> **select** *
> **from** *student* **natural full outer join** *takes*
>   **natural full outer join** *course*

include tuples with null values for the *title* attribute?

4.20   Show how to define a view *tot_credits* (*year, num_credits*), giving the total number of credits taken in each year.

4.21   For the view of Exercise 4.18, explain why the database system would not allow a tuple to be inserted into the database through this view.

4.22   Show how to express the **coalesce** function using the **case** construct.

4.23   Explain why, when a manager, say Satoshi, grants an authorization, the grant should be done by the manager role, rather than by the user Satoshi.

4.24   Suppose user *A*, who has all authorization privileges on a relation *r*, grants **select** on relation *r* to **public** with grant option. Suppose user *B* then grants **select** on *r* to *A*. Does this cause a cycle in the authorization graph? Explain why.

4.25   Suppose a user creates a new relation *r*1 with a foreign key referencing another relation *r*2. What authorization privilege does the user need on *r*2? Why should this not simply be allowed without any such authorization?

4.26   Explain the difference between integrity constraints and authorization constraints.

Further Reading

General SQL references were provided in Chapter 3. As noted earlier, many systems implement features in a non-standard manner, and, for that reason, a reference specific to the database system you are using is an essential guide. Most vendors also provide extensive support on the web.

The rules used by SQL to determine the updatability of a view, and how updates are reflected on the underlying database relations appeared in SQL:1999 and are summarized in [Melton and Simon (2001)].

The original SQL proposals for assertions date back to [Astrahan et al. (1976)], [Chamberlin et al. (1976)], and [Chamberlin et al. (1981)].

Bibliography

[Astrahan et al. (1976)]   M. M. Astrahan, M. W. Blasgen, D. D. Chamberlin, K. P. Eswaran, J. N. Gray, P. P. Griffiths, W. F. King, R. A. Lorie, P. R. McJones, J. W. Mehl, G. R. Putzolu, I. L. Traiger, B. W. Wade, and V. Watson, "System R, A Relational Approach to Data Base