

# Advanced Data Modeling

## Relational Data Model continued

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- ◆ Relational algebra, named perspective
- ◆ SQL
- ◆ Integrity constraints
- ◆ (Aggregates and grouping)

$$\begin{aligned} & \{ \{ a_1 = v_{11}, \dots, a_n = v_{1n} \}, \\ & \quad \dots \quad \dots \quad \dots \\ & \{ a_1 = v_{k1}, \dots, a_n = v_{kn} \} \} \end{aligned}$$

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

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

$R_1$

A	B
$\alpha$	1
$\alpha$	2
$\beta$	1

$R_2$

A	B
$\alpha$	2
$\beta$	3

$R_1 \cup R_2$

A	B
$\alpha$	1
$\alpha$	2
$\beta$	1
$\beta$	3

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

Let  $b_1, \dots, b_n$  be distinct attributes such that

$$\{b_1, \dots, b_n\} \cap \{c_1, \dots, c_m\} = \emptyset$$

Then

$$\rho_{a_1 \rightarrow b_1, \dots, a_n \rightarrow b_n}(R) = \{ \{b_1 = v_1, \dots, b_n = v_n, c_1 = w_1, \dots, c_m = w_m\} \mid \{a_1 = v_1, \dots, a_n = v_n, c_1 = w_1, \dots, c_m = w_m\} \in R \}$$

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

- ◆ A typical SQL query has the form:

**select**  $a_1, \dots, a_n$   
**from**  $R_1, \dots, R_m$   
**where**  $P$

- ◆ This query is equivalent to relational algebra expression:

- ◆  $\pi_{a_1, \dots, a_n} (\sigma_P (R_1 \times \dots \times R_m))$

- ◆ The result of an SQL query is a relation.

- ◆ Exceptions?

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

Allow one to define:

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