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This book is an anthology of the results of research and development in database query processing during the past decade. The relational model of data provided tremendous impetus for research into query processing. Since a relational query does not specify access paths to the stored data, the database management system (DBMS) must provide an intelligent query-processing subsystem which will evaluate a number of potentially efficient strategies for processing the query and select the one that optimizes a given performance measure. The degree of sophistication of this subsystem, often called the optimizer, critically affects the performance of the DBMS. Research into query processing thus started has taken off in several directions during the past decade. The emergence of research into distributed databases has enormously complicated the tasks of the optimizer. In a distributed environment, the database may be partitioned into horizontal or vertical fragments of relations. Replicas of the fragments may be stored in different sites of a network and even migrate to other sites. The measure of performance of a query in a distributed system must include the communication cost between sites. To minimize communication costs for-queries involving multiple relations across multiple sites, optimizers may also have to consider semi-join techniques.

Until recently, databases contained easily indexed numbers and text. Today, in the age of powerful, graphically based computers, and the world wide web, databases are likely to contain a much greater variety of data forms, including images, sound, video clips, and even handwritten documents. When multimedia databases are the norm, traditional methods of working with databases no longer apply. How do you query a video library, or an image database containing x-rays, or sounds in an audio database? Principles of Multimedia Database Systems explains how to work with these new multimedia data forms. It is the first comprehensive treatment of the skills and techniques required to build, maintain, and query multimedia databases. This book presents the mix of techniques necessary for working with multimedia databases, including synthetic solutions for the design and deployment of multimedia database systems. Because rapid technological developments are constantly changing the landscape of multimedia databases, the book teaches basic theoretical principles applicable to any database. * Covers the major issues of multimedia database design, with a strong focus on distributed multimedia databases. * Discusses important topics including how to organize the vast data types, storage and retrieval, and creation and delivery of multimedia presentations. * Organized around the lively scenario of a crime-fighting database that evolves as new concepts are introduced. * Includes numerous exercises and suggestions for programming projects. * Ad-

ditional materials on the web include updates, on-line supplements, and links to downloadable software.

N etwork-based computing domain unifies all best research efforts presented from single computer systems to networked systems to render overwhelming computational power for several modern day applications. Although this power is expected to grow with respect to time due to tech nological advancements, application requirements impose a continuous thrust on network utilization and on the resources to deliver supreme quality of service. Strictly speaking, network-based computing dornain has no confined scope and each element offers considerable challenges. Any modern day networked application strongly thrives on efficient data storage and management system, which is essentially a Database System. There have been nurnber of books-to-date in this domain that discuss fundamental principles of designing a database systern. Research in this dornain is now far matured and rnany researchers are venturing in this dornain continuously due to a wide variety of challenges posed. In this book, our dornain of interest is in exposing the underlying key challenges in designing algorithms to handle unpredictable requests that arrive at a Distributed Database System(DDBS) and evaluating their performance. These requests are otherwise called as on-line requests arriving at a system to process. Transactions in an on-line Banking service, Airline Reservation systern, Video-on-Demand systern, etc, are few examples of on-line requests.

This book describes the theory, algorithms, and practical implementation techniques behind transaction processing in information technology systems.

Architecture of a Database System presents an architectural discussion of DBMS design principles, including process models, parallel architecture, storage system design, transaction system implementation, query processor and optimizer architectures, and typical shared components and utilities. Presents research and analysis of various developments in the fields of database systems and software development.

When it comes to choosing, using, and maintaining a database, understanding its internals is essential. But with so many distributed databases and tools available today, it's often difficult to understand what each one offers and how they differ. With this practical guide, Alex Petrov guides developers through the concepts behind modern database and storage engine internals. Throughout the book, you'll explore relevant material gleaned from numerous books, papers, blog posts, and the source code of several open source databases. These resources are listed at the end of parts one and two. You'll discover that the most significant distinctions among many modern databases reside in subsystems that determine how storage is organized and how data is distributed. This book ex-

amines: Storage engines: Explore storage classification and taxonomy, and dive into B-Tree-based and immutable Log Structured storage engines, with differences and use-cases for each Storage building blocks: Learn how database files are organized to build efficient storage, using auxiliary data structures such as Page Cache, Buffer Pool and Write-Ahead Log Distributed systems: Learn step-by-step how nodes and processes connect and build complex communication patterns Database clusters: Which consistency models are commonly used by modern databases and how distributed storage systems achieve consistency

This book addresses issues related to managing data across a distributed database system. It is unique because it covers traditional database theory and current research, explaining the difficulties in providing a unified user interface and global data dictionary. The book gives implementers guidance on hiding discrepancies across systems and creating the illusion of a single repository for users. It also includes three sample frameworks—implemented using J2SE with JMS, J2EE, and Microsoft .Net—that readers can use to learn how to implement a distributed database management system. IT and development groups and computer sciences/software engineering graduates will find this guide invaluable.

The first and only database primer for today's global economy Today's businesses depend on their databases to provide information essential for their day-to-day operations and to help them take advantage of today's rapidly growing and maturing electronic commerce opportunities. The primary responsibility for the design and maintenance of these databases rests with a company's information technology department. Unlike other IT resources currently available that tend to focus on a particular product, Database Design and Development: An Essential Guide for IT Professionals was created to give today's IT directors and other IT staff a solid basic knowledge of database design and development to help them make educated decisions about the right database environment for their companies. Today's IT professionals must understand the fundamentals in order to determine their next steps for specializing in the vast field of database technology. Database Design and Development: An Essential Guide for IT Professionals answers such common questions as: What is the purpose of a database system? What are the components of a database system? What type of data does your company need to capture? How do you design a database for a particular goal? How do you capture information through data modeling? How do you determine which database will best meet your business objectives? What's involved in effective database management and maintenance? How are database systems used to interface with the Internet? With more than twenty-five years of experience teaching IT courses and designing databases for some of America's top institutions, the author has succeeded in creating an essential resource for today's IT managers as well as for students planning a career in information technology.

In the race to compete in today's fast-moving markets, large enterprises are busy adopting new technologies for creating new products, processes, and business models. But one obstacle on the road to digital transformation is placing too much emphasis on technology, and not enough on the types of processes technology enables. What if different lines of business could build their own services and applications—and decision-making was distributed rather than centralized? This report explores the concept of a digital business platform as a way of empowering individual business sectors to act on data in real time. Much innovation in a digital enterprise will increasingly happen at the edge,

whether it involves business users (from marketers to data scientists) or IoT devices. To facilitate the process, your core IT team can provide these sectors with the digital tools they need to innovate quickly. This report explores: Key cultural and organizational changes for developing business capabilities through cross-functional product teams A platform for integrating applications, data sources, business partners, clients, mobile apps, social networks, and IoT devices Creating internal API programs for building innovative edge services in low-code or no-code environments Tools including Integration Platform as a Service, Application Platform as a Service, and Integration Software as a Service The challenge of integrating microservices and serverless architectures Event-driven architectures for processing and reacting to events in real time You'll also learn about a complete pervasive integration solution as a core component of a digital business platform to serve every audience in your organization.

With the rapid growth in the use of computers to manipulate, process, and reason about multimedia data, the problem of how to store and retrieve such data is becoming increasingly important. Thus, although the field of multimedia database systems is only about 5 years old, it is rapidly becoming a focus for much excitement and research effort. Multimedia database systems are intended to provide unified frameworks for requesting and integrating information in a wide variety of formats, such as audio and video data, document data, and image data. Such data often have special storage requirements that are closely coupled to the various kinds of devices that are used for recording and presenting the data, and for each form of data there are often multiple representations and multiple standards - all of which make the database integration task quite complex. Some of the problems include: - what a multimedia database query means - what kinds of languages to use for posing queries - how to develop compilers for such languages - how to develop indexing structures for storing media on ancillary devices - data compression techniques - how to present and author presentations based on user queries. Although approaches are being developed for a number of these problems, they have often been ad hoc in nature, and there is a need to provide a princi pled theoretical foundation.

This book presents the most current information on distributed object management; a synthesis between systems and object orientation. It will be of interest to researchers in the field.

Covers the important requirements of teaching databases with a modular and progressive perspective. This book can be used for a full course (or pair of courses), but its first half can be profitably used for a shorter course.

This is the eBook of the printed book and may not include any media, website access codes, or print supplements that may come packaged with the bound book. Database Systems: The Complete Book is ideal for Database Systems and Database Design and Application courses offered at the junior, senior and graduate levels in Computer Science departments. A basic understanding of algebraic expressions and laws, logic, basic data structure, OOP concepts, and programming environments is implied. Written by well-known computer scientists, this introduction to database systems offers a comprehensive approach, focusing on database design, database use, and implementation of database applications and database management systems. The first half of the book provides in-depth coverage of databases from the point of view of the database designer, user, and application programmer. It covers the latest database standards SQL:1999, SQL/PSM, SQL/CLI, JDBC, ODL, and XML, with

broader coverage of SQL than most other texts. The second half of the book provides in-depth coverage of databases from the point of view of the DBMS implementor. It focuses on storage structures, query processing, and transaction management. The book covers the main techniques in these areas with broader coverage of query optimization than most other texts, along with advanced topics including multidimensional and bitmap indexes, distributed transactions, and information integration techniques.

This text describes the major components of Oracle such as SQL Plus, PL/SQL, indexing, security and integrity, and distributed databases. Underlying principles are also described in the book, and there are chapters on the objectives of database systems and on the relational model.

Designing distributed computing systems is a complex process requiring a solid understanding of the design problems and the theoretical and practical aspects of their solutions. This comprehensive textbook covers the fundamental principles and models underlying the theory, algorithms and systems aspects of distributed computing. Broad and detailed coverage of the theory is balanced with practical systems-related issues such as mutual exclusion, deadlock detection, authentication, and failure recovery. Algorithms are carefully selected, lucidly presented, and described without complex proofs. Simple explanations and illustrations are used to elucidate the algorithms. Important emerging topics such as peer-to-peer networks and network security are also considered. With vital algorithms, numerous illustrations, examples and homework problems, this textbook is suitable for advanced undergraduate and graduate students of electrical and computer engineering and computer science. Practitioners in data networking and sensor networks will also find this a valuable resource. Additional resources are available online at www.cambridge.org/9780521876346.

This edition combines clear explanations of database theory and design with up-to-date coverage of models and real systems. It features excellent examples and access to Addison Wesley's database Web site that includes further teaching, tutorials and many useful student resources.

Principles of Transaction Processing is a comprehensive guide to developing applications, designing systems, and evaluating engineering products. The book provides detailed discussions of the internal workings of transaction processing systems, and it discusses how these systems work and how best to utilize them. It covers the architecture of Web Application Servers and transactional communication paradigms. The book is divided into 11 chapters, which cover the following: Overview of transaction processing application and system structure Software abstractions found in transaction processing systems Architecture of multitier applications and the functions of transactional middleware and database servers Queued transaction processing and its internals, with IBM's Websphere MQ and Oracle's Stream AQ as examples Business process management and its mechanisms Description of the two-phase locking function, B-tree locking and multigranularity locking used in SQL database systems and nested transaction locking System recovery and its failures Two-phase commit protocol Comparison between the tradeoffs of replicating servers versus replication resources Transactional middleware products and standards Future trends, such as cloud computing platforms, composing scalable systems using distributed computing components, the use of flash storage to replace disks and data streams from sensor devices as a source of transaction requests. The text meets the needs of systems professionals, such as IT application programmers who construct TP applications, application analysts, and product developers. The book will also be invaluable to students

and novices in application programming. Complete revision of the classic "non mathematical" transaction processing reference for systems professionals. Updated to focus on the needs of transaction processing via the Internet-- the main focus of business data processing investments, via web application servers, SOA, and important new TP standards. Retains the practical, non-mathematical, but thorough conceptual basis of the first edition.

Introductory, theory-practice balanced text teaching the fundamentals of databases to advanced undergraduates or graduate students in information systems or computer science.

This, the third edition of the classic textbook explores fundamental theory as well as practical techniques and algorithms, and features fresh chapters on aspects such as database replication and integration as well as emerging topics such as cloud computing.

Database System Concepts by Silberschatz, Korth and Sudarshan is now in its 6th edition and is one of the cornerstone texts of database education. It presents the fundamental concepts of database management in an intuitive manner geared toward allowing students to begin working with databases as quickly as possible. The text is designed for a first course in databases at the junior/senior undergraduate level or the first year graduate level. It also contains additional material that can be used as supplements or as introductory material for an advanced course. Because the authors present concepts as intuitive descriptions, a familiarity with basic data structures, computer organization, and a high-level programming language are the only prerequisites. Important theoretical results are covered, but formal proofs are omitted. In place of proofs, figures and examples are used to suggest why a result is true.

SQL in a Nutshell applies the eminently useful "Nutshell" format to Structured Query Language (SQL), the elegant--but complex--descriptive language that is used to create and manipulate large stores of data. For SQL programmers, analysts, and database administrators, the new second edition of SQL in a Nutshell is the essential date language reference for the world's top SQL database products. SQL in a Nutshell is a lean, focused, and thoroughly comprehensive reference for those who live in a deadline-driven world.This invaluable desktop quick reference drills down and documents every SQL command and how to use it in both commercial (Oracle, DB2, and Microsoft SQL Server) and open source implementations (PostgreSQL, and MySQL). It describes every command and reference and includes the command syntax (by vendor, if the syntax differs across implementations), a clear description, and practical examples that illustrate important concepts and uses. And it also explains how the leading commercial and open sources database product implement SQL. This wealth of information is packed into a succinct, comprehensive, and extraordinarily easy-to-use format that covers the SQL syntax of no less than 4 different databases.When you need fast, accurate, detailed, and up--to-date SQL information, SQL in a Nutshell, Second Edition will be the quick reference you'll reach for every time. SQL in a Nutshell is small enough to keep by your keyboard, and concise (as well as clearly organized) enough that you can look up the syntax you need quickly without having to wade through a lot of useless fluff. You won't want to work on a project involving SQL without it.

The major objective of a distributed system is to provide low coast availability of the resources of the system by localizing access and providing insulation against failures of individual components. Since many users can be concurrently accessing the system, it is essential that a distributed system also provide a high degree of concurrency. Research into algorithms has been focused on concurren-

cy, consistency, failure detection, management of replicated copy, and commitment and termination of transactions. This book is a compilation of a subset of research contributions in the area of concurrency control and reliability in distributed systems, with brief explorations of interesting areas, including theoretical and experimental efforts.

This book adopts a practical approach, reviewing the fundamentals of database technology and developments in data communications (including standards) before reviewing the principles of distributed DB systems. It includes case studies of the leading products.

The overwhelming majority of a software system's lifespan is spent in use, not in design or implementation. So, why does conventional wisdom insist that software engineers focus primarily on the design and development of large-scale computing systems? In this collection of essays and articles, key members of Google's Site Reliability Team explain how and why their commitment to the entire lifecycle has enabled the company to successfully build, deploy, monitor, and maintain some of the largest software systems in the world. You'll learn the principles and practices that enable Google engineers to make systems more scalable, reliable, and efficient—lessons directly applicable to your organization. This book is divided into four sections: Introduction—Learn what site reliability engineering is and why it differs from conventional IT industry practices Principles—Examine the patterns, behaviors, and areas of concern that influence the work of a site reliability engineer (SRE) Practices—Understand the theory and practice of an SRE's day-to-day work: building and operating large distributed computing systems Management—Explore Google's best practices for training, communication, and meetings that your organization can use

An introduction to fundamental theories of concurrent computation and associated programming languages for developing distributed and mobile computing systems. Starting from the premise that understanding the foundations of concurrent programming is key to developing distributed computing systems, this book first presents the fundamental theories of concurrent computing and then introduces the programming languages that help develop distributed computing systems at a high level of abstraction. The major theories of concurrent computation—including the π-calculus, the actor model, the join calculus, and mobile ambients—are explained with a focus on how they help design and reason about distributed and mobile computing systems. The book then presents programming languages that follow the theoretical models already described, including Pict, SALSA, and JoCaml. The parallel structure of the chapters in both part one (theory) and part two (practice) enable the reader not only to compare the different theories but also to see clearly how a programming language supports a theoretical model. The book is unique in bridging the gap between the theory and the practice of programming distributed computing systems. It can be used as a textbook for graduate and advanced undergraduate students in computer science or as a reference for researchers in the area of programming technology for distributed computing. By presenting theory first, the book allows readers to focus on the essential components of concurrency, distribution, and mobility without getting bogged down in syntactic details of specific programming languages. Once the theory is understood, the practical part of implementing a system in an actual programming language becomes much easier.

The latest edition of a popular text and reference on database research, with substantial new material and revision; covers classical literature and recent hot topics. Lessons from database research

have been applied in academic fields ranging from bioinformatics to next-generation Internet architecture and in industrial uses including Web-based e-commerce and search engines. The core ideas in the field have become increasingly influential. This text provides both students and professionals with a grounding in database research and a technical context for understanding recent innovations in the field. The readings included treat the most important issues in the database area--the basic material for any DBMS professional. This fourth edition has been substantially updated and revised, with 21 of the 48 papers new to the edition, four of them published for the first time. Many of the sections have been newly organized, and each section includes a new or substantially revised introduction that discusses the context, motivation, and controversies in a particular area, placing it in the broader perspective of database research. Two introductory articles, never before published, provide an organized, current introduction to basic knowledge of the field; one discusses the history of data models and query languages and the other offers an architectural overview of a database system. The remaining articles range from the classical literature on database research to treatments of current hot topics, including a paper on search engine architecture and a paper on application servers, both written expressly for this edition. The result is a collection of papers that are seminal and also accessible to a reader who has a basic familiarity with database systems.

The Internet and World Wide Web have revolutionized access to information. Users now store information across multiple platforms from personal computers to smartphones and websites. As a consequence, data management concepts, methods and techniques are increasingly focused on distribution concerns. Now that information largely resides in the network, so do the tools that process this information. This book explains the foundations of XML with a focus on data distribution. It covers the many facets of distributed data management on the Web, such as description logics, that are already emerging in today's data integration applications and herald tomorrow's semantic Web. It also introduces the machinery used to manipulate the unprecedented amount of data collected on the Web. Several 'Putting into Practice' chapters describe detailed practical applications of the technologies and techniques. The book will serve as an introduction to the new, global, information systems for Web professionals and master's level courses.

Database: Principles Programming Performance provides an introduction to the fundamental principles of database systems. This book focuses on database programming and the relationships between principles, programming, and performance. Organized into 10 chapters, this book begins with an overview of database design principles and presents a comprehensive introduction to the concepts used by a DBA. This text then provides grounding in many abstract concepts of the relational model. Other chapters introduce SQL, describing its capabilities and covering the statements and functions of the programming language. This book provides as well an introduction to Embedded SQL and Dynamic SQL that is sufficiently detailed to enable students to immediately start writing database programs. The final chapter deals with some of the motivations for database systems spanning multiple CPUs, including client-server and distributed transactions. This book is a valuable resource for database administrators, application programmers, specialist users, and end users.

A thorough presentation of query processing techniques in a broad range of database systems for advanced applications. Provides the most effective query processing techniques and ways to optimize the information retrieval process. Intended for database systems designers creating advanced appli-

cations.

This third edition of a classic textbook can be used to teach at the senior undergraduate and graduate levels. The material concentrates on fundamental theories as well as techniques and algorithms. The advent of the Internet and the World Wide Web, and, more recently, the emergence of cloud computing and streaming data applications, has forced a renewal of interest in distributed and parallel data management, while, at the same time, requiring a rethinking of some of the traditional techniques. This book covers the breadth and depth of this re-emerging field. The coverage consists of two parts. The first part discusses the fundamental principles of distributed data management and includes distribution design, data integration, distributed query processing and optimization, distributed transaction management, and replication. The second part focuses on more advanced topics and includes discussion of parallel database systems, distributed object management, peer-to-peer data management, web data management, data stream systems, and cloud computing. New in this Edition: • New chapters, covering database replication, database integration, multidatabase query processing, peer-to-peer data management, and web data management. • Coverage of emerging topics such as data streams and cloud computing • Extensive revisions and updates based on years of class testing and feedback Ancillary teaching materials are available.

Data is at the center of many challenges in system design today. Difficult issues need to be figured out, such as scalability, consistency, reliability, efficiency, and maintainability. In addition, we have an overwhelming variety of tools, including relational databases, NoSQL datastores, stream or batch processors, and message brokers. What are the right choices for your application? How do you make sense of all these buzzwords? In this practical and comprehensive guide, author Martin Kleppmann helps you navigate this diverse landscape by examining the pros and cons of various technologies for processing and storing data. Software keeps changing, but the fundamental principles remain the same. With this book, software engineers and architects will learn how to apply those ideas in practice, and how to make full use of data in modern applications. Peer under the hood of the systems you already use, and learn how to use and operate them more effectively Make informed decisions by identifying the strengths and weaknesses of different tools Navigate the trade-offs around consistency, scalability, fault tolerance, and complexity Understand the distributed systems research upon which modern databases are built Peek behind the scenes of major online services, and learn from their architectures