

Principles of Database Systems With Internet and Java Applications

Today's Topic

Chapter 6: Techniques for Manipulating Relational Data

Instructor's name and information goes here
Please see the notes pages for more information.

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Today's Topic

Chapter 6: Methods for Manipulating Relational Data

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Section 6.1 Relational Algebra

- Look at the formal basis for operations on the relational data model
- An “algebra” is a collection of operations on some domain
- *Relational Algebra* is a collection of operators
 - operands and results are relations
 - operators
 - projection and selection remove parts of a relation
 - set operators, union, intersection and difference
 - joins and products combine the tuples of two relations
 - other operators follow

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Projection Operation

- Projection is used to produce a relation with fewer attributes (columns)
 - called *projection* because it reduces the dimension of the relation
 - for example, removing a column from a 3-dimensional relation produces a 2-dimensional relation
- Examples
 - list the title and movielfid of every movie (but not the other attributes)
 - list the last name of every Customer
 - may have fewer rows than the Customer table

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Selection Operator

- Selection, applied to R produces a subset of R
- Selection applies a *selection criterion* to a relation
 - all tuples from Rental that have `dateRented < 'jan-01-1999'`
 - all tuples from Movies that are longer than 100 minutes and genre is 'action comedy'

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Set Operations

- Union: $R \cup S = \{ t \mid t \in R \text{ or } t \in S \}$
 - R and S must have the same number and types of attributes (in U&W, identical sets of attributes)
 - Names of the attributes are those of R
 - No duplicate tuples
- Consider union of tables
 - Rental (accountId, videoId, dateRented, dateDue, cost)
 - PreviousRental (accountId, videoId, dateRented, dateReturned, cost)
 - $\text{Rental} \cup \text{PreviousRental}$
- Intersection and Difference are similarly based on normal set operations

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Cartesian Product Operation

- Cartesian product of two relations R and S creates a new relation
 - one attribute for each attribute in R and one for each attribute in S
 - one tuple for each combination of tuple in R and tuple in S
 - $|R| * |S|$ tuples
 - if R has m tuples and S has n tuples, $R \times S$ has $m * n$ tuples
 - Just like cartesian product of any set

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Join Operations

- Natural join is based on the cartesian product
 - With a restriction on the tuples and attributes
 - each common attribute appears once in result
 - tuples are included only where the common attributes have the same values
 - R join S on A has those tuples of $R \times S$
 - where $R.A = S.A$
 - Each tuple from R is joined to all tuples of S that have the same value for attribute A
- Example
 - Every combination of Customer and Rental where the accountId fields match

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Combining Operations to Form Queries

- Can put all operations together
 - Names and grades of students who made took quiz 1
- We'll see how this works in in Access
- In class, time permitting
 - Demonstration of Queries in Access

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Relational Expressions

- Select account 113, project videoId and dateDue
 - $\pi_{\text{videoId, dateDue}}(\sigma_{\text{accountId}=113}(\text{Rental}))$
- VideoId, title and date due for account 113
 - $\pi_{\text{videoId, title, dateDue}}((\sigma_{\text{accountId}=113}(\text{Rental})) \times_{\text{videoId}} \text{Videotape} \times_{\text{movieId}} \text{Movie})$
 - $\pi_{\text{videoId, title, dateDue}}(\sigma_{\text{accountId}=113}(\text{Rental} \times_{\text{videoId}} \text{Videotape} \times_{\text{movieId}} \text{Movie}))$
- What is the order of evaluation?

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Complex Expression-Evaluation Order

- 1. select the action comedy movies,
- 2. join the results of step 1 and Videotape on movieId,
- 3. select the previous rentals with date rented after December 1, 1998,
- 4. join the results of steps 2 and 3 on videotapeId, and
- 5. join the results of step 4 and customer on accountId, and
- 6. project the first name, last name, title, and date rented from step 4.

π firstName, lastName, title, dateRented (

 Step 6

 ((σ genre='action comedy' (Movie)

 Step 1

 × movieId Videotape)

 Step 2

 × videoId

 Step 4₁₁

Query By Example in Access

- Examples from BigHitVideo.mdb

