BASIC LIBRARY LIST

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INTRODUCTION

One of the many channels by which the Mathematical Association of America offers advice and guidance to colleges is the Committee on the Undergraduate Program in Mathematics. A project of this Committee has been an attempt to define a minimal college mathematics library. Preliminary versions of the accompanying list have been used to improve mathematics libraries.

This list of some 300 books, from which approximately 170 are to be chosen to form a basic library in undergraduate mathematics, is intended to do the following:

1. Provide the student with introductory material in various fields of mathematics which he may not previously have encountered
2. Provide the student, whose interest has been aroused by his teachers, with reading material collateral to his course work
3. Provide the student with reading at a level beyond that ordinarily encountered in his undergraduate curriculum
4. Provide the faculty with reference material
5. Provide the general reader with elementary material in the field of mathematics

The list is minimal and is not intended to provide anyone with the grounds of an argument that a particular library is complete, and hence cannot be improved. On the contrary, the list is basic in that it provides a nucleus for a library whose further acquisitions should be dictated by student and faculty interests. There has been a concerted effort to keep the list small, in the exercise of which many books of merit have had to be excluded; several equally attractive areas sometimes have been combined into one group from which one book is to be selected. In many cases similar books are suggested as alternate choices so that a library may exploit its present holdings.

The Advisory Group on Communications of CUPM has prepared this list over a period ending in 1964; hence, recently published books do not appear on the list.

BASIC LIBRARY LIST

I. Background and Orientation

The volumes listed here offer a variety of topics which must have representation in any basic library. Of the three books on the history of mathematics, _Men of Mathematics_ can be read with enjoyment
by students at any level. Equally readable are What is Mathematics?, Number, the Language of Science, and The Enjoyment of Mathematics. Symmetry, An Introduction to Mathematics, and Mathematical Snapshots are well-known classics, while the books on finite mathematics (1.10) bring numerous modern topics to the freshman level.


1.10 At least one of the following: (a-c)


1.11 At least one of the following: (a-b)

II. Algebra

For reference and for systematic study, a basic library should contain general treatments of abstract algebra at successive levels (2.15, 2.7, 2.2, 2.4, 2.9). Because of the tremendous importance of the basic structures, models, and tools of linear algebra, there should be introductions emphasizing linear transformations (2.11) and also emphasizing matrices (2.10). For the casual reader there should be attractive elementary approaches to modern algebra via special topics such as groups (2.16), rings (2.6), and other subjects (2.5). For the serious student there should be more advanced works in a few key special fields, e.g., group theory (2.17), linear algebra (2.12, 2.13), fields and Galois theory (2.1). The uniquely useful book 2.3 provides for a transition from linear algebra towards the theory of Hilbert space. Connections between linear algebra and geometry deserve attention (2.14).


2.9 At least one of the following: (a-b)


2.10 At least one of the following: (a-e)


2.11 At least one of the following: (a-e)


2.12 At least one of the following: (a-d)


2.13 At least one of the following: (a-c)


2.14 At least one of the following: (a-c)


2.15 At least one of the following: (a-c)


2.16 At least one of the following: (a-b)


2.17 At least one of the following: (a-c)


III. Analysis

Analysis covers a broad spectrum of mathematical disciplines. This section contains a selection of books which may serve to introduce the mathematics undergraduate to many of these disciplines.

In those areas in which undergraduate courses are usually offered, books of mathematical depth and sophistication are recommended. Thus, for advanced calculus, or what is rapidly being renamed real analysis, we list 3.25, 3.26, and 3.27; the last all contain elements of Lebesgue integration. In addition, we recommend the now classic 3.4, 3.6. Interesting and unusual presentations of material in this general area occur in 3.11 and 3.15a.

The elements of ordinary differential equations appear in 3.20. More advanced treatments are contained in 3.21 and 3.22; the former have excellent material on boundary value problems while the latter stress the geometrical and qualitative aspects of differential equations. An excellent problem source is 3.3.

Presentations of the theory of functions of a complex variable are to be found in 3.13, 3.23, and 3.24. Introductions to topics in the theory of linear spaces and functional analysis are contained in 3.10, 3.15b, 3.16, among others. In 3.17 two distinct elementary treatments of generalized functions are listed. Finally, attention is called to the note on calculus books which is at the end of this section.

3.1 Bliss, Gilbert A. **Calculus of Variations** (Carus Monograph No. 1). Chicago, Illinois, The Open Court Publishing Company, 1925.


3.15 At least one of the following: (a-b)


3.16 At least one of the following: (a-b)


3.17 At least one of the following: (a-b)


3.18 At least one of the following: (a-b)


3.19 At least one of the following: (a-c)


3.20 At least one of the following: (a-f)


3.21 At least one of the following: (a-b)


3.22 At least one of the following: (a-c)


3.23 At least one of the following: (a-c)


3.24 At least one of the following: (a-d)


3.25 At least one of the following: (a-f)


3.26 At least one of the following: (a-d)


3.27 At least one of the following: (a-e)


3.28 At least one of the following: (a-d)


3.29 At least one of the following: (a-b)


3.30 At least one of the following: (a-b)


Two books on mathematical tables: one numerical, such as 3.31, and one functional, such as 3.32.


3.32 At least one of the following: (a-b)


The Library should also contain a selection of several calculus books to which students may refer for supplementary reading. These books should be chosen so as to describe a variety of approaches and motivations. It is felt that there should be at least one careful, detailed development such as is contained in any of the following (or similar works):


IV. Applied Mathematics

Because of the increasing interaction between mathematics and the natural and social sciences, it is virtually impossible to list a definitive collection of library books in this area. We urge the student and the teacher, intent on following this interaction, to make use of materials already available in libraries under the science, social science, and engineering listings. Nevertheless, we do recommend that the libraries contain certain books on the
mathematical aspects of physical science and engineering. These are 4.5, 4.6, 4.7, 4.12, 4.15, and 4.18. Recent developments in applied mathematics which bear a close relationship to the developments in social sciences are 4.9, 4.23, 4.24, 4.27, 4.28, and 4.29.

Since mathematical methods form part of applied mathematics, we recommend a few of the many compilations of mathematical analysis methods such as those listed in 4.20 and 4.21. We note that 4.1 consists of a definitive study of problems of partial differential equations occurring in many applications of mathematics. Introductions to functional analytical methods useful in applied mathematics are listed in 4.14.

In the past decade or so, with the advent of highspeed computing machines, numerical analysis and some branches of algebra and logic have become an important area of applied mathematics. Numerical analysis books are listed in 4.2, 4.26, 4.18. The last (4.18) stresses algebraic aspects. Incidentally, the books on linear algebra contained in the algebra section of this report furnish material indispensable in the area of numerical analysis. Selection 4.17 contains introductions to computing machines--their modes of operation, programming techniques, computer logic, and the use of algorithms.


4.14 At least one of the following: (a-b)


4.15 At least one of the following: (a-b)


4.16 At least one of the following: (a-c)


4.17 At least one of the following: (a-c)

16


4.18 At least one of the following: (a-d)


4.19 At least one of the following: (a-b)


4.20 At least one of the following: (a-c)


17
4.21 At least one of the following: (a-c)


4.22 At least one of the following: (a-b)


4.23 At least one of the following: (a-c)


4.24 At least one of the following: (a-d)


4.25 At least one of the following: (a-b)


4.26 At least one of the following: (a-c)


4.27 At least one of the following: (a-c)


4.28 At least one of the following: (a-b)


4.29 At least one of the following: (a-c)


V. Geometry-Topology

The following 38 books, of which a minimum of 15 are to be selected, are intended to cover topics in geometry and topology. Besides general reading and introductory material on geometry as found in 5.3 and 5.5, various other topics such as projective geometry (5.4, 5.8), algebraic geometry (5.7), non-Euclidean geometry (5.10), and differential geometry (5.11) are represented. In addition to general and introductory material on topology (5.1, 5.3), increasing levels of sophistication in general topology (5.12, 5.13, 5.14) are mentioned, as is algebraic topology (5.9).


5.5 At least of the following: (a-b)


5.6 At least one of the following: (a-c)


5.7 At least one of the following: (a-b)


5.8 At least one of the following: (a-c)


5.9 At least one of the following: (a-d)


5.10 At least one of the following: (a-b)


5.11 At least one of the following: (a-d)


5.12 At least one of the following: (a-f)


5.13 At least one of the following: (a-b)


5.14 At least one of the following: (a-b)


5.15 At least one of the following: (a-d)


VI. Logic, Foundations, and Set Theory

Of the following 23 books on logic, foundations, and set theory, at least 13 are to be selected. Besides historical and introductory material on set theory (6.1, 6.4, 6.8), this field is covered in increasingly sophisticated fashion in 6.8, 6.2, and 6.11. Foundational material is to be found in 6.5, 6.9, and 6.10, while logic is covered in increasing levels of sophistication in 6.6, 6.8, 6.7, 6.3, 6.12, and 6.13.


6.10 At least one of the following: (a-e)


6.11 At least one of the following: (a-b)


6.12 At least one of the following: (a-e)


6.13 At least one of the following: (a-b)


VII. Probability-Statistics

The first five books listed are authoritative reference books in this rapidly growing field. The remainder of the list consists of pairings of books, one book from each pair being sufficient in a minimum library. Probability is treated in increasing levels of sophistication in 7.6, 7.7, 7.2, 7.4, and 7.3, and statistics in the order 7.8, 7.9, 7.10, 7.5, and 7.1. Items 7.6 and 7.8 do not assume a knowledge of the calculus.


7.6 At least one of the following: (a-b)


7.7 At least one of the following: (a-b)


7.8  At least one of the following:  (a-d)


7.9  At least one of the following:  (a-b)


7.10  At least one of the following:  (a-b)


VIII.  Number Theory

The theory of numbers has a perennial appeal for amateurs as well as for specialists.  Both for browsers and for serious students, a basic library should contain some of the lore of number theory as well as systematic works.


8.6 At least one of the following: (a-d)


8.7 At least two of the following: (a-g)


IX. Miscellaneous

Inevitably there are some books which a library needs, not because they neatly fit a category, but because they themselves have unique appeal or utility. The titles under Miscellaneous resist omission for miscellaneous reasons. A mathematics library is made more useful by the inclusion of collections of problems, more diverting because of the less technical or even whimsical insights of capable mathematicians, and better suited for browsing if it is stocked with collections of mathematical fragments or synopses. The following two dozen volumes are an especially good investment because they are likely to wear out first!


9.22 At least one of the following: (a-c)


9.23 At least one of the following: (a-b)


FURTHER MATHEMATICAL MATERIALS

The value of a mathematical library is considerably enhanced by the inclusion of materials beyond those in the preceding basic list. Much of mathematical value can be found in general reference works, such as encyclopedias. In addition, it is recommended that the basic library be supplemented by items under the following headings.

Journals


*Scripta Mathematica*. Yeshiva University, New York, New York 10033 Quarterly.


There exist series of excellent inexpensive books whose inclusion in a library for undergraduates is suggested. Individual volumes in some of the following series are included in the basic list. In general, the following series are recommended, although, of course, individual volumes vary in quality and no endorsement of future volumes in any series is implied.

The Athena Series (Selected Topics in Mathematics). Holt, Rinehart and Winston, Inc., New York. This is a series of small books that form excellent supplements to standard junior- and senior-level courses.

Blaisdell Scientific Paperbacks. Blaisdell Publishing Company, New York. This is a series of small pamphlets that are translations of the Russian series "Popular Lectures in Mathematics."

The Carus Mathematical Monographs. The Mathematical Association of America, Inc., Washington, D. C. There are now 16 volumes in this series.


The MAA Studies in Mathematics. The Mathematical Association of America, Inc., Washington, D. C.


University Mathematical Texts. Interscience, New York. This is a series of small books at the advanced undergraduate level.

Topics in Mathematics. D. C. Heath and Company, Boston, Massachusetts. This is a series of booklets translated and adapted from the Russian series "Popular Lectures in Mathematics." These American editions have been prepared by the Survey of Recent East European Mathematical Literature at the University of Chicago under a grant from the National Science Foundation. These booklets provide students of mathematics at various levels, as well as other interested readers, with valuable supplementary material to further their mathematical knowledge and development.

The Slaught Memorial Papers. The Herbert Ellsworth Slaught Memorial Papers are a series of brief expository pamphlets published as supplements to the American Mathematical Monthly. When they are issued, copies are sent free of charge to all members of the Association and subscribers to the Monthly. Additional copies may be purchased from the Mathematical Association of America.
Books in Foreign Languages

We recommend that some books in foreign languages—especially French, German, and Russian—be included in the collection. The principal purpose of these books would be to provide an opportunity for the student to learn to read mathematics in the language rather than to provide additions to the mathematical content of the list. Thus, in some cases it is suggested that, where available, both the English translation and the foreign language original be provided (good examples are van der Waerden's Modern Algebra, and the Heath Series Topics in Mathematics, in the preceding list).

There also should be included some books which do not exist in translation, such as Pólya and Szegö, Aufgaben und Lehrsätze aus der Analysis, or de la Vallée Poussin, Cours d'Analyse.