SQL language: basics

Set operators

Set operators

- The UNION operator
- The INTERSECT operator
- The EXCEPT operator

Elena Baralis and Tania Cerquitelli
©2013 Politecnico di Torino

Set operators

The UNION operator

The UNION operator

- Set union operator

  A UNION B

- It performs the union of the two relational expressions A and B
  - relational expressions A and B may be generated by SELECT statements
  - it requires schema compatibility between A and B
  - removal of duplicates
    - UNION removes duplicates
    - UNION ALL does not remove duplicates

©2013 Politecnico di Torino

UNION: example

- Find the codes of products that are either red or supplied by supplier S2 (or both)

P

PId	PName	Color	Size	Store
P1	Jumper	Red	40	London
P2	Jeans	Green	48	Paris
P3	Blouse	Blue	48	Rome
P4	Blouse	Red	44	London
P5	Skirt	Blue	40	Paris
P6	Shorts	Red	42	London

SP

SId	PId	Qty
S1	P1	300
S1	P2	200
S1	P3	400
S1	P4	200
S1	P5	100
S1	P6	100
S2	P1	300
S2	P2	400
S3	P2	200
S4	P3	200
S4	P4	300
S4	P5	400

UNION: example

- Find *the codes of products that are* either *red* or supplied by supplier S2 (or both)

```
SELECT PId
FROM P
WHERE Color='Red'
```

P

PId	PName	Color	Size	Store
P1	Jumper	Red	40	London
P2	Jeans	Green	48	Paris
P3	Blouse	Blue	48	Rome
P4	Blouse	Red	44	London
P5	Skirt	Blue	40	Paris
P6	Shorts	Red	42	London

PId
P1
P6

©2013 Politecnico di Torino

UNION: example

- Find the *codes of the products that are* either red or *supplied by supplier S2* (or both)

SP

SId	PId	Qty
S1	P1	300
S1	P2	200
S1	P3	400
S1	P4	200
S1	P5	100
S1	P6	100
S2	P1	300
S2	P2	400
S3	P2	200
S4	P3	200
S4	P4	300
S4	P5	400

```
SELECT PId
FROM SP
WHERE SId='S2'
```

PId
P1
P2

UNION: example

- Find the codes of products that are either red or supplied by supplier S2 (or both)

```
SELECT PId
FROM P
WHERE Color='Red'
UNION
SELECT PId
FROM SP
WHERE SId='S2';
```

PId
P1
P6

PId
P1
P2

R

PId
P1
P2
P6

©2013 Politecnico di Torino

UNION: example

- Find the codes of products that are either red or supplied by supplier S2 (or both)

```
SELECT PId
FROM P
WHERE Color='Red'
UNION
SELECT PId
FROM SP
WHERE SId='S2';
```

R

PId
P1
P2
P6

Duplicate removal

UNION: example

- Find the codes of products that are either red or supplied by supplier S2 (or both)

Schema compatibility

```
SELECT PId
FROM P
WHERE Color='Red'
UNION
SELECT PId
FROM SP
WHERE SId='S2';
```


©2013 Politecnico di Torino

UNION ALL: example

- Find the codes of products that are either red or supplied by supplier S2 (or both)

```
SELECT PId
FROM P
WHERE Color='Red'
UNION ALL
SELECT PId
FROM SP
WHERE SId='S2';
```

PId
P1
P6

PId
P1
P2

R

PId
P1
P1
P2
P6

Set operators

The INTERSECT operator

The INTERSECT operator

- Set intersection operator

  A INTERSECT B

- It performs the intersection of the two relational expressions A and B
  - relational expressions A and B may be generated by SELECT statements
  - it requires schema compatibility between A and B

INTERSECT: example

- Find the cities where both one or more suppliers and one or more stores are based

P

PId	PName	Color	Size	Store
P1	Jumper	Red	40	London
P2	Jeans	Green	48	Paris
P3	Blouse	Blue	48	Rome
P4	Blouse	Red	44	London
P5	Skirt	Blue	40	Paris
P6	Shorts	Red	42	London

S

SId	SName	#Employees	City
S1	Smith	20	London
S2	Jones	10	Paris
S3	Blake	30	Paris
S4	Clark	20	London
S5	Adams	30	Athens

©2013 Politecnico di Torino

INTERSECT: example

- Find *the cities where* both *one or more suppliers* and one or more stores *are based*

```
SELECT City
FROM S
```

S

SId	SName	#Employees	City
S1	Smith	20	London
S2	Jones	10	Paris
S3	Blake	30	Paris
S4	Clark	20	London
S5	Adams	30	Athens

City
London
Paris
Paris
London
Athens

INTERSECT: example

- Find *the cities where* both one or more suppliers and *one or more stores are based*

```
SELECT Store
FROM P
```

P

PId	PName	Color	Size	Store
P1	Jumper	Red	40	London
P2	Jeans	Green	48	Paris
P3	Blouse	Blue	48	Rome
P4	Blouse	Red	44	London
P5	Skirt	Blue	40	Paris
P6	Shorts	Red	42	London

Store
London
Paris
Rome
London
Paris
London

©2013 Politecnico di Torino

INTERSECT: example

- Find the cities where both one or more suppliers and one or more stores are based

```
SELECT City
FROM S
INTERSECT
SELECT Store
FROM P;
```

City
London
Paris
Paris
London
Athens

Store
London
Paris
Rome
London
Paris
London

R

London
Paris

Equivalence with other operators

- The intersection operation may also be performed by means of
  - a join
  - the IN operator

©2013 Politecnico di Torino

Equivalence with join

- The FROM clause contains the relations involved in the intersection
- The WHERE clause contains join conditions between the attributes listed in the SELECT clauses of relational expressions A and B

Equivalence with join: example

- Find the cities where both one or more suppliers and one or more stores are based

```
SELECT City
FROM S, P
WHERE S.City=P.Store;
```


©2013 Politecnico di Torino

Equivalence with the IN operator

- One of the two relational expressions is turned into a nested query using operator IN
- The attributes in the outer SELECT clause, joined together by a tuple constructor, make up the left-hand side of the IN operator

Equivalence with IN: example

- Find the cities where both one or more suppliers and one or more stores are based

```
SELECT Store
FROM P
WHERE Store IN (SELECT City
                FROM S);
```


©2013 Politecnico di Torino

Set operators

The EXCEPT operator

The EXCEPT operator

- Set difference operator

  A EXCEPT B

- It subtracts relational expression B from relational expression A
  - it requires schema compatibility between A and B

©2013 Politecnico di Torino

EXCEPT: example

- Find the cities where one or more suppliers, but no stores are based

P

PId	PName	Color	Size	Store
P1	Jumper	Red	40	London
P2	Jeans	Green	48	Paris
P3	Blouse	Blue	48	Rome
P4	Blouse	Red	44	London
P5	Skirt	Blue	40	Paris
P6	Shorts	Red	42	London

S

SId	SName	#Employees	City
S1	Smith	20	London
S2	Jones	10	Paris
S3	Blake	30	Paris
S4	Clark	20	London
S5	Adams	30	Athens

DBMG

EXCEPT: example

- Find *the cities where one or more suppliers*, but no stores *are based*

```
SELECT City
FROM S
```

S

SId	SName	#Employees	City
S1	Smith	20	London
S2	Jones	10	Paris
S3	Blake	30	Paris
S4	Clark	20	London
S5	Adams	30	Athens

City
London
Paris
Paris
London
Athens

DBMG

©2013 Politecnico di Torino

EXCEPT: example

- Find *the cities where* one or more suppliers, but no *stores are based*

```
SELECT Store
FROM P
```

P

PId	PName	Color	Size	Store
P1	Jumper	Red	40	London
P2	Jeans	Green	48	Paris
P3	Blouse	Blue	48	Rome
P4	Blouse	Red	44	London
P5	Skirt	Blue	40	Paris
P6	Shorts	Red	42	London

Store
London
Paris
Rome
London
Paris
London

EXCEPT: example

- Find the cities where one or more suppliers, but no stores are based

```
SELECT City
FROM S
EXCEPT
SELECT Store
FROM P;
```

City
London
Paris
Paris
London
Athens

Store
London
Paris
Rome
London
Paris
London

R

Athens

©2013 Politecnico di Torino

Equivalence with the NOT IN operator

- The difference operation may also be performed by means of the NOT IN operator
  - relational expression B is nested within the NOT IN operator
  - the attributes in the SELECT clause of relational expression A, joined together by a tuple constructor, make up the left-hand side of the NOT IN operator

Equivalence with the NOT IN operator: example

- Find the cities where one or more suppliers, but no stores are based

```
SELECT City
FROM S
WHERE City NOT IN (SELECT Store
                   FROM P);
```


©2013 Politecnico di Torino