Politecnico
di Torino

DBMG

Set Operators

SQL Language: Set Operators

- The UNION Operator
- The INTERSECT Operator
- The EXCEPT Operator

UNION

- 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

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

SP

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

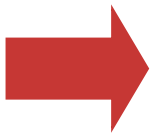
UNION: example

- 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



PId
P1
P4

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

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

PId
P6
P1

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'
```

Schema Compatibility

R

PId
P1
P4
P6

Removing the duplicate

UNION ALL: 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 ALL

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

PId
P1
P4

PId
P1
P6

R

PId
P1
P1
P4
P6

Duplicates are not removed

INTERSECT

- 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	Blue	44	London
P5	Skirt	Blue	40	Paris

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

INTERSECT: example

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

```
SELECT City
FROM S
```

S

SId	NameS	#Employees	City
F1	Smith	2	London
F2	Jones	1	Paris
F3	Blake	3	Paris
F4	Clark	2	London
F5	Adams	3	Athens

City
London
Paris
Paris
London
Athens

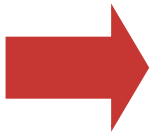
INTERSECT: example

- 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

INTERSECT: example

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

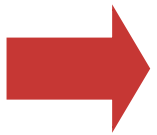
```
SELECT City
FROM S

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 JOIN and IN

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

IN

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

Example: equivalence with join

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

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

Example: equivalence with IN

- 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);
```

EXCEPT

- Set difference operator

A EXCEPT B

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

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

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

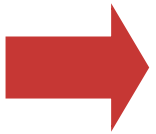
EXCEPT: example

- 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

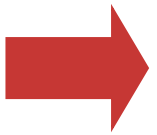
```
SELECT City
FROM S

EXCEPT

SELECT Store
FROM P;
```

City
London
Paris
Paris
London
Athens

Store
London
Paris
Rome
London
Paris
London



R

Athens

Equivalence with the NOT IN operator

- The EXCEPT 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, 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);
```