

- **Durable.** The effects of committed transactions are permanently recorded in the database.

When a transaction processing system supports the ACID properties, the database maintains a consistent and up-to-date model of the real world and the transactions supply responses to users that are always correct and up to date.

BIBLIOGRAPHIC NOTES

The relational model for databases was introduced in [Codd 1970, 1990]. The SQL language is described by the various SQL standards, such as [SQL 1992]. The term "ACID" was coined by [Haerder and Reuter 1983], but the individual components of ACID were introduced in earlier papers—for example, [Gray et al. 1976] and [Eswaran et al. 1976].

EXERCISES

- 2.1 Design the following two tables (in addition to that in Figure 2.1) that might be used in the Student Registration System. Note that the same student Id might appear in many rows of each of these tables.

- a. A table implementing the relation COURSEREGISTEREDFOR, relating a student's Id and the identifying numbers of the courses for which she is registered
- b. A table implementing the relation COURSESTAKEN, relating a student's Id, the identifying numbers of the courses he has taken, and the grade received in each course

Specify the predicate corresponding to each of these tables.

- 2.2 Write an SQL statement that

- a. Returns the Ids of all seniors in the table STUDENT
- b. Deletes all seniors from STUDENT
- c. Promotes all juniors in the table STUDENT to seniors

- 2.3 Write an SQL statement that creates the TRANSCRIPT table.

- 2.4 Using the TRANSCRIPT table, write an SQL statement that

- a. Deregisters the student with Id = 123456789 from the course CS305 for the fall of 2001
- b. Changes to an A the grade assigned to the student with Id = 123456789 for the course CS305 taken in the fall of 2000
- c. Returns the Id of all students who took CS305 in the fall of 2000

- *2.5

Given the relation MARRIED that consists of tuples of the form $\langle a, b \rangle$, where a is the husband and b is the wife, the relation BROTHER that has tuples of the form $\langle c, d \rangle$, where c is the brother of d , and the relation SIBLING, which has tuples of the form $\langle e, f \rangle$, where e and f are siblings, use SQL to define the relation BROTHER-IN-LAW, where tuples have the form $\langle x, y \rangle$ with x being the brother-in-law of y .