This book concerns itself primarily with real and complex Banach spaces. This provides a framework in which linear functional analysis, non-linear analysis and structural properties of Banach spaces themselves are introduced. These topics are broad and the authors must choose items to be included in the presentation. To give some sense of the choices made, an outline of the book follows.

Chapter 1 introduces notation as well as basic notions and tools that enable the study of Banach spaces. The authors suggest that “basic courses in calculus and linear algebra” should provide an adequate prerequisite for the text. The reviewer suggests that real analysis and introductory topology be added to the list. This chapter concludes, as do all the chapters, with a lengthy set of exercises of varying difficulty.

Chapter 2 presents several versions of the Hahn-Banach Theorem. Riesz representation theorems are developed enabling a description of the duals for several classical spaces. Another basic principle, namely the open mapping theorem, is also proven. Chapter 3 continues to develop fundamental properties of Banach spaces. In this chapter weak and weak* topologies are explored, the uniform boundedness principle is presented and the extremal structure of sets in a Banach space is studied. Several results are given including the classical Krein-Milman theorem and the ever-helpful Bishop-Phelps theorem.

Chapter 4 is a bit of an aside in which the basic properties of real locally convex topological vector spaces are studied. These include local bases, the Mackey topology and the bipolar theorem. Some of the applications of the results, such as the Eberlein-Smulian characterization of weakly compact sets, relate to Banach spaces.

A short Chapter 5 begins a study of the structure of a Banach space. Among the notions presented are projections and complements, Auerbach bases and the universality of $C([0,1])$ for separable Banach spaces. Continuing on the same theme, in Chapter 6 the authors introduce Schauder bases and derive several properties of such bases. Biorthogonal sequences, block basis sequences, unconditional bases and Markushевич bases are among the topics covered. This chapter (together with the exercises) gives a nice introductory development of bases in Banach spaces.

Chapter 7 provides an excursion through compact operator theory on Banach spaces. Spectral theory and spectral decomposition are visited. As well some results on fixed point theory are developed to enable proving that compact operators on infinite-dimensional Banach spaces have nontrivial invariant subspaces.

Differentiability of norms and convex functions is studied in Chapter 8. Dual rotundity properties, possible smooth renormings and applications to the extremal structure of convex sets are also studied. Continuing on in Chapter 9, uniform convexity and uniform smoothness are considered. Some applications, for example a characterization of superreflexive spaces, are given. Next, in Chapter 10, the relationships between the (often higher order) differentiability of norms and convex functions, the existence smooth bump functions and differentiable partitions-of-unity are studied as are structural conditions on a Banach space required for the existence of such functions.

Chapter 11 explores structural and renorming results on weakly compactly generated (WCG) spaces, for example Amir and Lindenstrauss’ embedding of a WCG space into some $c_0(G)$ and Troyanski’s nice locally uniformly rotund renorming of a WCG space. Also weakly compact operators are studied and their characterization by factorization through reflexive spaces is shown.

Finally, Chapter 12 considers topological and analytic properties (and characterizations) of compact spaces, including: Eberlein, uniform Eberlein, scattered and Corson compacts.

It has been suggested that an elephant is a racehorse designed by a committee. The committee of authors for this text has produced neither an elephant nor a racehorse. Although an economy of words is desirable when publishing, a short introductory paragraph for each chapter setting the objectives of the chapter and placing it into the larger picture would be helpful for the reader learning the subject. The “infinite-dimensional
geometry” portion of the title is underemphasized in the text. The authors would have done well to take one of their hints for an exercise: “draw a picture”, at least verbally.

Nonetheless, this book will serve as a source of information on Banach spaces for both the veteran and neophyte. It contains an enormous amount of material in the text and exercises which is supported by an extensive set of references. The book arose from material developed for courses and will serve well for that purpose provided an appropriate subset of the material is chosen. The authors have provided some helpful suggestions for this. All in all this is a worthwhile text.