

STUDENT OBJECTIVES

- Upon completion of this video, you should be able to:
 - List a set of tables and a query, write the tuple relational calculus statement that will answer the query
 - Determine when and when not to use the existential quantifier symbol \exists
 - Given a set of tables and a relation calculus expression, list the tuples that would be returned.

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We will be using the following tables for our discussion and examples:

Employee

FName Minit Lname SSN BDate Address Sex Salary SuperSSN* DNO*

Department

DName DNumber MGRSSN* MgrStartDate

Works On

DepartmentLocation

ESSN* PNO* Hours

Dnumber* | **Dlocation**

Project

PName PNumber Plocation Dnum*

Dependent

ESSN* DependentName Sex BDate Relationship

- With the existential quantifier, a formula:

$$(\exists t)(F)$$

is TRUE if the formula F evaluates to TRUE for some (at least one) tuple.

- If you are NOT displaying a tuples attribute in your answer, but you need that tuple from another table to do the join, then you MUST use (3t)(F)
- With the universal quantifier, a formula:

$$(\mathcal{W})(F)$$

is TRUE only if the formula F evaluates to TRUE for every tuple.

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TUPLE CALCULUS EXAMPLES (JOINING TABLES):

 Retrieve the name and address of all employees who work for the 'Research' Department

```
{t.Fname, t.Lname, t.Address | EMPLOYEE(t) and ((∃d)
(DEPARTMENT(d) and d.Dname = 'Research' and d.Dnumber =
t.DNO))}
```

• For every project located in 'London', list the project number, the controlling department number, and the department manager's last name.

{p.PNumber, p.Dnum, e.Lname | PROJECT(p) and EMPLOYEE(e) and p.PLocation = 'London' and ((∃ d)(DEPARTMENT(d) and d.Dnumber = p.Dnum and d.Mgrssn = e.ssn))}

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Retrieve t 'Research'

{t.Fname, t (DEPART t.DNO))}



controlling name.

{p.PNumbo p.PLocati = p.Dnur

Dependent

ESSN*

DependentName

Sex

• For every project located in 'London' list the project number, the **Employee** ger's last FName Minit Lname SSN BDate Address Sex Salary SuperSSN* DNO* Department MgrStartDate DName DNumber MGRSSN* YEE(e) and **DepartmentLocation** Works On d.Dnumber ESSN* PNO* Hours **Dnumber*** | **Dlocation Project PNumber Plocation PName** Dnum*

BDate Relationship

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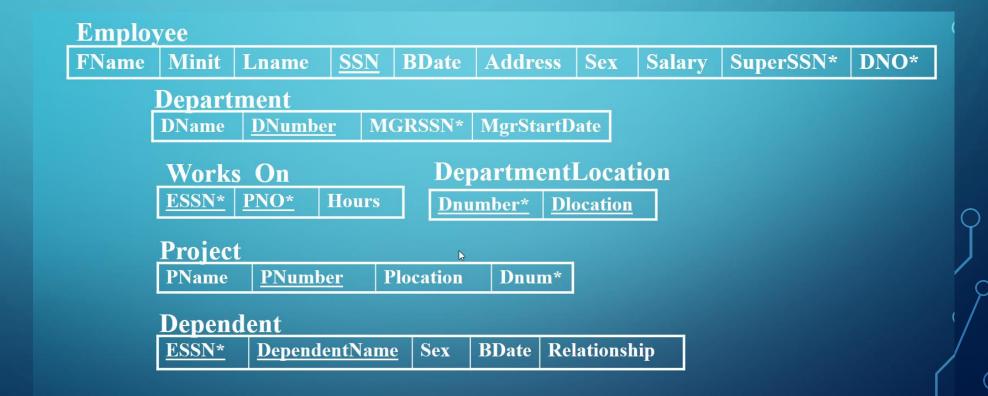
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Find the name of employees who have no dependents:

{e.Fname, e.Iname | EMPLOYEE(e) and (NOT (∃d) (DEPENDENT(d) and e.SSN = d.ESSN))}

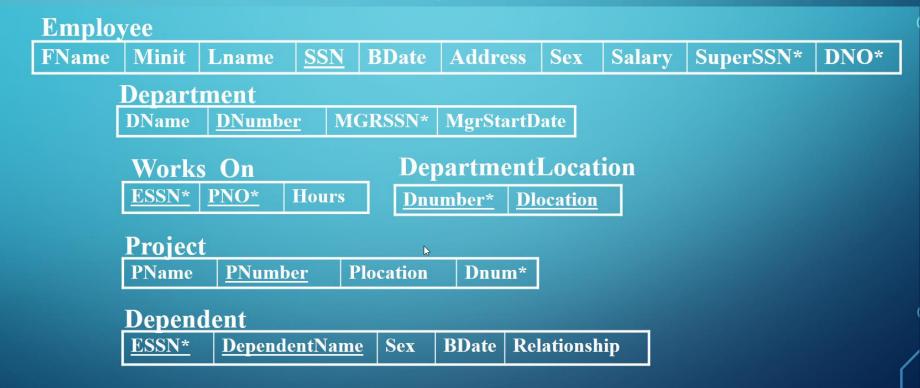
OR

{e.Fname, e.Iname | EMPLOYEE(e) and ($(\forall d)$ (NOT DEPENDENT(d)) or NOT(e.SSN = d.ESSN))



QUESTION: Write the tuple relation calculus to find any employee last name who work on projects. Also list the number of hours they worked on the project and the project name:

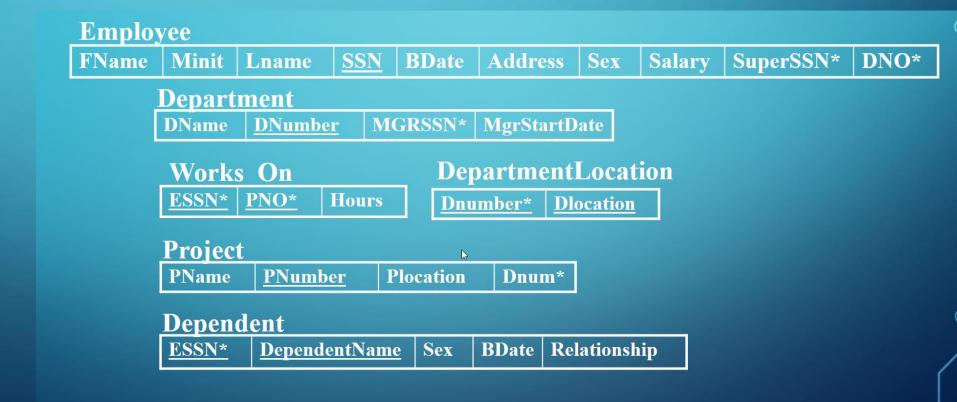
{e.Lname, w.Hours, p.Pname | EMPLOYEE(e) and WORKSON(w) and PROJECT(p) and p.PNumber=w.PNO and w.ESSN=e.SSN}



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QUESTION: Write the tuple relation calculus to find any employee lastname and project name of employees who work on projects:

{e.Lname, p.Pname | EMPLOYEE(e) and PROJECT(p) and ((∃w) (WORKSON(w) and p.PNumber=w.PNO and w.ESSN=e.SSN))}



AA

| A | В | С |
|-----|----|-------|
| Pig | 22 | Pink |
| Cat | 22 | Green |
| Cat | 55 | Blue |

BB

| A | В | С | D |
|-----|----|-------|----|
| Pig | 22 | Blue | 14 |
| Cat | 22 | Green | 33 |
| Cat | 22 | Blue | 22 |

{w | AA(w) and w.A = "Cat" }

$$\{w.C \mid BB(w) \text{ and } w.B > = w.D \}$$

 $\{t.C, w.D \mid AA(t) \text{ and } BB(w) \text{ and } w.C = t.C \}$

 $\{t.A, t.C \mid AA(t) \text{ and } ((\exists w) BB(w) \text{ and } w.C= t.C \text{ and } w.D \ge 20 \}$

| A | В | С |
|-----|----|-------|
| Cat | 22 | Green |
| Cat | 55 | Blue |

C

Blue

| t.C | w.D |
|-------|-----|
| Green | 33 |
| Blue | 14 |
| Blue | 22 |

| A | С |
|-----|-------|
| Cat | Green |
| Cat | Blue |