An Update of the Temporal Database Bibliography

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1 Introduction

This is the fifth in a series of bibliographies concerning temporal databases. Since the series is incremental, earlier bibliographies in the series should be consulted to find previous entries. The current bibliography includes papers that have been published since the last bibliography as well as papers that were not included in previous editions.

The most recent entry in this series was by Soo ("Bibliography on Temporal Databases," *ACM SIGMOD Record*, 20, No. 1, Mar. 1991, pp. 14–23.) Previous bibliographies were Stam & Snodgrass ("A Bibliography on Temporal Databases," *IEEE Database Engineering*, 7, No. 4, Dec. 1988, pp. 231–239), McKenzie ("Bibliography: Temporal Databases," *ACM SIGMOD Record*, 15, No. 4, Dec. 1986, pp. 40–52), and Bolour, Anderson, Dekeyser, and Wong ("The Role of Time in Information Processing: A Survey," *ACM SIGMOD Record*, 12, No. 3, 1983, pp. 27–50).

Since the last bibliography, there have been several developments in temporal databases. The International Workshop on an Infrastructure for Temporal Databases took place in Arlington, TX, June 14-16, 1993. A book describing research in temporal databases was edited by Tansel, Clifford, Gadia, Jajodia, Segev and Snodgrass (**Temporal Databases: Theory, Design, and Implementation.** Database Systems and Applications Series. Redwood City, CA: Benjamin/Cummings, 1993).

Several bibliographies have been compiled on specific areas within temporal databases. A bibliography on space and time in databases was originally published by Al-Taha, Snodgrass and Soo ("Bibliography on Spatiotemporal Databases," *ACM SIGMOD Record*, 22, No. 1, Mar. 1993), and later updated: Al-Tara, Snodgrass and Soo ("A Bibliography on Spatiotemporal Databases," to appear in the *International Journal of Geographic Information Systems*, 1993). A bibliogra-
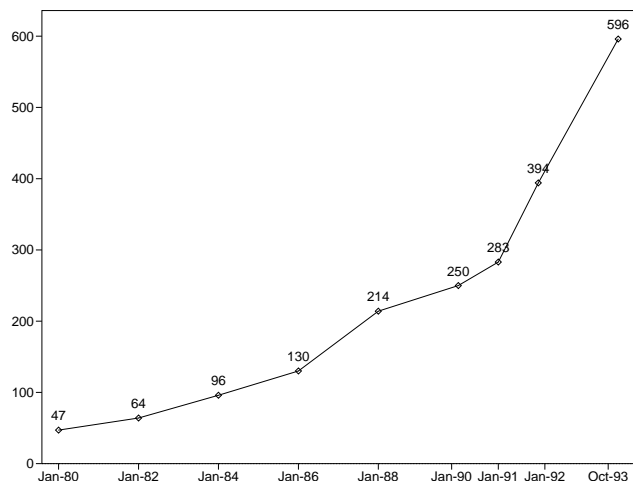
Figure 1: Temporal Database Papers

phy on incomplete and inexact information is maintained by Curtis Dyreson (email: dyreson@cs.arizona.edu). An annotated bibliography on schema evolution was prepared by Roddick ("Schema Evolution in Database Systems — An Annotated Bibliography," *ACM SIGMOD Record*, 21, No. 4, Dec. 1993). Temporal database papers in these subject areas were not reproduced here. These bibliographies list 144, 4, and 8 temporal database papers, respectively.

The present bibliography lists 313 new temporal database papers published or identified since the most recent bibliography, which contained bibliography entries of papers published through January, 1991 (see Figure 1). Since we do not include the temporal database papers listed in the above bibliographies, the growth of papers in the area of temporal databases is even greater than this graph shows.

This bibliography is divided into sections based on the well-accepted valid/transaction model of time (see Jensen, C. S., J. Clifford, S. K. Gadia, A. Segev, and R. T. Snodgrass "A Glossary of Temporal Database Concepts," Appendix A, pp. 621–633, in **Temporal**

Databases: Theory, Design, and Implementation.) The four categories are enumerated below. *Valid-time* models time in the real world, such as the period of time a person worked for a company (for which we have 53 new papers). To model database time, such as the time at which a computer writes a transaction to disk, we use *transaction time* (19 new or previously unrecorded papers). Some papers discuss concepts that apply to *both valid and transaction time* (161 papers). Finally, some papers are about other aspects of time, such as how to efficiently perform calculations on time stamps or object versioning in object-oriented databases (80 new papers).

The complete bibliography is available for anonymous ftp at `ftp.cs.arizona.edu` in the `bib` directory. We apologize in advance for any errors, misclassifications, or omissions and welcome any corrections. We would like to acknowledge Patrick Kalua for providing several bibliography entries he collected, and Richard Snodgrass for comments on this paper. Any errors in the entries herein are entirely our own.

2   Valid Time

Valid time is used to model real-world time, such as the times projected for a bus to arrive at its bus-stops, or the hours actually worked at a job.

Cardenas, A., I. Ieong, R. Taira, R. Barker and C. Breant. "The Knowledge-Based Object-Oriented PICQUERY+ Language." *IEEE Transactions on Knowledge and Data Engineering*, 5, No. 4, August 1993, pp. 644–657.

Chidananda, M. R. "Query Optimization and Access Planning in Historical Database Management Systems." Master's Thesis, Department of Computer Science and Engineering, 1992.

Chieuh, T.-C. and R. Katz. "Papyrus: a Structured History Database for VLSI Design Flow Management," in *Database Systems for Advanced Applications '91*. Tokyo, Japan: Apr. 1991, pp. 293–301.

Clifford, J., A. Croker and A. Tuzhilin. "On Completeness of Historical Relational Query Languages." Technical Report STERN IS-93-8. Stern School of Business, New York University. 1993.

Clifford, J., A. Croker and A. Tuzhilin. "On the Completeness of Query Languages for Grouped and Ungrouped Historical Data Models," in Temporal Databases: Theory, Design, and Implementation. Benjamin/Cummings, 1993. Chap. 20, pp. 496–533.

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Hsu, S. and R. Snodgrass. "Optimal Block Size for Set-valued Attributes." *Information Processing Letters*, 45, No. 3, Mar. 1993, pp. 153–158.

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Lorentzos, N. "The Interval-extended Relational Model and Its Application to Valid-time Databases," in Temporal Databases: Theory, Design, and Implementation. Benjamin/Cummings, 1993. Chap. 3, pp. 67–91.

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Tian, D. "An Extension Of The Relational Data Model Supporting Historical Data In Heterogeneous Formats." Technical Report. Computer Science Program, University of Texas at Dallas. May 1993, 27 pages.

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3   Transaction Time

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Kolovson, C. "Indexing Techniques for Historical Databases," in Temporal Databases: Theory, Design, and Implementation. Benjamin/Cummings, 1993. Chap. 17, pp. 418–432.

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4 Both Transaction and Valid Time

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