Notes on spectral theory, by S.K. Berberian. D. van Nostrand Co., Princeton, N.J., 1966. 118 pages. U.S. $2.50.

Perhaps the simplest of all "spectral theorems" is the one asserting that, given any Hermitian operator on a finite-dimensional Hilbert space, there exists an orthonormal basis for the space consisting entirely of eigenvectors for the operator, and the corresponding eigenvalues are real. With "Hermitian" replaced by "normal" the same theorem is valid, except that the corresponding eigenvalues need not be real. There are generalizations for each of these theorems when the Hilbert space is infinite-dimensional: these theorems are more difficult to prove, in fact they are difficult to state! There is special difficulty in the normal case.

At least one of these more general theorems must be included in every competently-taught introductory course on Hilbert space. However, not many instructors would go so far as to prove the spectral theorem for normal operators on an arbitrary Hilbert space. [When I was a graduate student, I was advised not to go quite that far in my study of the little monograph by Nagy, because Nagy assumed a result whose proof in fact did not come until long after his monograph was published.] Most instructors even now would feel it hardly worth the effort.

Not so the author of these notes. "Granted a minimum of integration theory, the spectral theorem for a normal operator, as formulated here, can be presented fully in an introductory course in Hilbert space." The author shows that it is possible to deduce this theorem from the spectral theorem for a Hermitian operator, using only elementary measure-theoretic techniques. Projection-valued measures play an important role. (Unbounded operators are not considered.)

For those who can afford to spend a little extra time on spectral theory, on relatively specialized techniques, there is much of interest in this book. It is nicely written and well organized, and suggestive of possibilities for current research.

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Hilbert transformation, Gebrochene integration and differentiation by Paul L. Butzer and Walter Trebels. Westdeutscher Verlag, Kola and Opladen, 1968. 81 pages. DM 70.

This is not a textbook but a research monograph on the subject of the Hilbert transformation and fractional differentiation and integration, and the relations between these topics. The chapter titles, which roughly indicate the contents, are: (1) Fundamental theorems on the Fourier transformation; (2) Results from the theory of the Hilbert transformation; (3) Fractional integration; (4) Derivatives of a function and its Hilbert transformation; (5) Derivatives of conjugate fractional integrals; (6) Characterization by sets of integrals.

Many new and important results are deduced, the methods being largely those of classical integration theory and Fourier analysis.

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