Advanced Data Modeling

Relational Data Model continued

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Overview

- Relational algebra, named perspective
- SQL
- Integrity constraints
- (Aggregates and grouping)
\[
\{ \{ a_1 = v_{11}, \ldots , a_n = v_{1n} \}, \\
\ldots \ldots \ldots \\
\{ a_1 = v_{k1}, \ldots , a_n = v_{kn} \} \}
\]
Union

Let $R_1$, $R_2$ be relations with the same attributes.

$$R_1 \cup R_2 = \{ t \mid t \in R_1 \text{ or } t \in R_2 \}$$
Union, example

\[ R_1 \cup R_2 \]

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Renaming

Let $R$ be a relation whose set of attributes is $a_1, \ldots, a_n, c_1, \ldots, c_m$

Let $b_1, \ldots, b_n$ be distinct attributes such that
\[
\{b_1, \ldots, b_n\} \cap \{c_1, \ldots, c_m\} = \emptyset
\]

Then
\[
\rho_{a_1 \rightarrow b_1, \ldots, a_n \rightarrow b_n}(R) = \{\{b_1 = v_1, \ldots, b_n = v_n, c_1 = w_1, \ldots, c_m = w_m\} \mid \{a_1 = v_1, \ldots, a_n = v_n, c_1 = w_1, \ldots, c_m = w_m\} \in R\}
\]
SQL

- SQL is based on set and relational operations with certain modifications and enhancements

- A typical SQL query has the form:
  
  ```
  select a_1, \ldots, a_n
  from R_1, \ldots, R_m
  where P
  ```

- This query is equivalent to relational algebra expression:
  
  ```
  \pi_{a_1,\ldots,a_n} (\sigma_P (R_1 \times \ldots \times R_m))
  ```

- The result of an SQL query is a relation.

- Exceptions?
Integrity constraints

- Domain constraints.
- Key constraints.
- Foreign key constraints.
- More general, defined constraints.
- How to translate them?
Query language

Allow one to define:

- Relation and database schemas;
- Relations through our relations;
- Integrity constraints;
- Updates.