The IN Operator

Conditions can contain IN for "element of"

```
SELECT pname
FROM project
WHERE pnumber IN (1,2,4,5);
```

```
SELECT pname
FROM project
WHERE pnumber NOT IN (1,2);
```

```
SELECT pname
FROM project
WHERE plocation IN ('Houston', 'Stafford');
```

The IN Operator

```
SELECT dependent_name
FROM dependent
WHERE (sex, relationship) IN
        (('M', 'SPOUSE'), ('F', 'DAUGHTER'));
```

This will not work in many systems (e.g. Access).
Can redo as OR of ANDS:

```
SELECT dependent_name
FROM dependent
WHERE ((sex = 'M' AND relationship = 'SPOUSE') OR
        (sex = 'F' AND relationship = 'DAUGHTER'));
```

Nesting Queries with IN

```
SELECT lname, fname
FROM employee
WHERE ssn IN
        (SELECT essn
         FROM dependent)
```

Nesting Queries Examples

- List the Names of all supervisors.
- List the Names of all employees that have a dependent spouse.
- List the SSNs of employees that on some project work the same time as ` John Smith'

- List departments located in 'Houston'
- List departments not located in 'Houston'
- List employees without dependents
- List projects nobody works on

EXCURSION: USING IN FOR SET OPERATIONS

Set Intersection

Example: Supervisors that have a dependent

```
SELECT fname, lname
FROM employee
WHERE ssn IN (SELECT essn
                FROM dependent)
    AND ssn IN (SELECT superssn
                FROM employee);
```

- Mangers that are also supervisors

Set Complement

Example: Employees without dependents

```
SELECT fname, lname
FROM employee
WHERE ssn NOT IN (SELECT essn
                  FROM dependent);
```

- Employees which are not managers
- Projects on which nobody works 20 hours or more

Set Difference

Example: Employees that have dependents, but no dependent children

```
SELECT fname, lname
FROM employee
WHERE ssn IN (SELECT essn
              FROM dependent)
  AND ssn NOT IN (SELECT essn
                  FROM dependent
                  WHERE relationship IN ('son', 'daughter');
```

- Projects that Franklin Wong works on, but not John Smith

Set UNION

```
(SELECT S.ssn
 FROM employee AS E, employee AS S
 WHERE E.superssn = S.ssn)
UNION
(SELECT mgrssn
 FROM department);
```

compare to

```
(SELECT lname, fname, ssn
FROM employee
WHERE ssn IN (SELECT superssn
              FROM employee)
  AND ssn IN (SELECT mgrssn
              FROM department);
```

Set Operations Examples

- List the names of managers that have a dependent
- Departments not located in Houston?
- Employees without dependents?

Henry Books

- List publishers of which Henry Books does not currently stock any books.
- List books that have exactly one author.
- List authors that have written both paperback and hardcover books.

END OF EXCURSION

The ALL Operator

= ALL <> ALL
< ALL <= ALL
> ALL >= ALL

```
SELECT fname, lname
FROM employee
WHERE salary > ALL (SELECT salary
                    FROM employee
                    WHERE dno IN
                    (SELECT dnumber
                     FROM department
                     WHERE dname = 'Research'));
```

Nesting Queries with ALL

- List the names of employees that make the maximum salary
- List the names of employees that make the minimum salary
- List the names of employees that make a salary that is different from everybody else's salary

Naming Scope for nested assignments

Correlated Nesting Queries

- List the names of employees that have a child of the opposite sex
- List the names of employees that make more money than their supervisors

Existence

Tests that a set is nonempty

```
SELECT fname, lname
FROM employee
WHERE EXISTS (SELECT *
                FROM dependent
                WHERE ssn = essn);

SELECT fname, lname
FROM employee
WHERE NOT EXISTS (SELECT *
                FROM dependent
                WHERE ssn = essn);
```

Unique Existence

Tests that a set contains one element

```
SELECT fname, lname
FROM employee
WHERE UNIQUE (SELECT *
                FROM dependent
                WHERE ssn = essn);
```

Not supported by Access or SQLServer

Existence Examples

- List the names of employees that work on all department 5 projects [connection to contains]
- List the names of employees that work on all department 4 projects
- List the names of people that work on projects in all departments

Joins in SQL

```
SELECT e.*, s.*
FROM employee AS e, employee AS s
WHERE e.superssn = s.ssn;
```

Explicit joins (with variations in Access, SQLServer)

```
SELECT e.*, s.*
FROM (employee AS e JOIN employee AS s
      ON e.superssn = s.ssn);

SELECT e.*, s.*
FROM (employee e LEFT OUTER JOIN employee s
      ON e.superssn = s.ssn);
```

Joins in Access

```
SELECT employee.*
FROM employee LEFT JOIN  dependent
ON  employee.ssn = dependent.essn;
```

Similarly right join
No full outer join

Table name necessary

Joins in SQLServer

```
SELECT *
FROM employee LEFT JOIN dependent
ON ssn = essn
WHERE relationship = 'daughter';
```

Similarly right join
No full outer join

More Examples

- List employees that work on a research department project, and an administration project.
- List departments which supervise a project that nobody is assigned to work on.
- List all employees and, if they have a supervisor, their supervisor

Henry Book Examples

- List authors that have published books with both Putnam Publishing Group and Jove Publications
- List authors that have written fiction, but not mystery
- List books that are available at only one of the branches
- List authors that have coauthored books