MILNOR, J. and HUSEMOLLER, D. *Symmetric Bilinear forms* (Ergebnisse der Mathematik und ihrer Grenzgebiete Bd. 73, Springer-Verlag, 1973), ii + 146 pp., $13.40.

The study of bilinear and quadratic forms over arbitrary commutative rings has recently received a strong impetus from the work of C. T. C. Wall and others on the classification and orientation problems for compact manifolds without boundary, and also from algebraic K-theory. The book under review is based on lectures given by J. Milnor at Princeton, and at Haverford College, on various occasions during the period 1966-70.

The first chapter develops, in elementary style, a theory of Witt decomposition for symmetric bilinear forms, applicable when the coefficient ring is either a field or a local ring in which 2 is invertible; the main prerequisite for Chapter 1 is an acquaintance with the basic vocabulary of the theory of modules over commutative rings.

The main theme of the book is the notion of the Witt ring, $W(R)$, associated with a commutative ring R, and Chapters 3 and 4 develop the fine structure of $W(R)$, for fields and for Dedekind domains respectively; in harmony with the modern approach to algebraic number theory, the relations between local and global Witt rings are emphasised, although a full proof of the Hasse-Minkowski theorem is omitted (a sketch proof being provided in an appendix). Chapter 5 is devoted to some applications of these results to algebraic topology and differential geometry, and also to the structure of the ring of integers in an algebraic number field.

Chapter 2 covers material familiar to experts in the geometry of numbers and provides an excellent survey of results on lattices and packing problems; this chapter can be strongly recommended to finite group-theorists, for example, for the straightforward account which it gives of lattices in many dimensions (the Leech lattice being discussed in an appendix) which makes the recent work by Conway more accessible. Chapter 2 also surveys work by Siegel on the density of values of quadratic forms and the associated calculations should prove instructive to those not versed in the techniques of analytic number theory. An interesting appendix deals with Gauss sums of lattices, a recent development which has proved useful in providing a straightforward proof of a " reciprocity law for lattices " due to Weil and which includes the Gauss quadratic reciprocity law as a special case.

In summary, the book caters for a wide variety of interests and provides an up-to-date exposition of material hitherto well-dispersed in the literature. The approach is attractive and uncomplicated and the overlap with O'Meara's book on quadratic forms is kept to a minimum. A sensible balance is maintained between the introduction of heavy artillery (e.g. class-field theory), necessary for some results, and the sense of direction required to keep the reader interested.

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PRYCE, J. D. *Basic Methods of Linear Functional Analysis* (Hutchinson, 1973), 320 pp., £4·00 cased, £2·25 paper.

This book provides a fairly comprehensive introduction to functional analysis, suitable for undergraduates in the final year of a British mathematics course or its equivalent. It should also be a useful text for postgraduate students, particularly in their first year of reasearch. The aim of the book is to present the basic themes of linear analysis, stressing the connection with and applications to problems in classical analysis. This aim is achieved admirably.

The reader is assumed to have a reasonable knowledge of the theory of metric and topological spaces and of linear algebra, and also a familiarity with basic measure and integration theory. These ideas are reviewed in the first chapter. The basic theory of

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normed spaces and bounded linear mappings is developed in Chapters 2 and 3. The standard theorems (Hahn-Banach, open mapping, closed graph, uniform boundedness) are discussed and various applications of these results are given. There is also a discussion of L_p spaces and spaces of continuous functions, including proofs of Ascoli's Theorem and the Stone-Weierstrass Theorem. Chapter 4 deals mainly with the geometry of Hilbert space and is followed by a chapter on dual spaces. This includes a proof of the Riesz Representation Theorem (for the case when the underlying space is compact metric) and a discussion of barycentres. There is then a chapter on weak topologies before the final chapter, which is devoted to various topics in operator theory. Here, the concepts of spectrum and adjoint are introduced and a development of the functional calculus for a self-adjoint operator on Hilbert space is given. The chapter concludes with an account of the spectral analysis of a compact self-adjoint operator and its application to Sturm-Liouville problems.

The author has a delightfully lively style which makes the book very readable, and there are numerous interesting and instructive problems throughout the text. There are, unfortunately, a rather large number of misprints, some of which may well cause confusion. For instance, on p. 162 axiom P3 for an inner-product space is incorrect as a result of a misprint. These shortcomings do not, however, detract greatly from what is otherwise an excellent book.

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