

CHAPTER 1



Introduction

A **database-management system (DBMS)** is a collection of interrelated data and a set of programs to access those data. The collection of data, usually referred to as the **database**, contains information relevant to an enterprise. The primary goal of a DBMS is to provide a way to store and retrieve database information that is both *convenient* and *efficient*.

Database systems are designed to manage large bodies of information. Management of data involves both defining structures for storage of information and providing mechanisms for the manipulation of information. In addition, the database system must ensure the safety of the information stored, despite system crashes or attempts at unauthorized access. If data are to be shared among several users, the system must avoid possible anomalous results.

Because information is so important in most organizations, computer scientists have developed a large body of concepts and techniques for managing data. These concepts and techniques form the focus of this book. This chapter briefly introduces the principles of database systems.

Bibliographical Notes

[Codd (1970)] is the landmark paper that introduced the relational model. Textbook coverage of database systems is provided by [O'Neil and O'Neil (2000)], [Ramakrishnan and Gehrke (2002)], [Date (2003)], [Kifer et al. (2005)], [Garcia-Molina et al. (2008)], and [Elmasri and Navathe (2016)], in addition to this textbook,

Textbook coverage of theoretical aspects of databases is provided by [Abiteboul et al. (1995)], while coverage of transaction processing is provided by [Bernstein and Newcomer (2009)] and [Gray and Reuter (1993)]. A book containing a collection of research papers on database management is offered by [Bailis et al. (2015)].

A review of accomplishments in database management and an assessment of future research challenges appears in [Silberschatz et al. (1990)], [Silberschatz et al. (1996)], [Bernstein et al. (1998)], [Abiteboul et al. (2003)], [Agrawal et al. (2009)], and [Abadi et al. (2016)].

The home page of the ACM Special Interest Group on Management of Data (www.acm.org/sigmod) provides a wealth of information about database research. Database vendor web sites (see the Tools section above) provide details about their respective products.

Bibliography

- [Abadi et al. (2016)] D. Abadi, R. Agrawal, A. Ailamaki, M. Balazinska, P. A. Bernstein, M. J. Carey, S. Chaudhuri, J. Dean, A. Doan, M. J. Franklin, J. Gehrke, L. M. Haas, A. Y. Halevy, J. M. Hellerstein, Y. E. Ioannidis, H. Jagadish, D. Kossmann, S. Madden, S. Mehrotra, T. Milo, J. F. Naughton, R. Ramakrishnan, V. Markl, C. Olston, B. C. Ooi, C. Răde, D. Suciu, M. Stonebraker, T. Walter, and J. Widom, “The Beckman Report on Database Research”, *Communications of the ACM*, Volume 59, Number 2 (2016), pages 92–99.
- [Abiteboul et al. (1995)] S. Abiteboul, R. Hull, and V. Vianu, *Foundations of Databases*, Addison Wesley (1995).
- [Abiteboul et al. (2003)] S. Abiteboul, R. Agrawal, P. A. Bernstein, M. J. Carey, et al. “The Lowell Database Research Self Assessment” (2003).
- [Agrawal et al. (2009)] R. Agrawal, A. Ailamaki, P. A. Bernstein, E. A. Brewer, M. J. Carey, S. Chaudhuri, A. Doan, D. Florescu, M. J. Franklin, H. Garcia-Molina, J. Gehrke, L. Gruenwald, L. M. Haas, A. Y. Halevy, J. M. Hellerstein, Y. E. Ioannidis, H. F. Korth, D. Kossmann, S. Madden, R. Magoulas, B. C. Ooi, T. O’Reilly, R. Ramakrishnan, S. Sarawagi, M. Stonebraker, A. S. Szalay, and G. Weikum, “The Claremont Report on Database Research”, *Communications of the ACM*, Volume 52, Number 6 (2009), pages 56–65.
- [Bailis et al. (2015)] P. Bailis, J. M. Hellerstein, and M. Stonebraker, *Readings in Database Systems*, 5th edition, The authors, under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License (2015).
- [Bernstein and Newcomer (2009)] P. A. Bernstein and E. Newcomer, *Principles of Transaction Processing*, 2nd edition, Morgan Kaufmann (2009).
- [Bernstein et al. (1998)] P. Bernstein, M. Brodie, S. Ceri, D. DeWitt, M. Franklin, H. Garcia-Molina, J. Gray, J. Held, J. Hellerstein, H. V. Jagadish, M. Lesk, D. Maier, J. Naughton, H. Pirahesh, M. Stonebraker, and J. Ullman, “The Asilomar Report on Database Research”, *ACM SIGMOD Record*, Volume 27, Number 4 (1998), pages 74–80.
- [Codd (1970)] E. F. Codd, “A Relational Model for Large Shared Data Banks”, *Communications of the ACM*, Volume 13, Number 6 (1970), pages 377–387.
- [Date (2003)] C. J. Date, *An Introduction to Database Systems*, 8th edition, Addison Wesley (2003).
- [Elmasri and Navathe (2016)] R. Elmasri and S. B. Navathe, *Fundamentals of Database Systems*, 7th edition, Addison Wesley (2016).

- [**Garcia-Molina et al. (2008)**] H. Garcia-Molina, J. D. Ullman, and J. D. Widom, *Database Systems: The Complete Book*, 2nd edition, Prentice Hall (2008).
- [**Gray and Reuter (1993)**] J. Gray and A. Reuter, *Transaction Processing: Concepts and Techniques*, Morgan Kaufmann (1993).
- [**Kifer et al. (2005)**] M. Kifer, A. Bernstein, and P. Lewis, *Database Systems: An Application Oriented Approach, Complete Version*, 2nd edition, Addison Wesley (2005).
- [**O’Neil and O’Neil (2000)**] P. O’Neil and E. O’Neil, *Database: Principles, Programming, Performance*, 2nd edition, Morgan Kaufmann (2000).
- [**Ramakrishnan and Gehrke (2002)**] R. Ramakrishnan and J. Gehrke, *Database Management Systems*, 3rd edition, McGraw Hill (2002).
- [**Silberschatz et al. (1990)**] A. Silberschatz, M. R. Stonebraker, and J. D. Ullman, “Database Systems: Achievements and Opportunities”, *ACM SIGMOD Record*, Volume 19, Number 4 (1990), pages 6–22.
- [**Silberschatz et al. (1996)**] A. Silberschatz, M. Stonebraker, and J. Ullman, “Database Research: Achievements and Opportunities into the 21st Century”, Technical Report CS-TR-96-1563, Department of Computer Science, Stanford University, Stanford (1996).

