

A. Wayne Corcoran

# Costs

ACCOUNTING,  
ANALYSIS,  
and  
CONTROL

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# COSTS

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## Accounting, Analysis, and Control

A. Wayne Corcoran

University of Massachusetts

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To Sandy in fond recognition  
of her cheerfulness and enthusiastic support

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## About the Author

A. Wayne Corcoran is a professor of accounting and management science at the University of Massachusetts. He previously taught full time at the University of Connecticut and The State University of New York at Buffalo. He has been a visiting professor of accounting at Rensselaer Polytechnic Institute and at Virginia Polytechnic Institute. He has taught part time for the United States Naval Postgraduate School, the University of Rochester, and the National Association of Accountants. He has taught a variety of courses in accounting, inventory theory, queuing theory, production management, applied mathematics, mathematical programming, and finance.

His undergraduate training took place at Cornell Univeristy. He earned his masters degree at The University of Rochester and his doctoral study was done at The State University of New York at Buffalo. He was awarded his CPA by the State of New York in 1960 and has a correspondence degree from the International Accountants Society.

Dr. Corcoran is the author of *The Audit* and *the Punched Card*, *Mathematical Applications in Accounting*, and *Readings in the Methodology of Operations Research: An Accounting Emphasis*, as well as numerous journal articles.

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# Preface

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As much as anything, this is a book on philosophy. I think you will agree that, while there is a lot of “how” in the book, “why” dominates. There is examination of conflicting theories and frank expression of opinion. Where my opinions are too outrageous, too out of keeping with established thought, or too naive, I have asked a colleague who is a supporter of a more prevalent or a more informed view in the particular area to expound on the opposing theory, so that you may better understand the controversy and form your own opinion.

One of my aspirations in writing this textbook has been to encourage readers to think how they feel about one problem or another, rather than to parrot some series of edicts. This is not to say that logic should give way to feeling, or that, for instance, the book would sanction dividing by zero because that was what the reader felt like doing at the moment. There are, after all, immutable mathematical truths which are not subject to capricious manipulation. But which approach to take, which model to apply, what purposes are to be served, who desires the information, what is the decision maker’s level of comprehension—these and many other questions are open to interpretation. They require thought—not an attitude of “Whenever situation A occurs, apply approach B.”

I have tried to make the book self-contained from both accounting and mathematical perspectives. If you have not devoted a significant portion of your recent life to studying these subjects, you will find appendices on bookkeeping and mathematics that should help to fill in the gaps. Cost accounting does not, by and large, demand much knowledge of bookkeeping or make unrelenting use of it. There is some application of bookkeeping, however, since it is an excellent tool for tracing the flows of certain costs. There is, too, the preparation of profit and loss statements to summarize these flows and thereby facilitate control of costs through the interpretation of results.

The mathematical appendix assumes a command of ordinary algebra and delves into probability theory, matrix algebra, calculus, optimization, and transform theory. The more exotic and esoteric branches of mathematics



do not really come into use until the second half of the text, when cost analysis becomes the primary focus. From a mathematical standpoint, the first half of the book rests solely on algebra and the rudiments of matrix algebra. Should you be unfamiliar with matrix algebra, a *half hour* spent with that appendix should suffice to make you “almost expert.” For while serious study of matrix algebra might require several years and bring you in contact with many courses, the fundamentals of vector addition, matrix multiplication, and matrix inversion are quickly learned. A grasp of these opens a whole world of applications for exploration, including a vast variety of accounting allocations, regression analysis, linear programming, and Markov chains—to mention but a few of the more fascinating areas.

Computer programming is also incorporated into the chapters. This is partly because I don’t believe in separating mathematics from computers, but rather in using one to supplement the other, and partly, it is because I am not interested in carrying out scads of arithmetic manually. And finally, it is because computers are becoming more ubiquitous every day. At this writing, for instance, a programmable hand calculator (TI 58) is available (for about \$100) that will multiply and invert matrices, among many other things. And while inverting a  $2 \times 2$  matrix manually is painless,  $3 \times 3$  to  $6 \times 6$  matrices take a little time, while larger matrices almost force the analyst to use a computer. Nevertheless, the nuisance (once you have inverted a few dozen matrices by hand, the thrill begins to wane) of inverting smaller, frequently encountered matrices is now virtually eliminated. Mathematical analysis, so expedited, cannot help but become more widespread.

I hasten to add that you should read only the output of the computer programs if programming is not one of your goals. The programs are written in the BASIC language on the grounds that this is probably the easiest scientific language to learn—should that be your goal. Rumor has it that at Dartmouth, where the language was first developed, admission to the computer programming course was contingent upon the student reading a 30-page pamphlet and showing up at the first class with the output of two programs. No output, no admission! The assignment, if rumor be true, took between three and five hours; the students had already taught themselves programming by the time they entered the programming class! Nonetheless, even though BASIC might better have been named SIMPLE, the language has variants from one computer installation to the next. The programs in this text were written over a period of four years at different universities and therefore necessarily using different compilers. Computers talk to computers no better than man talks to man; consequently, I would regard it as sheer luck if you were to reproduce some of these programs on your system and have them run without modification. The modifications should be minor, however. If you have done no computer programming, the

programs are annotated, and by studying them carefully, you should be able to pick up the language.

The book treats all of the popular areas in cost accounting, such as direct costing, cost-volume-profit relationships, forecasting, job order and process costing systems, standard costs and variance analysis, joint-product costing, replacement costing, decisionmaking costs, project and period budgeting, responsibility accounting, and transfer pricing—along with several areas that are not yet in the “popular” category—such as sampling, inventory theory, queuing theory, and linear and nonlinear programming. If you only have time to cover the popular, then Chapters 1 through 11 are for you. If cost analysis is your focus, then you should concentrate on Chapter 3 and Chapters 12 through 20, skimming the remaining chapters quickly to see if they contain any “nuggets.” In any event, do not fail to read Chapter 2 on human behavior, because mastery of all the accounting and mathematical techniques still leaves one with the problems of communication.

It would be arbitrary to say that this book is an accounting text; it could be used equally well in finance, production, economics, management science, and operations research courses. The dividing lines among these disciplines are mainly political; all are interested in cost, and that is what this book is about.

I have tried throughout to keep two of the goals of ancient Academe in mind:

- (1) to provide a forum for the exchange of ideas, and
- (2) to pursue excellence.

Excellence, of course, is elusive and one pursues it with whatever meager tools are at hand. I may have failed to achieve excellence—only you can be the judge of that—but you may rest assured that I pursued it with all the vigor at my command. I had help—lots of it—and I shall shortly acknowledge specific people who assisted me. If the text is good, they have had a significant role in making it so; if it is less than good, that will be no fault of theirs, but rather a reflection of my stubbornness and stupidity.

And now a few words for the teacher. To help you offer your course, I have prepared a very elaborate solutions manual that contains both detailed theoretical discussions and step-by-step solutions. You will find that much of the problem material is straightforward, but that a few problems are just plain tough. I acted on the notion that the student should at some time in his academic career encounter challenging depth and complexity. Therefore a few problems—such as problem 23 in the chapter on inventory theory—may well constitute a two-week homework assignment. I think I have cautioned the reader when such a problem occurs, but if my

idea of what is difficult differs from yours, you should look at the solution manual before assigning problems.

The book has been class-tested. I used selected chapters in teaching different courses and I also tested the text as a whole in a class in which I handpicked the students. This class contained graduate mathematicians, two certified public accountants, an electrical engineer, an information systems major, and accounting majors. Four of the students were master's candidates, two were doctoral candidates, and the rest were undergraduates. The charge was to tear the book apart—to find fault in any and every way, to exchange misgivings and insights freely. What a course! Nothing was sacred and we all aged five years in one semester! Some perceptions of the challenge of the book to the student emerged clearly.

If you were to spend three semesters, you could do all the chapters and all the problems comfortably. Whatever else is possible depends on the motivation, ability, and maturity of your students. My select group unanimously agreed that one semester was barely enough to read the text, investigate one or two topics with care, and work only one or two of the softer problems in each chapter. All agreed that two semesters would be adequate if one course in cost accounting and another in cost analysis were offered and four or five problems of varying complexity were assigned in each chapter.

Where an undergraduate course in cost accounting is based on this text, I would advise you to cover the appendices on bookkeeping and matrix algebra and Chapters 1 through 11 with care, and to have the class skim read the end results of the models in the remaining chapters.

More than one type of course can be based on this text because as I discuss each subject, I provide a great deal of detail in developing solutions. If I had only provided setups and end solutions of problems, the text would have been considerably thinner, but the choice of type of course would have been limited. As the text stands, a course can focus on developing mathematical abilities as well as on studying the situations in which the techniques have been employed. Or if scope is the main objective, mathematical detail can be left to the student for self-study at his leisure. Time available ultimately determines what can be done. If time is limited, you may well decide to pass up detailed study in favor of scope. The text should accommodate all persuasions.

It will be apparent as you read that I use language that is today labelled sexist. Thus you will read sentences like, "The analyst first ascertains the limits of his study." I do not mean to exclude women from the ranks of analysts, or from the ranks of managers for that matter. I have long been an advocate of letting anyone become whatever he wishes—at equal pay and with equal prestige—provided the individual has the requisite talent. However, I dislike the intrusion of the feminist movement on the use of grammar.

I shall never be a chairperson of anything, any more than I shall ever write the cumbersome symbology s/he, which, I suppose, becomes s/his in the possessive. I resent being told to use s/he or something like it as much as I would resent being told to abandon euphonious expression in favor of modern four-letter invective. If this labels me as an anachronism, so be it. My use of “man” and “he” is in a generic sense.

*A. Wayne Corcoran  
Amherst, Massachusetts*

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To one and all, my sincere thanks.

*A. Wayne Corcoran  
Amherst, Massachusetts*

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# Introduction

## 1

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### **Cost Accounting: What Is That?**

Tradition has every book that discusses accounting begin with a definition of the subject. Unfortunately, once one becomes familiar with the philosophy of accounting, no definition of the subject seems to capture its essence. Well, our subject is cost accounting, and the appendage of the word “cost” in no way eases the burden of defining it. Why the difficulty?

Years ago a beginning student was considered to know what accounting was all about if he could say, “Accounting is the recording, classifying, summarizing, and interpreting of financial data.” For the longest while, this nondefinition was held in the highest regard. Then someone remarked that categorizing or classifying was necessarily an integral part of recording (if you didn’t have categories, you couldn’t record usefully) and therefore the definition was redundant in part. Someone else expressed dissatisfaction with “summarizing” and suggested “reporting” in its stead. And many people observed that accountants did precious little interpreting of the statements they prepared. Furthermore, “financial data” was paradoxical—at once broad and narrow. All sorts of data not in dollar terms eventually cause dollar flows. But who said accounting was solely concerned with dollar flows? Another very significant group of accountants was dismayed that the definition of accounting did not emphasize helping management to make decisions. Still more recently those concerned about accounting’s contributions to society have asked why accounting reports should be restricted only to stockholders, management, and the government.

All of which leads to the sticky question “Who should define accounting—the person who does it or the person who makes use of it, or both?” Each party has a different perspective; the practitioner, being human, could be expected to exaggerate scope and importance, while the consumer, being cursed with much the same condition, could be expected to limit scope to that with which he is familiar. Truth can be elusive.

Over time a great deal of confusion was generated by a lot of well-intentioned people. Eventually there occurred a schism or splitting of



accounting into financial accounting and managerial accounting—a division that exists today. Nothing good seems to have come from this schism, for while there are many accountants who can participate in both financial and managerial accounting, the preponderance of accountants seems to disdain one for the other. “Managerial accounting is management, not accounting!” “Financial accounting is glorified bookkeeping; it misses the point of accounting entirely!” Sentiments like these characterize the antagonisms of the rival factions.

Other factions and schisms also exist. Thus there is governmental accounting, taxation accounting, cost accounting, mathematical accounting, national income accounting, nonprofit institutional accounting, fund accounting, and environmental (societal) accounting. Some of these could be forced into the managerial-financial categories, although their adherents might object. One might well ask, “If these are all different types of accounting, isn’t there agreement on at least a few points?”

The philosophy of accounting cuts through artificial barriers and offers a basis for uniting all schisms into one discipline. Simply stated, that philosophy is: *Accounting seeks to help people plan and control by means of collecting and analyzing information and communicating the results.* This philosophy, however, is not the exclusive property of accounting. Management science, production management, finance, industrial engineering, and many other disciplines share much the same philosophy. It is a small world, indeed. But aren’t these distinct disciplines?

There is a famous parable that may provide insight here. Three blind men were once asked to caress an elephant and then to describe it without being told what it was. One, who had hugged a leg, emphatically told the others that the object was a tree. Another, who had patted a side, convincingly declared the object to be a wall. The third blind man, who had grabbed the tail, jumped back in repulsion, swore violently, and insisted he had fondled a large snake. All three argued vehemently, not one of them swayed in the least by the protestations of the others. Viewed one way, all three were right; viewed another, all were wrong. Had they been able to trust one another and to exchange ideas, they might have arrived at the truth by determining what object possessed all three attributes.

So while many disciplines share a common philosophy, nevertheless, they pursue their separate courses. If they would exchange ideas, all would benefit. Some collect different information than others; some analyze their information using different techniques; still others view control differently. All have trouble when it comes to communication. Far too often, practitioners in any of these disciplines communicate mainly to other practitioners in that discipline. Thus the disciplines are esoteric—only the initiated seem to understand them.

It could be said that only the initiated *care* to understand them.