CS275 – Intro to Databases

Relational Algebra - *Chap.6.1-6.2*

The degree (or arity) of a relation is the number of fields.

1. True
2. False

A super key is…

1. A set of all candidate keys
2. A set of fields that contains a candidate key
3. A candidate key that is also the primary key
4. A set of fields that contains more than one candidate key

An integrity constraint limits the data that can be viewed by a database user

1. True
2. False

Using ON DELETE CASCADE, If the (a) ________ is deleted, then a (the) ________ is (are) deleted.

1. Student record; Enrolled record
2. Enrolled record; student record;
3. Enrolled table; Student table
4. Enrolled record; all student records

Query Languages

- Relational algebra
  - Procedural, explain how results are obtained
- Relational calculus
  - Will not cover in this course

Relational Algebra

- Queries consist of a collection of operators
- Every operator accepts one or two relation instances as input and return a relation instance as output
- Combining these operators can form more complex queries

Relational Algebra

- Basic operators
  - Selection
  - Projection
  - Union
  - Intersection
  - Difference
  - Cross-product

Relational Algebra

- Selection

$$\sigma_{GPA>3.5}(Students)$$

- Projection

$$\pi_{SID,SName,GPA}(Students)$$

Relational Algebra

- Display the ID, Name, and GPA of students with a GPA > 3.5

Relational Algebra

- Display the ID, Name, and GPA of students with a GPA > 3.5

$$\pi_{SID,SName,GPA}(\sigma_{GPA>3.5}Students)$$

Relational Algebra

- Set operations
  - Union
  - Intersection
  - Difference
  - Cross-product

Relational Algebra

- Union of two sets of relation instances

$$R \cup S$$

R

John	12345
Jean	54321

S

Mike	12405
Kathy	43109

Relational Algebra

- Union of two sets of relation instances

$$R \cup S$$

R

John	12345
Jean	54321

S

Mike	12405
Kathy	43109

$R \cup S$

Mike	12405
Kathy	43109
John	12345
Jean	54321

Relational Algebra

- Union of two sets of relation instances

$$R \cup S$$

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

Relational Algebra

- Union of two sets of relation instances

$$R \cup S$$

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

$R \cup S$

Mike	12405
Kathy	43109
John	12345
Jean	54321

Relational Algebra

- Union of two sets of relation instances

$$R \cup S$$

R

John	12345
Jean	54321

S

Mike	TX
Kathy	OR

Relational Algebra

- Union of two sets of relation instances

$$R \cup S$$

R

John	12345
Jean	54321

S

Mike	TX
Kathy	OR

$R \cup S$

John	12345
Jean	54321
Mike	TX
Kathy	OR

Relational Algebra

- Union of two sets of relation instances

R

John	12345
Jean	54321

S

Mike	TX
Kathy	OR

$R \cup S$

John	12345
Jean	54321
Mike	TX
Kathy	OR

Relational Algebra

- Union-compatibility
  - Same number of fields
  - Same domain for every corresponding field

R

John	12345
Jean	54321

S

Mike	TX
Kathy	OR

$R \cup S$

John	12345
Jean	54321
Mike	TX
Kathy	OR

Relational Algebra

- Intersection

$$R \cap S$$

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

Relational Algebra

- Intersection

$$R \cap S$$

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

$R \cap S$

Mike	12405

Relational Algebra

- Intersection
  - Do we need to be union-compatible?

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

$R \cap S$

Mike	12405

Relational Algebra

- Intersection
  - Do we need to be union-compatible?
  - Yes!

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

$R \cap S$

Mike	12405

Relational Algebra

- Difference

$$R - S$$

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

$R - S$

John	12345
Jean	54321

Relational Algebra

- Difference
  - Do we need union-compatibility?

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

$R - S$

John	12345
Jean	54321

Relational Algebra

- Difference
  - Do we need union-compatibility?
  - You bet!

R

John	12345
Jean	54321
Mike	12405

S

Mike	12405
Kathy	43109

$R - S$

John	12345
Jean	54321

Relational Algebra

- Difference
  - Is this commutative, R-S = S-R?

S

Mike	12405
Kathy	43109

R

John	12345
Jean	54321
Mike	12405

Relational Algebra

- Difference
  - Is this commutative, R-S = S-R?
  - NO!!!!

S

Mike	12405
Kathy	43109

R

John	12345
Jean	54321
Mike	12405

$S - R$

Kathy	43109

Relational Algebra

- Cross Product

$R \times S$

R

John	12345
Jean	54321
Mike	12405

S

TX
OR

$R \times S$

John	12345	TX
Jean	54321	TX
Mike	12405	TX
John	12345	OR
Jean	54321	OR
Mike	12405	OR

Relational Algebra

- Renaming

R

Name	**ID**
Jean	54321
Mike	12405

S

Name	**ID**
Marketing	6
Research	5

$R \times S$

Relational Algebra

- Renaming

$$\rho_{(Dept, DeptID)}(S)$$

R

Name	ID
Jean	54321
Mike	12405

S

Name	ID
Marketing	6
Research	5

$R \times S$

Name	ID	Dept	DeptID
Jean	54321	Marketing	6
Mike	12405	Marketing	6
Jean	54321	Research	5
Mike	12405	Research	5

Relational Algebra

- Renaming

$$\rho_{(DeptName, DeptID)}(S)$$

$$\rho_{(NewS)}(S)$$

$$\rho_{NewS(DeptName, DeptID)}(S)$$