Preface

It is a familiar observation that an organism's genotype may be conceived as a function that maps potential environments into potential phenotypes. Relativizing this conception to cognitive science allows human intellectual endowment to be construed as a particular function mapping early experience into mature cognitive competence. The function might be called "human nature relative to cognition." Learning theory is a mathematical tool for the study of this function. This book attempts to acquaint the reader with the use of this tool.

Less cryptically, learning theory is the study of systems that map evidence into hypotheses. Of special interest are the circumstances under which these hypotheses stabilize to an accurate representation of the environment from which the evidence is drawn. Such stability and accuracy are conceived as the hallmarks of learning. Within learning theory, the concepts "evidence," "stabilization," "accuracy," and so on, give way to precise definitions.

As developed in this book, learning theory is a collection of theorems about certain kinds of number-theoretic functions. We have discussed the application of such theorems to cognitive science and epistemology in a variety of places (e.g., Osherson, Stob, and Weinstein, 1984, 1985, 1985a; Osherson and Weinstein, 1982a, 1984, 1985). In contrast, the present work centers on the mathematical development of learning theory rather than on empirical hypotheses about human learning. As an aid to intuition, however, we have attempted to concretize the formal developments in this book through extended discussion of first language acquisition.

We have not tried to survey the immense field of machine inductive inference. Rather, we have selected for presentation just those results that seem to us to clarify questions relevant to human intellectual development. Several otherwise fascinating topics in machine learning have thus been left aside. Our choices no doubt reflect tacit theoretical commitments not universally shared. An excellent review of many topics passed over here is provided by Angluin and Smith (1982). Our own previously published work in the technical development of learning theory (e.g., Osherson and Weinstein, 1982, 1982a; Osherson, Stob, and Weinstein, 1982, 1982a, 1985) is entirely integrated herein.

Our concern in the present work for the mathematical development of learning theory has resulted in rigorous exposition. Less formal introductions to the central concepts and topics of learning theory are available in Osherson and Weinstein (1984) and Osherson, Stob, and Weinstein (1984).

We would be pleased to receive from our readers comments and corrections, as well as word of new results.