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A logical reconstruction of temporal databases.

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Summary: Temporal databases are concerned with storing, querying and manipulating data associated with time. They inherit the intrinsic complexity of representing, querying and manipulating data in general, and also face extra difficulties having to do with dealing with explicitly with time. Traditional approaches to temporal databases are either not formal or deal with only static features, considering mainly a single state of the database. The temporal nature of data in temporal databases is intrinsically dynamic, for it deals with the evolution of data. In this paper, a temporal logic framework is proposed to simultaneously cope with the static and the dynamic aspects of temporal data. The framework consists of a two-dimensional temporal model. One-dimensional temporal models deal with static aspects such as temporal querying and data representation. The second temporal dimension is introduced as a natural extension that captures the dynamics of temporal databases. The resulting two-dimensional temporal model is used to formally characterize the differences between valid time and transaction time, to characterize the notion of 'now' in a temporal database, and to give a formal model for bitemporal databases. Readers with different backgrounds can view this paper in different ways. For the logician, the paper can be seen as a case of 'applied logic', where a temporal logic theory is applied to describe a temporal database. For the computer scientist, this paper provides a unified formal description of the principles underlying temporal databases.

Keywords: temporal databases; temporal logic; two-dimensional temporal model; bitemporal databases
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