Expert Oracle Database 11*g* Administration

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To my dear wife, Valerie, as a small token for her immense help and support

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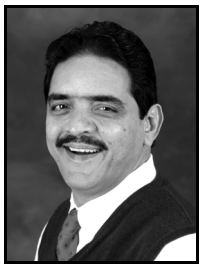
About the Author



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About the Technical Reviewer

JOHN WATSON has spent 20 years hacking away at the Oracle product set, some of those years working for Oracle Corporation (in Internal Support and for Oracle University). Now he works for BPLC Management Consultants, consulting and teaching Oracle server technologies throughout Europe and Africa. He has written and edited several books for Apress and Oracle Press. He currently lives in Oxfordshire with his wife, two Chow Chows, six cats, and a parrot.

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Introduction

GRATIANO: . . . As who should say "I am Sir Oracle, And when I ope my lips, let no dog bark!"

—*The Merchant of Venice*, act 1, scene 1

Oracle Corporation used to print the preceding quotation from Shakespeare at the beginning of one of its chapters in the database administrator (DBA) manual for an earlier release of the Oracle database (Oracle version 6). I always thought the quote was interesting. If you proceed a little further in the play, you'll find this quotation:

BASSANIO: Gratiano speaks an infinite deal of nothing, more than any man in all Venice. His reasons are as two grains of wheat hid in two bushels of chaff: you shall seek all day ere you find them . . .

—*The Merchant of Venice*, act 1, scene 1

Bassanio counters that, in truth, Gratiano speaks too much: from two bushels of chaff, two grains of wheat may be recovered. And that's the *raison d'être* for this book: to separate the wheat from the chaff. The second quotation is even more apt when you consider the difficulty of extracting the right database management procedures from the tons of material available for the Oracle Database 11*g* database. Oracle Corporation publishes copious material to help you manage its increasingly complex databases. Oracle Corporation also conducts a variety of in-person and web-based classes to explain the vast amount of subject matter that you need to understand to effectively work with the Oracle database today. Yet users will have a good deal of difficulty finding the essential material for performing their jobs if they rely exclusively on Oracle's voluminous (albeit well-written) material in the form of manuals, class notes, web-based seminars, and so on.

The goal of this book is to provide you with a single source for most of your day-to-day Oracle database management tasks. Of course, it isn't feasible to cover each and every DBA topic in detail. What I've done in this book is focus on the topics that are common to most enterprises, such as installing the Oracle Database 11*g* software, creating and upgrading databases, exporting and importing data, backing up and recovering data, and performance tuning. I place a lot of emphasis in this book on explaining all of Oracle's automatic management solutions. Using Oracle's automatic management features will keep you from reinventing the wheel each time. It also turns out that after several years of development, Oracle has finally placed in your hands a set of powerful management advisors and other tools that make a lot of traditional DBA work obsolete.

How to Become an Oracle DBA

As you start out on your journey to become a proficient Oracle DBA, you have many sources of information on the Oracle database:

- Oracle Database 11*g* database administration classes, which have now been boiled down to a pair of five-day long classes
- Oracle manuals—an entire library of which are available on the Oracle web sites
- Books from various publishers that impart the various pieces of knowledge you need to become an accomplished Oracle DBA

You'll also need to acquire the necessary operating system knowledge. Most of the large Oracle databases are based on the UNIX (or Linux) operating system, so you'll need to have a reasonably good understanding of UNIX. Again, you have many sources of information available. You can attend a class or two from the leading UNIX system vendors, such as Hewlett-Packard and Sun Microsystems, you can read the manuals, or you can buy some books. Microsoft Windows is another popular operating system for Oracle databases, so you need to have a basic understanding of the Windows Server operating system as well.

As many of the new entrants to the Oracle Database 11*g* field find out, the Oracle DBA world is exhilarating, but alas, it's also exhaustive in its reach and scope. It isn't uncommon for DBAs to have an entire shelf full of books, all explaining various facets of the DBA profession—modeling books, UNIX texts, DBA handbooks, backup and recovery guides, performance-tuning manuals, and networking and troubleshooting books. The amazing thing is, even after you run through the whole gauntlet of courses and books, you aren't really assured of being fully prepared to handle complex, day-to-day database administration chores. There are many people who have taken all the requisite classes to become an Oracle DBA who won't or can't be competent Oracle DBAs based solely on their training. The reason? Refer back to that quotation from Shakespeare at the beginning of this introduction: you need to separate the grain from the chaff, and all the coursework and manuals, while excellent in their content, can serve to muddy the waters further.

The experienced Oracle DBA can find his or her way through this baffling amount of material, but how's the neophyte DBA to cope with the overwhelming amount of information? That's where this book comes in. This text will not only educate you in the theory and principles involved in managing relational databases, it will also help you translate that theory into the useful, practical knowledge that will enable you to manage real-life Oracle Database 11*g* databases with real-life data and real-life issues.

Oracle Database 11*g*

The *g* in Oracle Database 11*g* stands for "grid." The idea is to enable software to access spare processing power across networks (grids) of inexpensive servers. Traditionally, database systems have been run on large servers capable of running several very large databases at once. However, there are distinct disadvantages inherent in the single-server model. For example, resources tied up in the large servers can't be redistributed among the various databases and other services to ensure an optimal allocation of resources. If you need a massive amount of resources to handle your database's peak needs, chances are that you'll run with identical resources throughout the day, thus guaranteeing that you are going to waste critical resources during low-utilization periods.

Grid computing provides a means of harnessing the power of a large number of cheaper servers to supply the computing power you need in a flexible manner. This hardware would be servers like the Intel-based blade servers, and the software would include the free (or almost free) open source Linux operating system. By choosing small, generic servers, your system will cost much less than a

traditional large server system, and because you can dynamically reallocate or provision resources based on actual needs, you'll be using resources efficiently.

Grid computing (also referred to as *computing on demand* and *utility computing*) isn't a new innovation invented solely by Oracle. The idea of grid computing has been around for a while, primarily in the academic world. In fact, grid computing arose out of the academic community's need for extremely fast and scalable computers to perform complex, massive research tasks. Another overriding goal of the academic community was to permit the sharing of computing resources among large numbers of researchers. Of course, the academics also aimed to keep the cost as low as possible. Grid computing emerged out of these efforts as a viable way to create huge sharable computing environments that are dynamically adjustable to changes in the demand for computing power.

When we talk about harnessing the power of a number of commodity servers, realize that the number of computers may not be limited to just a handful. We are talking about combining the power of a fairly large number of small servers linked together to form a grid. Obviously, the key idea here is that the sum is far greater than the individual components. Enterprise grid computing, as envisioned by Oracle, uses large pools of modular storage and commodity servers. Underutilization of resources will be cut down, because capacity could be altered from the centralized pool of resources as necessary.

Here is a summary of the key benefits of grid computing:

- *Flexibility*: Since you are creating a single logical entity from a bunch of small servers, you can, of course, add or remove individual components as your computing needs dictate.
- *Efficiency*: The concept of *dynamic provisioning* underlies grid computing. Dynamic provisioning means that the allocation of resources for various services is not rigidly fixed, but changes according to the need for resources and the availability of the resources. Ideally, a well-run grid will channel resources to where they are needed the most by diverting them from underutilized sources.
- *Easy manageability*: It is far easier to manage a single logical combination of your computing resources (which may include several databases and application servers), rather than monitoring each one as a completely independent unit.
- *Economy*: The total cost of a grid environment could be considerably lower than a traditional single, big server environment. Oracle strongly recommends the use of Linux-based commodity servers, which Oracle says offer the best price/performance ratio.

Key Components of Oracle Database 11*g*

Following are the essential components of Oracle's grid-based systems:

- Real Application Clusters (RAC)
- Information sharing
- Easy server manageability
- Extensive instrumentation
- The advisory framework
- Automatic performance tuning
- Automatic Storage Management (ASM)
- Automatic memory management
- Scheduling and resource management
- Real Application Testing

Note that you most certainly don't have to use a "grid" platform to be able to use the Oracle Database 11*g* server. In either case, you can take advantage of all the new features of the database system.

Real Application Clusters

Oracle has had a feature called the Oracle Parallel Server (OPS) for many years, which enabled people to access the database from more than one instance, thus providing for scalability as well as high availability. Oracle has refined the parallel server technology considerably over the years, eventually renaming it Real Application Clusters (RAC) a few years ago.

Note This book concerns itself exclusively with the "mainstream" Oracle Database 11*g* DBA concepts and techniques. You'll not find any discussion of the Oracle Real Application Clusters in this book. If you are interested in RAC, you may want to take a look at Oracle manuals or refer to one of the many good books devoted to RAC.

Information Sharing

In order to efficiently share information over a grid spanning many heterogeneous systems, you need to share information efficiently. Data exchange can be occasional (such as when you perform data loads for a new system), or it could be regular and instantaneous (updating one part of the system when something changes in another part). In order to facilitate either type of information sharing, Oracle Database 11*g* provides *transportable tablespaces* and *Oracle Streams*.

Transportable Tablespaces

The transportable tablespaces feature enables high-speed transport of huge amounts of data from one database to another, even if the databases are running on different operating systems. The ability to move huge amounts of data across platforms, and even to rename the tablespaces during the process, makes information exchange far easier.

Oracle Streams

Oracle Streams is a feature that enables you to effortlessly capture changes made in one database and propagate them to subscriber nodes in the grid. The Oracle Streams feature can keep all the copies in sync while the changes are being applied.

Easy Server Manageability

Through its Database Control and Grid Control interfaces, Oracle Enterprise Manager enables the management of either a single database or all databases, application servers, hosts, listeners, HTTP servers, and web applications as well.

The prevailing view among IT organizations is that Oracle is a complex, difficult-to-manage database, especially when compared with the Windows server database, SQL Server. Oracle Database 11*g* makes a conscious effort to simplify management, right from the installation process through to daily monitoring and performance tuning. There is a new common infrastructure for storing workload- and performance-related information. You can now use powerful SQL tuning tools to determine ways to improve performance.

Oracle Enterprise Manager (OEM), which includes the single database-level Database Control, and its enterprise-wide counterpart, the Grid Control, provide unsurpassed capabilities for managing the database. Traditionally, Oracle DBAs relied on complex SQL scripts to monitor the database as well as diagnose and fix performance problems. OEM now can help you do all those things and a lot

more, without having to spend enormous amounts of time writing lengthy scripts to help manage the database.

Note I've reduced the use of DBA scripts to the bare minimum in this book. Instead, I show you how to use the OEM Database Control effectively to perform all your tasks quickly and with far less effort.

Extensive Instrumentation

Oracle Database 11*g* provides instrumentation of its code base that ranges further than any prior release of Oracle, providing accurate metrics about database performance that weren't available until now. Oracle's own instrumentation and metrics, since they are embedded in the database code, provide better information without any measurable performance degradation, compared to third-party performance-measurement tools.

The Advisory Framework

Oracle Database 11*g* contains several highly useful *advisors* to help you optimize the performance of the various components of the database. Here are some of them:

- The *Automatic Database Diagnostic Monitor* (ADDM) helps you analyze current and past instance performance.
- The *SQL Tuning Advisor* helps you tune SQL statements.
- The *SQL Access Advisor* tells you whether you should add (or drop) indexes and materialized views.
- The *Segment Advisor* helps you figure out the necessary space for new tables and to reclaim unused space assigned to segments, among other things.
- The *Undo Advisor* helps you configure the critical undo tablespace.
- The *Memory Advisor* provides recommendations for memory-related parameters.

Each of these advisors has a similar look and feel, and this consistency will help you learn how to use them effectively. Using the advisors isn't mandatory, of course—you can also tune space and memory by using Oracle-supplied packages and various dynamic performance views—but it's more efficient to simply invoke the necessary advisor.

Automatic Performance Tuning

Oracle Database 11*g* provides you with automatic performance diagnosis and tuning recommendations. An expert diagnosis tool called the Automatic Database Diagnostic Monitor uses the new Automatic Workload Repository contents to analyze instance performance. The ADDM's analysis includes a summary of database problems ranked according to the amount of database time they're costing, as well as a list of recommendations to eliminate these problems. The ADDM's recommendations may include modifying configuration settings or running one of the advisors listed in the previous section.

Automatic Storage Management

A significant component of the Oracle's push toward easier management is the Automatic Storage Management feature. Traditionally, database administrators relied on third-party vendors, such as VERITAS and EMC, to provide storage management tools for larger systems. ASM enables the automatic management of disks without resorting to third-party Logical Volume Managers (LVMs).

You can use Oracle's storage virtualization layer to automate and simplify the layout and management of all Oracle database files, when you use ASM. Instead of directly managing numerous files and disks, you can pay attention to a relatively small number of *disk groups*. If you need additional storage, you simply add new physical disks to the logical disk groups.

Automatic Memory Management

The Oracle Database 11*g* server provides you with an easy way of managing the memory needs of your databases. Automatic memory management and automatic program global area management use information collected from the instance to efficiently allocate both the major components of Oracle's memory allocation—the system global area (SGA) and the program global area (PGA).

Scheduling and Resource Management

It's common for enterprise users to share computing resources, and there needs to be a way of scheduling the users and sharing the enterprise's resources efficiently. Oracle Database 11*g* DBAs can use the *Database Resource Manager* to control and channel scarce database resources among the various users of the grid. You can also use the *Oracle Scheduler* to manage and monitor jobs as well as prioritize them.

Real Application Testing

Two major features of Oracle Database 11*g*—Database Replay and the SQL Performance Analyzer—facilitate change management by letting you replay database activities and SQL workloads, respectively. You can thus test the impact of a potential database or server upgrade, for example, by invoking the Database Replay and the SQL Performance Analyzer tools.

Why Read *This* Book?

What sets this book apart from the others on the market is the constant focus on the practical side of the DBA's work life. What does a new DBA need to know to begin work? How much and what SQL does the new DBA need to know? What UNIX, Linux, and Windows commands and utilities does the new DBA need to know? How does a DBA perform the basic UNIX administration tasks? How does a DBA install the Oracle software from scratch? How does the DBA use all the powerful new performance tuning features of the Oracle Database 11*g* server?

This book provides the conceptual background and operational details for all the topics a professional Oracle DBA needs to know. The following sections outline other reasons to choose this book over its competitors.

Delivers a One-Volume Reference

This book's specific purpose is to serve as a one-volume handbook for professional Oracle DBAs—as a book that covers both the theory and practice of the DBA craft. As I mentioned before, most newcomers to the field are intimidated and bewildered by the sheer amount of material they're confronted with and the great number of administrative commands they need to have at their fingertips. Well, everything you need to know to run your databases efficiently is right here in this one book.

How did I manage to achieve the difficult feat of providing comprehensive instruction in just one book? Well, although there *is* a lot of terrain to cover if you want to learn all the DBA material, you

must learn to separate the critical from the mundane, so you can identify what matters most and what you merely need to be aware of, at least in the beginning.

I'm definitely not suggesting that this one book will supplant all of the other Oracle material available. I strongly recommend that inquisitive readers make it a habit to refer to Oracle's documentation for the 11*g* database. You can obtain this documentation on the Web by getting a free membership to the Oracle Technology Network (OTN), which you can access through the Oracle web site at `http://technet.oracle.com`.

It's extremely important to read the Oracle database manuals and to understand how the database works. However, nothing can replace working on an actual database when it comes to mastering DBA techniques, so if you have a Windows desktop, you can easily install the freely downloadable Oracle Database 11*g* software. If you want, you can do the same on a Linux system as well. One of the great things about the Oracle database software is that it runs virtually identically on each operating system. In fact, your production system will operate exactly the same as the free "toy database" on your desktop machine, so go ahead and practice to your heart's content on the Oracle Database 11*g* database.

READING THE ORACLE MANUALS

Whether you use this or some other DBA handbook, you will still need to refer to the Oracle database manuals frequently to get the full details of complex database operations. I can't overemphasize the importance of mastering the fundamentals of Oracle Database 11*g* that are presented in the *Oracle Concepts* manual. Mastering this volume is critical to understanding many advanced DBA procedures.

The Oracle manuals are invaluable if you need a lot of detail. For example, the chapters on backup and recovery (Chapters 15 and 16) are good starting points in your attempt to master the Oracle procedures in those areas. Oracle has several manuals covering the backup and recovery material. Once you finish the two relevant chapters in this book, you'll find going through those manuals a pretty easy task, because you'll already have a good understanding of all the important concepts. This book provides a foundation on which you can build using the Oracle manuals and other online help available from Oracle.

In addition to the online manuals, Oracle provides an excellent set of tutorials that contain systematic instructions on how to perform many useful Oracle Database 11*g* tasks. You can access these tutorials, the *Oracle by Example* series, by going to `http://www.oracle.com/technology/obe/start/index.html`.

Emphasizes New Methods and When to Use Them

One of the fundamental difficulties for a neophyte in this field is determining the right strategy for managing databases. Although the essential tasks of database management are pretty similar in Oracle Database 11*g* compared to earlier versions of the software, the database contains several innovative techniques that make a number of routine tasks easier to perform than in the past. Oracle Corporation, however, has shied away from firmly recommending the adoption of the new methods and techniques to manage databases. The reason for this is twofold. First, Oracle rarely discards existing techniques abruptly between versions; features advertised as being destined for obsolescence are made obsolete only after many years. Thus, old and new ways of performing similar tasks coexist in the same version. Second, Oracle isn't very effective in clearly communicating its guidelines concerning contending methods. Thus, when more than one method exists for performing a task, you as a DBA have to exercise caution when you select the appropriate methods to use.

In this book, I clearly emphasize the newer features of Oracle that have been refined in the last few years and encourage you to move away from older techniques when the new innovations are clearly superior. I help you in formulating a solid strategy when multiple choices are offered. A good example is performance tuning: it was common to employ a traditional SQL-script approach to guide performance tuning efforts, but this book comes down squarely on the side of using the latest Oracle Enterprise Manager (OEM) GUI techniques to perform all your performance tuning and other DBA tasks.

Covers UNIX, SQL, PL/SQL, and Data Modeling

Some people who are motivated to become Oracle DBAs are stymied in their initial efforts to do so by their lack of training in UNIX/Linux and SQL. Also, sometimes DBAs are confused by the whole set of data modeling and the "logical DBA" techniques. This book is unique in that it covers all the essential UNIX, SQL, PL/SQL, and data modeling that a DBA ought to know to perform his or her job well.

As a DBA, you need to be able to use a number of UNIX tools and utilities to administer an Oracle database. Unfortunately, up until now many books haven't included coverage of these vital tools. This book remedies this neglect by covering tools such as telnet, FTP, and the crontab. Many developers and managers want to have a better understanding of the UNIX system, including the use of the vi file editor, file manipulation, and basic shell-script writing techniques. This book enables you to start using the UNIX operating system right away and shows you how to write solid shell scripts to perform various tasks. Of course, you can take a specialized class or study a separate book in each of the previous areas, but that's exactly what you're trying to avoid by using this book.

In addition to learning all the UNIX you need to start working with the UNIX operating system right away, you can get a good working knowledge of SQL and PL/SQL from a DBA's perspective in this book. Of course, I strongly recommend further study of both UNIX and SQL to strengthen your skills as an Oracle DBA as you progress in your career.

Offers Hands-On Administrative Experience

Although a number of books have been published in the last decade on the subject of Oracle database administration, there has been a surprising lack of the blending of the concepts of the Oracle database with the techniques needed to perform several administrative tasks. A glaring example is the area of backup and recovery, where it's difficult to find discussions of the conceptual underpinnings of Oracle's backup and recovery process. Consequently, many DBAs end up learning backup and recovery techniques without having a solid grasp of the underlying principles of backup and recovery. As you can imagine, this split between theory and practice proves expensive in the middle of a recovery operation, where fuzziness on the concepts could lead to simple mistakes.

Your success as a professional database administrator is directly related to the amount of hands-on experience you have, and to your understanding of the concepts behind the operation of the database. To get this practice, you can experiment with all the commands in this book on a UNIX- or a Windows-based Oracle Database 11*g* database. Oracle Database 11*g* is loaded with features that make it the cutting-edge database in the relational database market, and this book covers all the new additions and modifications to database administration contained in the 11*g* version. It's a lot of fun for an experienced DBA to have the opportunity to use all the wonderful features of the new database, but beginning- and intermediate-level DBAs will have *more* fun, because they're embarking on the great endeavor that is the mastery of Oracle database management.

Who Should Read This Book?

This book is primarily intended for beginning- and intermediate-level Oracle Database 11*g* DBAs. Prior experience with Oracle databases isn't assumed, so if you've never managed databases and intend to master the management of the new Oracle Database 11*g* database, you can do so with the help of this book.

More precisely, the audience for this book will fall into the following categories:

- Oracle DBAs who are just starting out
- Oracle developers and UNIX/Linux or Windows system administrators who intend to learn Oracle DBA skills
- Managers who want to get a hands-on feel for database management
- Anybody who wants to learn how to become a proficient Oracle DBA on his or her own

A Note About UNIX, Linux, and Windows

I personally like the UNIX operating system and use it at work. I'm familiar with the Windows platform and I think it's a good operating system for small enterprises, but my favorite operating system remains UNIX, which stands out for its reliability, scalability, and speed. For medium and large organizations, the UNIX system offers wonderful features and ease of use. As a result, you'll find this book heavily oriented toward the use of Oracle on UNIX systems.

If you happen to admire the Linux operating system, there isn't a new learning curve involved, as most of the operating system commands will work the same way in the UNIX and Linux systems. If you need to find out how to use the Oracle Database 11*g* database on a Windows platform, here's some interesting news for you: the database commands work exactly the same way in both the UNIX and Windows environments.

How This Book Is Organized

I have organized the contents of this book with the new DBA in mind. My goal is to provide you with a decent background in data modeling, SQL, and UNIX, while providing a thorough course in the essentials of Oracle Database 11*g* database management skills. I know it's unusual to provide UNIX and SQL background in an Oracle DBA book, but this inclusion is in line with the goal I set when I decided to write this book: there ought to be a single book or manual that has all the necessary background for a reader to start working as an Oracle Database 11*g* DBA.

I strove to write the chapters to mirror real-life practical training. For example, you should understand basic database modeling and fundamental UNIX operating system commands before learning to manage Oracle databases. I therefore start with a discussion of database modeling and UNIX. You'll install the Oracle database software before learning how to create an Oracle database. After you install the software and create a database, you can create users and establish connectivity. Subsequent chapters deal with the loading and unloading of data, backup and recovery, day-to-day database management, and performance tuning.

I advise beginning DBAs to start at the beginning of the book and keep going. A more experienced user, on the other hand, can pick the topics in any sequence he or she desires. Throughout the book, I've provided detailed, step-by-step, tested examples to illustrate the use of data concepts and

features of Oracle Database 11*g*. I strongly recommend that you set up an Oracle Database 11*g* database server on your PC and follow along with these examples. Doing so will teach you the relevant commands and help you build confidence in your skill level. Moreover, the examples are a whole lot of fun! The following sections briefly summarize the contents of the book.

Part 1: Background, Data Modeling, UNIX/Linux, and SQL*Plus

Part 1 provides a background on the Oracle DBA profession and offers an introduction to data modeling and the UNIX operating system as well as SQL*Plus. In Chapter 1 I discuss the role of the Oracle DBA in the organization, and I offer some advice on improving your skill set as a DBA. I also discuss the basics of relational databases. Chapter 2 provides an introduction to both logical and physical database design, including the use of entity-relationship diagrams. You'll learn about the Optimal Flexible Architecture (OFA) with regard to disk layout. Chapter 3 provides a quick introduction to UNIX/Linux operating systems, including the most common commands that you need as an Oracle DBA, the rudiments of shell scripting, and how to use the vi text-processing commands. You'll also explore the essential UNIX system administration tasks for Oracle DBAs. This chapter finishes with coverage of disks and storage systems, including the popular RAID systems. Chapter 4 provides a thorough introduction to the use of SQL* Plus, the main interface to the Oracle database. In addition, Chapter 4 also describes how to use the powerful Oracle Enterprise Manager to monitor and manage your databases as well as your entire system. You'll learn how to install and use the Database Control, which you use for managing a single database, and the Grid Control, through which you can manage your enterprise, including application servers and hosts.

Part 2: Oracle Database 11*g* Architecture, Schema, and Transaction Management

Part 2 is in many ways the heart of the book—it covers the important topics of Oracle Database 11g's architecture, schema management, and transaction management. In Chapter 5 you'll learn about the important components of the Oracle database architecture, such as how the database processes and memory work. It also covers the conceptual foundations of the Oracle database. Chapter 6 provides a detailed introduction to the management of tablespaces. Chapter 7 covers schema management in Oracle Database 11*g*, and it contains a quick review of the important types of Oracle objects, such as tables and indexes, and shows you how to manage them. Chapter 8 provides you with a thorough understanding of how Oracle databases conduct transaction processing.

Part 3: Installing Oracle Database 11*g*, Upgrading, and Creating Databases

Part 3 includes two chapters that show you how to install the Oracle Database 11*g* software, create Oracle databases, and upgrade databases. Chapter 9, which covers Oracle software installation, shows how to install the Oracle Database 11*g* database server. In addition, Chapter 9 also shows you in detail how to upgrade to Oracle Database 11*g*. Chapter 10 shows you how to create an Oracle database from scratch, both manually as well as by using the Database Configuration Assistant (DBCA).

Part 4: Connectivity and User Management

Part 4 explains how to establish connectivity to the Oracle database and manage database users. Chapter 11 covers connecting to Oracle databases, and Chapter 12 shows you how to manage users and discusses ways of securing your database.

Part 5: Data Loading, Backup, and Recovery

Part 5 deals with loading data and performing backups and recovery. You'll learn how to use SQL*Loader in Chapter 13, and Chapter 14 covers the Data Pump technology, which enables you to load and unload Oracle data. Chapters 15 and 16 deal with the crucial topics of database backups and recovery, respectively.

Part 6: Managing the Database

Part 6 covers managing the operational Oracle Database 11*g* database. Chapter 17 focuses on the important Oracle Database 11*g* automatic management features, as well as exploring several powerful online capabilities of the Oracle database. Chapter 18 shows you how to manage data files, tablespaces, and Oracle redo logs, and how to perform undo management. The chapter also provides an introduction to the Oracle storage solution, Automatic Storage Management.

Part 7: Performance Tuning

Part 7 covers Oracle Database 11*g* performance tuning and troubleshooting issues. Chapter 19 discusses the Cost-Based Optimizer and provides tips on writing efficient SQL queries. You'll also see how to use Oracle's Automatic SQL Tuning Advisor to improve query performance. In Chapter 20, you'll learn how to optimize the use of Oracle's memory, disk I/O, and the operating system. You'll also learn about the Oracle wait interface in this chapter. A basic approach to performance analysis and troubleshooting production databases is explained as well.

Appendix: Oracle Database 11*g* SQL and PL/SQL: A Brief Primer

In the Appendix, I introduce Oracle SQL and PL/SQL, provide an introduction to Oracle XML DB, which helps you deal with XML data, and include an introduction to using the Java programming language with Oracle.

Salud!

I truly enjoy working with the Oracle database, because of its amazing range of capabilities and the intricate challenges it throws my way as I explore its wide-ranging capabilities. I hope you derive as much satisfaction and fulfillment from the Oracle database as I do. I leave you with the following observation, adapted from the introduction to the famous economics textbook by Paul A. Samuelson, the great economist and Nobel Laureate:[1]

> *I envy you, the beginning Oracle DBA, as you set out to explore the exciting world of Oracle Database 11*g *database management for the first time. This is a thrill that, alas, you can experience only once in a lifetime. So, as you embark, I wish you bon voyage!*

1. Paul A. Samuelson and William D. Nordhaus, *Economics, Seventeenth Edition* (New York: McGraw-Hill, 1998).