

Databases - 2

More on the Relational Model and Selection

Relational Algebra operations

| | |
|-------------------|-----------|
| Selection | σ |
| Projection | π |
| Cartesian Product | \times |
| Union | \cup |
| Set Difference | $-$ |
| Join | \bowtie |
| Intersection | \cap |
| Division | \div |

Choose particular rows

SELECTION

$\sigma_{\text{predicate}}(R)$

Selection operation works on a single relation R and defines a relation that contains only those tuples (rows) of R that satisfy the specified condition (predicate)

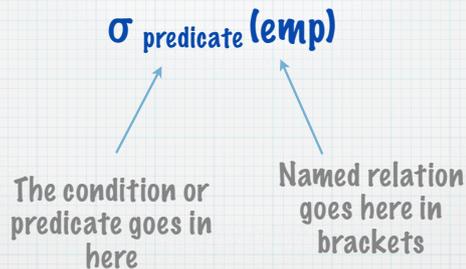
SELECTION RA example

List all staff with a salary greater than £25,000

| EMPNO | ENAME | JOB | MGR | HIREDATE | SAL | COMM | DEPTNO |
|-------|---------|-----------|-----|------------|-------|------|--------|
| 405 | MARCH | ADMIN | 938 | 13/06/1997 | 18000 | | 2 |
| 535 | BYRNE | SALES | 734 | 15/08/1997 | 26000 | 300 | 3 |
| 557 | BELL | SALES | 734 | 26/03/2000 | 22500 | 500 | 3 |
| 602 | BIRD | MANAGER | 875 | 31/10/1997 | 39750 | | 2 |
| 690 | AHMAD | SALES | 734 | 05/12/1997 | 22500 | 1400 | 3 |
| 734 | COX | MANAGER | 875 | 11/06/2002 | 38500 | | 3 |
| 818 | POLLARD | MANAGER | 875 | 14/05/2000 | 34500 | | 1 |
| 824 | REES | ANALYST | 602 | 05/03/2000 | 40000 | | 2 |
| 875 | PARKER | PRESIDENT | | 09/07/2002 | 60000 | | 1 |
| 880 | TURNER | SALES | 734 | 04/06/2001 | 25000 | 0 | 3 |
| 912 | HAYES | ADMIN | 824 | 04/06/2001 | 21000 | | 2 |
| 936 | CASSY | ADMIN | 734 | 23/07/2002 | 19500 | | 3 |
| 938 | GIBSON | ANALYST | 602 | 05/12/1997 | 40000 | | 2 |
| 970 | BLACK | ADMIN | 818 | 21/11/1997 | 23000 | | 1 |

SELECTION RA example

List all staff with a salary greater than £25,000



Predicates

Expressions that evaluate to **true** or **false** once all the names have been replaced with a value

| expression | explanation |
|---|--|
| $\text{job} = \text{"manager"}$ | is job equal to "manager" |
| $\text{sal} > 30000$ | is salary greater than 30000 |
| $\text{job} = \text{"admin" and sal} > 25000$ | is job equal to "admin" and salary > 25000 |

Predicates

| hints | example |
|--|--------------------------------------|
| literal strings must be wrapped in " " | "Manager" |
| Use <, >, =, <=, >= and <> | sal>=25000 comm<=300 deptno<>3 |
| Build more complex expressions with and, or, not | sal<25000 and deptno=5 |

SELECTION RA example

List all staff with a salary greater than £25,000

The condition or predicate goes in here

$\sigma_{sal > 25000} (emp)$

| EMPNO | ENAME | JOB | MGR | HIREDATE | SAL | COMM | DEPTNO |
|-------|---------|-----------|-----|------------|-------|------|--------|
| 535 | BYRNE | SALES | 734 | 15/08/1997 | 26000 | 300 | 3 |
| 602 | BIRD | MANAGER | 875 | 31/10/1997 | 39750 | | 2 |
| 734 | COX | MANAGER | 875 | 11/06/2002 | 38500 | | 3 |
| 818 | POLLARD | MANAGER | 875 | 14/05/2000 | 34500 | | 1 |
| 824 | REES | ANALYST | 602 | 05/03/2000 | 40000 | | 2 |
| 875 | PARKER | PRESIDENT | | 09/07/2002 | 60000 | | 1 |
| 938 | GIBSON | ANALYST | 602 | 05/12/1997 | 40000 | | 2 |

SELECTION RA example (2)

Show all the staff who are managers

The condition or predicate goes in here

$\sigma_{job = \text{"manager"}} (emp)$

Named relation goes here in brackets

| EMPNO | ENAME | JOB | MGR | HIREDATE | SAL | COMM | DEPTNO |
|-------|---------|---------|-----|------------|-------|------|--------|
| 602 | BIRD | MANAGER | 875 | 31/10/1997 | 39750 | | 2 |
| 734 | COX | MANAGER | 875 | 11/06/2002 | 38500 | | 3 |
| 818 | POLLARD | MANAGER | 875 | 14/05/2000 | 34500 | | 1 |

SELECTION RA example (3)

Show all the staff who are managed by employee no 734

$\sigma_{mgr=734}(emp)$

The condition or predicate goes in here

Named relation goes here in brackets

| EMPNO | ENAME | JOB | MGR | HIREDATE | SAL | COMM | DEPTNO |
|-------|--------|-------|-----|------------|-------|------|--------|
| 535 | BYRNE | SALES | 734 | 15/08/1997 | 26000 | 300 | 3 |
| 557 | BELL | SALES | 734 | 26/03/2000 | 22500 | 500 | 3 |
| 690 | AHMAD | SALES | 734 | 05/12/1997 | 22500 | 1400 | 3 |
| 880 | TURNER | SALES | 734 | 04/06/2001 | 25000 | 0 | 3 |
| 936 | CASSY | ADMIN | 734 | 23/07/2002 | 19500 | | 3 |

SELECTION RA example (4)

Display all the staff who are administrators and earn over £22000

$\sigma_{job='Admin' \text{ and } sal > 22000}(emp)$

The condition or predicate goes in here

Named relation goes here in brackets

| EMPNO | ENAME | JOB | MGR | HIREDATE | SAL | COMM | DEPTNO |
|-------|-------|-------|-----|------------|-------|------|--------|
| 970 | BLACK | ADMIN | 818 | 21/11/1997 | 23000 | | 1 |

So: how do we do SELECTION in SQL?

SQL always looks like this:

select * or expression
from relations
[where expression]

the 'where' part is optional

SELECTION SQL example

List all staff with a salary greater than £25,000

select *
from emp
where sal > 25000

the particular columns we require go here

table name goes here

the predicate goes here

| EMPNO | ENAME | JOB | MGR | HIREDATE | SAL | COMM | DEPTNO |
|-------|---------|-----------|-----|------------|-------|------|--------|
| 535 | BYRNE | SALES | 734 | 15/08/1997 | 26000 | 300 | 3 |
| 602 | BIRD | MANAGER | 875 | 31/10/1997 | 39750 | | 2 |
| 734 | COX | MANAGER | 875 | 11/06/2002 | 38500 | | 3 |
| 818 | POLLARD | MANAGER | 875 | 14/05/2000 | 34500 | | 1 |
| 824 | REES | ANALYST | 602 | 05/03/2000 | 40000 | | 2 |
| 875 | PARKER | PRESIDENT | | 09/07/2002 | 60000 | | 1 |
| 938 | GIBSON | ANALYST | 602 | 05/12/1997 | 40000 | | 2 |

SELECTION SQL - other examples

Show all the staff who are managers

$\sigma_{\text{job}=\text{"manager"}}(\text{emp})$

SQL:

SELECTION SQL - other examples

Show all the staff who are managed by employee no 734

$\sigma_{\text{mgr}=734}(\text{emp})$

SQL:

SELECTION SQL - other examples

Display all the staff who are administrators and earn over £22000

σ job="Admin" and sal>22000 (emp)

SQL:

Note

In fact, the standard SQL select statement does selection and projection

select * or expression
from relations
where expression

to choose particular
columns, write
projection columns
here

to choose
particular rows,
write selection
predicates here

PROJECTION AND SELECTION SQL example

Produce a list of staff who earn over 25000, showing only the Empno, EName and Job

| EMPNO | ENAME | JOB | MGR | HIREDATE | SAL | COMM | DEPTNO |
|-------|---------|-----------|-----|------------|-------|------|--------|
| 405 | MARCH | ADMIN | 938 | 13/06/1997 | 18000 | | 2 |
| 535 | BYRNE | SALES | 734 | 15/08/1997 | 26000 | 300 | 3 |
| 557 | BELL | SALES | 734 | 26/03/2000 | 22500 | 500 | 3 |
| 602 | BIRD | MANAGER | 875 | 31/10/1997 | 39750 | | 2 |
| 690 | AHMAD | SALES | 734 | 05/12/1997 | 22500 | 1400 | 3 |
| 734 | COX | MANAGER | 875 | 11/06/2002 | 38500 | | 3 |
| 818 | POLLARD | MANAGER | 875 | 14/05/2000 | 34500 | | 1 |
| 824 | REES | ANALYST | 602 | 05/03/2000 | 40000 | | 2 |
| 875 | PARKER | PRESIDENT | | 09/07/2002 | 60000 | | 1 |
| 880 | TURNER | SALES | 734 | 04/06/2001 | 25000 | 0 | 3 |
| 912 | HAYES | ADMIN | 824 | 04/06/2001 | 21000 | | 2 |
| 936 | CASSY | ADMIN | 734 | 23/07/2002 | 19500 | | 3 |
| 938 | GIBSON | ANALYST | 602 | 05/12/1997 | 40000 | | 2 |
| 970 | BLACK | ADMIN | 818 | 21/11/1997 | 23000 | | 1 |

PROJECTION AND SELECTION SQL example

Produce a list of staff who earn over 25000, showing only the Empno, EName and Job

```
select empno, ename, job  
from emp  
where sal > 25000
```

particular
columns go here

table name goes
here

conditions go
here

| empno | ename | job |
|-------|---------|-----------|
| 535 | BYRNE | SALES |
| 602 | BIRD | MANAGER |
| 734 | COX | MANAGER |
| 818 | POLLARD | MANAGER |
| 824 | REES | ANALYST |
| 875 | PARKER | PRESIDENT |
| 938 | GIBSON | ANALYST |

Note - even though we are using sal in the selection, it's not necessary in the projection