 Zone (Z—a), written simply as (Z—a), consists of all the numbers in an array beginning with a Roman small;

3 Zone (Z—1), written simply as (Z—1), consists of all the numbers in an array beginning with an Indo-Arabic numeral;

4 Zone (Z—A), written simply as (Z—A), consists of all the numbers in an array beginning with a Roman capital; and

5 Zone (Z—()), written simply as (Z—()), consists of all the packeted numbers in the array.

752 SECTORS IN ZONES

The tables given in Sec HD4 and in Sec HD5 show the sectors comprehended in each zone when the number of digits in the class number or the isolate number, as the case may be, in an array is restricted not to exceed 3.

76 FURTHER INCREASE IN THE CAPACITY OF AN ARRAY

The capacity of an array can be further increased by the interpolation of class numbers or isolate numbers with the help of one or other of the Emptying Digits such as those mentioned in Sec HA77. The increase in capacity by interpolation is theoretically without limit. In practice, it can be very large.

8 Capacity of a Notational System

The maximum number of distinct class numbers that can be constructed in a notational system.

91 Notational System of Some Schemes for Classification

911 DECIMAL CLASSIFICATION

In the simplest form of DC, only one species of digits is used. Thus, it has a pure base and its notation is linear, right-handed, and decimal fractional. It uses sector notation to a limited extent (For examples *See* Sec LC31).

Note.—It is usual to put a dot after the first three digits in a DC Number. The dot is used only to give relief to the eye. It has neither

semantic nor ordinal value. It is indeed a dummy digit. Therefore, it has been ignored in describing the DC Notational System.

912 EXPANSIVE CLASSIFICATION

In EC, the following three species of digits are used:

1 The 26 Roman capitals;
2 The 10 Indo-Arabic numerals; and
3 A dot.

Thus, it has a mixed base, although the original intention of the author of the Scheme was to make it a pure base consisting of Roman capitals only. Its notation is linear, right-handed, and decimal fractional. It does not use sector notation.

913 UNIVERSAL DECIMAL CLASSIFICATION

In UDC, the following five species of digits are used:

1 The 10 Indo-Arabic numerals;
2 The 26 Roman capitals;
3 Some punctuation marks;
4 Some mathematical symbols; and
5 The 26 Roman smalls (when alphabetical device is used).

Thus, it has a mixed base. Its notation is linear, right-handed, and decimal fractional. It uses sector notation to a limited extent. The scale of absolute values of digits is fixed by rules.

914 LIBRARY OF CONGRESS CLASSIFICATION

In LC, the following three species of digits are used.

1 The 10 Indo-Arabic numberals;
2 The 26 Roman capitals; and
3 A dot.

Thus, it has a mixed base. Its notation is linear, right-handed, but *integral* and not decimal fractional. It does not use sector notation.

Note.—The question of fixing the absolute values of the digits of the different species relative to one another does not arise, because, in this Scheme the capital letters and dots can come in only at particular places. For example, the first digit must always be a capital letter. The second digit may be a capital letter. But without explicitly stating a rule, in such classes the schedule is arranged as if the capital letter had greater value than an Indo-Arabic numeral. In certain subjects, the capital letter again appears when alphabetical arrangement is prescribed, which is after the third digit in some subjects, after the fourth in other subjects, and so on. Such a rigid prescription of the place where a capital letter can follow an Indo-Arabic numeral obviates the necessity for considering the relative absolute values of Indo-Arabic numerals and Roman capitals. The dot usually precedes a capital letter, and hence there is no need to fix its absolute value either (*See also* Sec LF31).

915 SUBJECT CLASSIFICATION

In SC, the following three species of digits are used:

1 The 10 Indo-Arabic numerals;

2 The 26 Roman capitals; and

3 A dot.

Thus, it has a mixed base. Its notation is linear, right-handed, and may be treated as decimal fractional. It does not use sector notation.

916 COLON CLASSIFICATION

In CC, the following five species of digits are used:

1 The 10 Indo-Arabic numerals;

2 The 24 Roman capitals (excluding I and O except in the case of Main Class Numbers);

3 23 Roman smalls (excluding 'i', 'l', and 'o');

4 Inverted 'V'—'Λ' (not yet finalised);

5 Punctuation marks; and

6 Arrows, circular brackets, and 'equal to' (=) sign.

Thus, it has a mixed base (more mixed than that of any other existing scheme). Its notation is linear, right-handed, and decimal fractional. It uses sector notation profusely by making z, 9, and Z Empty Digits. The scale of absolute values of digits is fixed by rules. In particular, z is less than 1; and 9 is less than A; Starter bracket is greater than Z; and "Λ" is greater than any other digit (For examples *See* Sec LC33).

Note.–There is a queer rule according to which a number followed by a Roman small precedes the host number. By this rule, the so-called "anteriorising divisions" are secured in "anterior" places.

917 BIBLIOGRAPHIC CLASSIFICATION

In BC, the following five species of digits are used:

1 9 Indo-Arabic numerals, excluding 0;

2 The 26 Roman capitals;

3 The 26 Roman smalls;

4 Some punctuation marks; and

5 Some other improvised digits, such as '&' and '*'.

Thus, it has a mixed base. Its notation is linear, right-handed, and decimal fractional. It does not use sector notation.

918 RIDER'S INTERNATIONAL CLASSIFICATION

In RIC, only Roman capitals are used. Thus, it has a pure base. Its notation is linear, right-handed, it may be treated as decimal fractional. It does not use sector notation.

CHAPTER HD

CAPACITY OF NOTATIONAL SYSTEMS

0 Introduction

The succeeding sections of this chapter give the capacities of different kinds of notational systems. The following abbreviations are used in the tables.

b = Number of digits in the base
c = Number of Class Numbers
d = Number of digits in a Class Number

AN = Arabic numerals
RS = Roman smalls
RC = Roman capitals

1 Table 1

Capacity of a Non-faceted Notational System with the same number of digits in all Class Numbers

SN	Species of digits	b	c when d equals			
			Three		Six	
			Actual Number	In Round Figures	Actual Number	In Round Figures
1	AN	9	729	7×10^2	531,441	5.3×10^5
2	RS	23	11,167	1.1×10^4	124,701,889	1.2×10^8
3	RC	24	13,824	1.3×10^4	191,102,976	1.9×10^8
4	AN+RS	32	32,768	3.2×10^4	1,073,741,824	1.0×10^9
5	AN+RC	33	35,937	3.5×10^4	1,291,467,969	1.2×10^9
6	RS+RS	47	103,823	1.0×10^5	10,779,215,329	1.0×10^{10}
7	AN+RC+RS	56	175,616	1.7×10^5	30,840,979,456	3.0×10^{10}

2 Table 2

Capacity of a Non-faceted Notational System with an Upper Limit to the Number of Digits in a Class Number

SN	Species of Digits	b	c when d is not greater than			
			Three		Six	
			Actual Number	In Round Figures	Actual Number	In Round Figures
1	AN	9	819	8.2×10^{2}	597,870	6.0×10^{5}
2	RS	23	12,719	1.3×10^{4}	129,740,792	1.3×10^{8}
3	RC	24	14,214	1.4×10^{4}	199,911,800	2.0×10^{8}
4	AN+RS	32	33,824	3.4×10^{4}	1,108,378,656	1.1×10^{9}
5	AN+RC	33	37,059	3.7×10^{4}	1,330,726,342	1.3×10^{9}
6	RC+RS	47	106,079	1.1×10^{5}	11,013,546,096	1.1×10^{10}
7	AN+RC+RS	56	178,808	1.8×10^{5}	31,401,725,537	3.1×10^{10}

3 Table 3

Capacity of a Faceted Notational System

In the following table each facet is taken to have three or less than three digits. This is in accordance with the optimum number of digits in a block being three (*See* Sec HB6).

SN	Species of Digits	b	Number of Class Numbers in Round Figures when the Number of Facets is			
			1	2	3	4
1	AN	9	8.2×10^{2}	6.7×10^{4}	5.5×10^{8}	4.5×10^{10}
2	RS	23	1.3×10^{4}	1.7×10^{8}	2.2×10^{12}	2.9×10^{16}
3	RC	24	1.4×10^{4}	2.0×10^{8}	2.7×10^{12}	3.8×10^{16}
4	AN+RS	32	3.4×10^{4}	1.2×10^{9}	3.9×10^{13}	1.3×10^{18}
5	AN+RC	33	3.7×10^{4}	1.4×10^{9}	5.1×10^{13}	1.9×10^{18}
6	RS+RC	47	1.1×10^{15}	1.2×10^{10}	1.3×10^{15}	1.5×10^{20}
7	AN+RS+RC	56	1.8×10^{15}	3.2×10^{10}	5.6×10^{15}	1.0×10^{21}

4 Table 4

Capacity of Array of Order 1 in Sector Notation

Using a . . . z 1 . . . 9 A . . . Z as the Base

Note.—In this Table, the digit "0" (Zero) also is treated as an empty digit. Further, the ordinal value of the digit "0" zero is taken to be smaller than that of the digit "a". Further, the upper limit to the number of digits in a class number in the array is taken to be 3. (*See* Sec HC73 to HC75).

Zone	Sector	N of Sector	Class Number	Capacity of Sector	Capacity of Zone
1	2	3	4	5	6
(Z—0)	(S—00a)		00a ... 00y	22	
	(S—001)		001 ... 008	8	
	(S—00A)		00A ... 00Y	23	
	(S—0a)		0a ... 0y	22	
	(S—0za)		0za ... 0zy	22	
	(S—0z1)		0z1 ... 0z8	8	
	(S—0zA)		0zA ... 0zY	23	
	(S—01)		01 ... 08	8	
	(S—09a)		09a ... 09y	22	
	(S—091)		091 ... 098	8	
	(S—09A)		09A ... 09Y	23	
	(S—0A)		0A ... 0Y	23	
	(S—0Za)		0Za ... 0Zy	22	
	(S—0Z1)		0Z1 ... 0Z8	8	
	(S—0ZA)		0ZA ... 0ZY	23	
		15			265
(Z—a)	(S—a)		zZa ... zZy	22	
	(S—z0a)		z0a ... z0y	22	
	(S—z01)		z01 ... z08	8	
	(S—z0A)		z0A ... z0Y	23	
	(S—za)		za ... zy	22	
	(S—zza)		zza ... zzy	22	
	(S—zz1)		zz1 ... zz8	8	
	(S—zzA)		zzA ... zzY	23	
	(S—z1)		z1 ... z8	8	
	(S—z9a)		z9a ... z9y	22	
	(S—z91)		z91 ... z98	8	
	(S—z9A)		z9A ... z9Y	23	
	(S—zA)		zA ... zY	23	
	(S—zZa)		zZa ... zZy	22	
	(S—zZ1)		zZ1 ... zZ8	8	
	(S—zZA)		zZA ... zZY	23	
		16			287
(Z—1)	(S—1)		1 ... 8	8	
	(S—90a)		90a ... 90y	22	
	(S—901)		901 ... 908	8	

Zone	Sector	N of Sector	Class Number	Capacity of Sector	Capacity of Zone
	(S—90A)		90A ... 90Y	23	
	(S—9a)		9a ... 9y	8	
	(S—9za)		9za ... 9zy	22	
	(S—9z1)		9z1 ... 9z8	8	
	(S—9zA)		9zA ... 9zY	23	
	(S—91)		91 ... 98	8	
	(S—99a)		99a ... 99y	22	
	(S—991)		991 ... 998	8	
	(S—99A)		99A ... 99Y	23	
	(S—9A)		9A ... 9Y	23	
	(S—9Za)		9Za ... 9Zy	22	
	(S—9Z1)		9Z1 ... 9Z8	8	
	(S—9ZA)		9ZA ... 9ZY	23	
		16			
(Z—A)	(S—A)		A ... Y	23	273
	(S—Z0a)		Z0a ... Z0y	22	
	(S—Z01)		Z01 ... Z08	8	
	(S—Z0A)		Z0A ... Z0Y	23	
	(S—Za)		Za ... Zy	22	
	(S—Zza)		Zza ... Zzy	22	
	(S—Zz1)		Zz1 ... Zz8	8	
	(S—ZzA)		ZzA ... ZzY	23	
	(S—Z1)		Z1 ... Z8	8	
	(S—Z9a)		Z9a ... Z9y	22	
	(S—Z91)		Z91 ... Z98	8	
	(S—Z9A)		Z9A ... Z9Y	23	
	(S—ZA)		ZA ... ZY	23	
	(S—ZZa)		ZZa ... ZZy	22	
	(S—ZZ1)		ZZ1 ... ZZ8	8	
	(S—ZZA)		ZZA ... ZZY	23	
		16			288
Capacity of Array		63			1,113

5 Table 5

Increase by Packet Notation of Capacity of Array of Order 1

The following table shows the zones, the sectors, and their capacities resulting from the use of Packet Notation (*See* Sec HA74). Further, the upper limit to the number of digits including the brackets, in the Class Number in the array, is taken to be 3.

Zone	Sector	N of Sector	Class Number	Capacity of Sector	Capacity of Zone
1	2	3	4	5	6
(Z—())	(S—(a))		(a) ... (y)	22	
	(S—(1))		(1) ... (8)	8	
	(S—(A))		(A) ... (Y)	23	
		3			53

By extending the array by Packet Notation, the capacity of the array is increased to 1,166.

6 Capacity—A Function of Two Variables.

If b = the number of digits in the base, d = the number of digits allowed in the class number, and c = the capacity of the notational system, we get

$$c = \frac{b^{d+1} - b}{b - 1}$$

Thus, the capacity of a notational system is a function of two variables. The function shows that the increase in the variable d yields more class numbers than the increase in variable b. However, we have seen that the optimum value for d is 3 (*See* Sec HB6). Thus, we have essentially to depend on increasing b for increasing c. There again, there are only 3 species of widely used conventional species of digits. As shown in Table 2, even if we use all the three species of digits (omitting some inconvenient digits), we get only 56 as the highest value of b.

61 Capacity of Non-Faceted Notation

With these highest values available for b and d the capacity of a non-faceted notational system can be only about 10^5 that is, a hundred thousand. But the number of subjects is surely more than a hundred thousand. Thus, we are obliged to increase "d".

62 Capacity of a Faceted Notational System

If we increase "d", we should naturally have to break up the class number into blocks of 3 digits (*See* Sec HB6) and make the system a faceted one (*See* Sec HB7). We find from Table 3 that the capacity of a notational system with four facets is 10^{21}—that is, a thousand trillions. This is only a statistical view. It does not mean that every subject will have four facets. In fact, some may have only one facet.

While at the other extreme some may have even as many as fifteen or twenty facets, depending upon the extension and the intension of the subject. It goes without saying that the capacity of a notational system increases as the average number of facets increases. The use of this will be demonstrated in the companion volume, *Depth classification and its design*. It is sufficient to state here that micro subjects are innumerable and that a faceted notational system is able to keep pace with the endless proliferations and the ever increasing number of subjects in the universe of subjects.

7 Correlate of Facet Numbers in a Class

Increasing the capacity of the notational system is not the only value of a faceted notational system. It will be seen in Chap MD, that work in the Idea Plane is very much facilitated in the design of a scheme for the classification of Universe of Subjects. This finding is based on experience. It is due to the uncanny and unpredictable way in which chains of new classes sprout from any existing class irrespective of its degree of extension or intension. Facet-formation even in the Idea Plane is one of the means—perhaps the only means known so far—of meeting the situation. This has even led to the assertion that all future schemes for classification should be faceted ones [8, 68].

CHAPTER HE

GROUP NOTATIONAL SYSTEM

1 Definition

A decimal fraction notational system in which each number consists of two and only two rich digits; or three and only three rich digits; and so on; and does not include an empty digit. The numbers of a Group System are deemed to form a single array.

2 Example

21 INDO-ARABIC NUMERALS

211 TWO-DIGITED GROUP SYSTEM

11 12 ... 18 21 22 ... 28 ... 81 82 ... 88

These 64 numbers are taken as co-ordinate numbers forming a single array.

212 THREE-DIGITED GROUP SYSTEM

111 112 ... 118 121 122 ... 128 ... 181 182 ... 188
211 212 ... 218 221 222 ... 228 ... 281 282 ... 288
.
.
.
811 812 ... 818 821 822 ... 828 ... 881 882 ... 888

These 512 numbers are taken as co-ordinate numbers forming an array

22 ROMAN CAPITALS (EXCLUDING I AND O)

221 TWO-DIGITED SYSTEM

AA AB ... AY BA BB ... BY ... YA YB ... YY

These 529 numbers are taken as co-ordinate numbers forming an array.

222 THREE-DIGITED SYSTEM

AAA AAB ... AAY ABA ABB ... ABY ... AYA AYB ... AYY
BAA BAB ... BAY BBA BBB ... BBY ... BYA BYB ... BYY
.
.
.
YAA YAB ... YAY YBA YBB ... YBY ... YYA YYB ... YYY

These 12,167 numbers are taken as co-ordinate numbers forming an array.

23 Indo-Arabic Numerals and Roman Capitals

In the mixed base of Indo-Arabic numerals and Roman capitals, the ordinal value of an Indo-Arabic numeral is taken, for our purpose, to be less than the ordinal value of "A".

231 Two-Digited System

A1 A2 ... A8 AA AB ... AY B1 B2 ... B8 BA BB ... BY ... Y1 Y2 ... Y8 YA YB ... YY

These 961 numbers are taken as co-ordinate numbers forming an array.

232 Three-Digited System

111 112 ... 118 11A 11B ... 11Y 121 122 ... 128 12A 12B ... 12Y ... 181 182 ... 188 18A 18B ... 18Y 1A1 1A2 ... 1A8 1AA 1AB ... 1AY 1B1 1B2 ... 1B8 1BA 1BB ... 1BY ... 1Y1 1Y2 ... 1Y8 1YA 1YB ... 1YY

211 212 ... 218 21A 21B ... 21Y 221 222 ... 228 22A 22B ... 22Y ... 281 282 ... 288 28A 28B ... 28Y 2A1 2A2 ... 2A8 2AA 2AB ... 2AY 2B1 2B2 ... 2B8 2BA 2BB ... 2BY ... 2Y1 2Y2 ... 2Y8 2YA 2YB ... 2YY

.

.

.

811 812 ... 818 81A 81B ... 81Y 821 822 ... 828 82A 82B ... 82Y ... 881 882 ... 888 8A1 8A2 ... 8A8 8AA 8AB ... 8AY 8B1 8B2 ... 8B8 8BA 8BB ... 8BY ... 8Y1 8Y2 ... 8Y8 8YA 8YB ... 8YY

A11 A12 ... A18 A1A A1B ... A1Y A21 A22 ... A28 A2A A2B ... A2Y ... A81 A82 ... A88 A8A A8B ... A8Y AA1 AA2 ... AA8 AAA AAB ... AAY

B11 B12 ... B18 B1A B1B ... B1Y B21 B22 ... B28 B2A B2B ... B2Y ... B81 B82 ... B88 B8A B8B ... B8Y BA1 BA2 ... BA8 BAA BAB ... BAY BB1 BB2 ... BB8 BBA BBB ... BBY ... BY1 BY2 ... BY8 BYA BYB ... BYY

.

.

.

Y11 Y12 ... Y18 Y1A Y1B ... Y1Y Y21 Y22 ... Y28 Y2A Y2B ... Y2Y ... Y81 Y82 ... Y88 Y8A Y8B ... Y8Y YA1 YA2 ... YA8 YAA YAB ... YAY YB1 YB2 ... YB8 YBA YBB ... YBY ... YY1 YY2 ... YY8 YYA YYB ... YYY

These 29,791 numbers are taken as co-ordinate numbers forming an array.

3 Sector *Vs* Group Notational System

For any array we have now provided two notational systems —Sector System and Group System. By so doing we have created a problem. Which of these two is to be chosen for a particular array? The Laws of Library Science are neutral in this matter. Therefore, the answer to this question has to be left to the Law of Parsimony. Naturally, this Law will give its decision on the basis of the average number of digits in an array. We shall next illustrate the decision of the Law of Parsimony with different bases for notational system.

4 Base of Indo-Arabic Numerals

41 TWO-DIGITED GROUP SYSTEM

As shown in Sec HE211, the Two-digited Group System has capacity for 64 numbers. Then the average of the number of digits in the numbers of the array is two. Even if the number of numbers to be accommodated in the array is less than 64—even if it is one only—the average will continue to be two.

42 SECTOR SYSTEM

Let us consider the Sector System with only one rich digit and the digit 9 alone as the sectorising digit. Then the first three sectors —*viz* (S—1), (S 91), and (S—991)—can accommodate only 24 numbers in the array. The average of the number of digits in the numbers of the first three sectors is

$$\frac{8\times1+8\times2+8\times3}{24} = \frac{8+16+24}{24} = \frac{48}{24} = 2$$

If the number of numbers to be accommodated in the array is less than 24, the average will be less than two. The average will be one if the number of numbers to be accommodated in the array is not more than eight. On the other hand, if the number of numbers to be accommodated in the array is greater than 24, the average will be greater than two. If the capacity of the array should be 64, the first eight sectors will be necessary, and the average of the number of digits in the numbers of the array will be

$$\frac{8+16+24+32+40+48+56+64}{64}$$

$$= \frac{8\,(1+2+3+4+5+6+7+8)}{64}$$

$$= \frac{1+2+3+4+5+6+7+8}{8} = \frac{36}{8}$$

$$= 4.5$$

43 DECISION

Thus, in a base of Indo-Arabic numerals only, the Law of Parsimony would recommend,

1 Sector System, if the number of numbers to be accommodated in the array is less than 24;

2 Group System, if the number of numbers to be accommodated in the array is greater than 24; and

3 Either system, if the number of numbers to be accommodated in the array is 24.

44 CRITICAL NUMBER

In other words, 24 is a Critical Number in the choice between Group System and Sector System. The Law of Parsimony is unable to make a decision in this case. It leaves it to Laws of Library Science to make a decision on some grounds of their own.

45 NUMBER OF DIGITS IN A GROUP NOTATION

The number of digits to be used in each Group Notation is determined as shown in the following table

Maximum Number of Numbers in an Array	Number of digits in the Group Notation
$64 = 8^2$	2
$512 = 8^3$	3
$4,096 = 8^4$	4
$32,768 = 8^5$	5
$262,144 = 8^6$	6
8^n	n

5 Base of Roman Capitals

51 TWO-DIGITED GROUP SYSTEM

As shown in Sec HE221, Two-digited Group System has capacity for $23 \times 23 = 529$ numbers. Then the average of the number of digits of the numbers of the array is two. Even if the number of numbers to be accommodated in the array is less than 529—even if it is one only—the average will continue to be two.

52 SECTOR SYSTEM

Let us consider the Sector System with only one rich digit and the digit Z alone as the sectorising digit. Then the first three sectors —*viz*, (S—A), (S—ZA), and (S—ZZA)—can accommodate only 69 numbers in the array. The average of the number of digits in the numbers of the first three sectors is

$$\frac{23\times1+23\times2+23\times3}{69}=\frac{23+46+69}{69}=\frac{138}{69}=2$$

If the number of numbers to be accommodated in the array is less than 69, the average will be less than two; the average will be one if the number of numbers to be accommodated in the array is not more than 23. On the other hand, if the number of numbers to be accommodated in the array is greater than 69; the average will be greater than two. If the capacity of the array should be 529, the first 23 sectors will be necessary and the average of the number of digits in the numbers of the array will be

$$=\frac{23\,(1+2+3+4+5+6+7+8+9+10+11+12+13+14+15+16+17+18+19+20+21+22+23)}{529}$$

$$=\frac{23\,(276)}{529}=\frac{276}{23}$$

$$=12$$

53 Decision

Thus, in a base of Roman capitals only, the Law of Parsimony would recommend,

1 Sector System, if the number of numbers to be accommodated in the array is less than 69;

2 Group System, if the number of numbers to be accommodated in the array is greater than 69; and

3 Either system, if the number of numbers to be accommodated in the array is 69.

54 Critical Number

In other words, 69 is a Critical Number in the choice between Group System and Sector System. The Law of Parsimony is unable to make a decision in this case. It leaves it to the Laws of Library Science to make a decision on some grounds of their own.

55 Number of Digits in Group Notation

The number of digits to be used in each Group Notation is determined as shown in the following table

Maximum Number of Numbers in an Array	Number of Digits in the Group Notation
$529=23^2$	2
$12,167=23^3$	3
23^n	n

6 Base of Indo-Arabic Numerals and Roman Capitals

61 Two-Digited Group System

As shown in Sec HE231, the Two-digited Group System has capacity for 961 numbers. The average of the number of digits in the numbers of the array is two. Even if the number of numbers to be accommodated in the array is less than 961—even if it is one only—the average will continue to be two.

62 Sector System

Let us consider the Sector System with only one rich digit and the digits 9 and Z as Sectorising Digits. Then the eight sectors—*viz*, (S—1), (S—91), (S—991), (S—9A), (S—A), (S—Z1), (S—ZA), and (S—ZZA) can accommodate only 124 numbers in the array. The average of the number of digits in the numbers of the eight sectors is

$$\frac{(8\times 1+8\times 2+8\times 3+23\times 2+23\times 1+8\times 2+23\times 2+23\times 3)}{124}$$

$$=-\frac{8\,(1+2+3+2)+23\,(2+1+2+3)}{124}$$

$$=\frac{64+184}{124}=\frac{248}{124}$$

$$=2$$

If the number of the numbers to be accommodated in the array is less than 124, the average will be less than two. The average will be one, if the number of numbers to be accommodated in the array is not more than 31. On the other hand, if the number of numbers to be accommodated in the array is greater than 124, the average will be greater than two.

63 Decision

Thus, in a base of Indo-Arabic numerals and Roman capitals, the Law of Parsimony would recommend,

1 Sector System, if the number of numbers to be accommodated in the array is less than 124;

2 Group System, if the number of numbers to be accommodated in the array is greater than 124; and

3 Either system, if the number of numbers to be accommodated in the array is 124.

64 Critical Number

In other words, in a base of Indo-Arabic numerals and Roman capitals the number 124 is a Critical Number in the choice between

Group System and Sector System. The Law of Parsimony is unable to make a decision in this case. It leaves to the Laws of Library Science to make a decision on some grounds of their own.

7 Occasion for Use

The occasion for using Three-digited Group System may arise in the schedule for raw materials, intermediate commodities, and commodities. It may also arise in the schedule for chemical substances—Inorganic and Organic.

8 Generic Term

While a Group System of two-digited numbers is taken to form a single array, in appearance it looks as if it were made of two arrays. Advantage can be taken of this and different generic terms, if any, may be used for representation by the respective digits of the apparent first order array. Similarly, in the case of the apparent first and second order arrays in a Group System of three digits.

The following two examples are taken from the schedules of CC.

1 In the Schedule of Inorganic Substances in Chap E Chemistry, the number of digits in the number for an element is usually 3. The first digit is '1' representing the idea "Inorganic". This may be ignored for the moment. Then we have in effect a Two-digited Group System. The digits in the apparent first order array admit of being regarded as representing the generic terms, 'Elements of Group 0', 'Elements of Group 1', etc.

For example, in the isolate number 148, we have agreed to ignore the digit '1'. Then in the surviving number '48', the digit '4' represents "Group 4" and the digit '8' represents "Lead".

2 In the Schedule of Cultivars in Chap J Agriculture, the number of digits in the number for a cultivar is usually 3. The digits in the apparent first order array admit of being regarded as representing the generic terms of utility such as 'Decoration', 'Feed', 'Food', etc. Similarly, the digits in the apparent array of second order admit of being regarded as representing the generic terms of parts of plant such as 'Sap', 'Bulb', 'Root' ...'Fruit', and 'Seed'. Then each digit in the number for a Cultivar becomes meaningful. For example, in the isolate number 381, the digit '3' represents "Food", the digit '8' represents "Seed" and the digit '1' represents "Rice".

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