This text is part of the lecture notes in computer science series of Springer-Verlag. It is a user guide to EISPACK and to a control program EISPAC.

EISPACK is a systematized collection of Fortran subroutines which compute the eigenvalues and eigenvectors for matrices in one of six classes: complex general, complex Hermitian, real general, real symmetric tridiagonal, and special real tridiagonal.

The subroutines are based mainly upon Algol procedures published in the Handbook series of Springer-Verlag by Wilkinson and Reinsch [1].

The text is divided into seven sections. Section 1 is an introduction that discusses briefly the development of the codes from their Algol base to the systematized collection of certified FORTRAN subroutines that resulted.

Section 2 is a guide to using EISPACK. It describes how one can link EISPACK subroutines together to solve various eigenproblems. Such linkages are called paths in the discussion.

The user first selects one of twenty-two categories of the eigenproblem. A table gives the corresponding subsection within the text that discusses the recommended path for the given category. Each of these subsections gives clear instructions on how to use EISPACK subroutines or the EISPAC control program to solve the problem. Other subsections discuss variations of the recommended EISPACK paths, and give additional information and examples.

Sections 3, 4, 5, and 6 discuss validation of EISPACK, execution times for EISPACK, certification and availability of EISPACK, and the differences between EISPACK subroutines and Handbook Algol procedures, respectively.

Section 7 contains complete documentation and FORTRAN source listings for EISPACK subroutines. Documentation is also given for the EISPAC control program.

This is an excellent text valuable not only for potential users but also as a reference text for persons in the mathematical software area. It does attain the goal that so many seek, of producing a well-documented, thoroughly tested, easy-to-use collection of subroutines.

T. J. AIRD

1. J. H. WILKINSON & CHRISTIAN REINSCH, *Handbook for Automatic Computation*, vol. 2, *Linear Algebra*, Part II, Die Grundlehren der math. Wissenschaften, Bd. 186, Springer-Verlag, New York, 1971.

International Mathematical & Statistical Libraries, Inc.
GNB Building
7500 Bellaire Boulevard
Houston, Texas 77036

6 [9].—ROBERT BAILLIE, *Table of* $\phi(n) = \phi(n + 1)$, Computer-Based Education Lab., University of Illinois, Urbana, 1975. Thirty-eight computer output pages deposited in the UMT file.

With $\phi(n)$ being Euler's function, there are listed here all 306 solutions of

$$\phi(n) = \phi(n + 1)$$

for $1 \leqslant n \leqslant 10^8$. The factorizations of n, $n + 1$, and $\phi(n)$ are included. This extensive computation goes far beyond Ballew, Case & Higgins [1] who gave the eighty-nine solutions $<28 \cdot 10^5$. If $E(m)$ is the number of solutions with $n \leqslant 10^m$, one has

m	$E(m)$	m	$E(m)$	m	$E(m)$
0	1	3	10	6	68
1	2	4	17	7	142
2	3	5	36	8	306

Since $E(m)$ approximately doubles each line, *empirically* the number of solutions with $n \leqslant N$ can be expected to increase something like $N^{0.3}$. There is little doubt that there are infinitely many solutions, but this has not been proven.

However, a $N^{0.3}$ growth does suggest that there are only finitely many triples:

$$\phi(n) = \phi(n + 1) = \phi(n + 2);$$

and, in fact, none is known besides the single triple $n = 5186$ discovered long ago.

Of these three hundred and six solutions, I find that there are only twenty-three where the $\phi(n)$ residue classes prime to n have the same abelian group under multiplication $(\text{mod}\, n)$ as the $\phi(n + 1)$ classes have $(\text{mod}\, n + 1)$. These twenty-three are determined from the listed factorizations as in [2, Theorem 43, p. 93]. The twenty-three are $n =$

1	3	15	104
495	975	22935	32864
57584	131144	491535	2539004
3988424	6235215	7378371	13258575
17949434	25637744	26879684	29357475
32235735	41246864	48615735	

For example, for the largest n here, the $\phi(n) = \phi(n + 1)$ residue classes both have the abelian group

$$C(2) \times C(2) \times C(2) \times C(12) \times C(230208).$$

It is not unlikely that there are infinitely many solutions even with this much more stringent requirement, but note that there are none at all in the second half of the range of n here.

D. S.

1. DAVID BALLEW, JANELL CASE & ROBERT N. HIGGINS, *Table of* $\phi(n) = \phi(n + 1)$, UMT 2, *Math. Comp.*, v. 29, 1975, pp. 329–330.

2. DANIEL SHANKS, *Solved and Unsolved Problems in Number Theory.* Vol. I, Spartan, Washington, D. C., 1962.

7 [10].—LOUIS COMTET, *Advanced Combinatorics,* D. Reidel Publishing Co., Dordrecht, Holland; Boston, Mass., 1974, translated from the French by J. W. Nienhuys, xi + 343 pp. Price $34; $19.50 paperback.

The original French edition, *Analyse Combinatoire*, appeared in 1970 in two pocketsize paper-covered volumes of modest price; a review, by the present reviewer, is published in *Math. Rev.*, v. 41, 1971, #6697. The current edition, as advertised, is revised and enlarged; the most evident revision is the absence of footnotes, now absorbed in the text, and it is also apparent that there are many additional "supplements and exercises", the author's variation on the conventional problem section. While much of my earlier review is still relevant, the book comes to me now in a new light, probably because I am more at home in English than in French.

Incidentally, the translation has a Dutch accent and seems to have lost the author's French elegance; one oddity is the use of figured for figurate (numbers).

In the new light, the book appears as a continuation of traditional combinatorial analysis, made current by greater use of the vocabulary of set theory. To some combinatorialists this is a great step forward; it supplies a sorely lacking mathematical respectability. To me, the prescribed use of any particular vocabulary is a Procrustean bed, the more irrelevant as combinatorial mappings proliferate.