

A decorative graphic on the left side of the slide, consisting of a network of white lines and circles on a teal background, resembling a circuit board or a neural network.

WEEK 6

DOING A JOIN IN TUPLE RELATIONAL CALCULUS

CS3319

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.

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

Employee

FName	Minit	Lname	<u>SSN</u>	BDate	Address	Sex	Salary	SuperSSN*	DNO*
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Department

DName	<u>DNumber</u>	MGRSSN*	MgrStartDate
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Works On

<u>ESSN*</u>	<u>PNO*</u>	Hours
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DepartmentLocation

<u>Dnumber*</u>	<u>Dlocation</u>
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Project

PName	<u>PNumber</u>	Plocation	Dnum*
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Dependent

<u>ESSN*</u>	<u>DependentName</u>	Sex	BDate	Relationship
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- Also we need two more symbols called quantifiers: they are the **universal quantifier** $\rightarrow \forall$ and the **existential quantifier** $\rightarrow \exists$

- With the existential quantifier, a formula:

$(\exists)(F)$ there exists at least one row τ that formula F true.
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 $(\exists)(F)$

- With the universal quantifier, a formula:

$(\forall)(F)$ For every single row in the tuple over the all entire db
is TRUE only if the formula F evaluates to TRUE for every tuple. that formula F is true.

TUPLE CALCULUS EXAMPLES (JOINING TABLES) :

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

$\{t.Fname, t.Lname, t.Address \mid EMPLOYEE(t) \text{ and } ((\exists d) \text{ } \leftarrow \text{Temp variable.} \right.$
 $(DEPARTMENT(d) \text{ and } d.Dname = 'Research' \text{ and } d.Dnumber =$
 $t.DNO)))\}$ there exist department d that is Research dept
and the number of the dept is employee's dept no.

- For every project located in 'London', list the project number, the controlling department number, and the department manager's last name. *to make a join, you have to: 2.*

$\{p.PNumber, p.Dnum, e.Lname \mid PROJECT(p) \text{ and } EMPLOYEE(e) \text{ and } p.PLocation = 'London' \text{ and } ((\exists d)(DEPARTMENT(d) \text{ and } d.Dnumber = p.Dnum \text{ and } d.Mgrssn = e.ssn)))\}$

TUPLE CALC

- Retrieve the employees who work in 'Research'.

$\{t.Fname, t.Minit, t.Lname \mid (DEPARTMENT(DName, DNumber, MGRSSN, MgrStartDate) = 'Research' \wedge t.DNO = DNumber)\}$

Employee

FName	Minit	Lname	<u>SSN</u>	BDate	Address	Sex	Salary	SuperSSN*	DNO*
-------	-------	-------	------------	-------	---------	-----	--------	-----------	------

Department

DName	<u>DNumber</u>	MGRSSN*	MgrStartDate
-------	----------------	---------	--------------

Works On

<u>ESSN*</u>	<u>PNO*</u>	Hours
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DepartmentLocation

<u>Dnumber*</u>	<u>Dlocation</u>
-----------------	------------------

Project

PName	<u>PNumber</u>	Plocation	Dnum*
-------	----------------	-----------	-------

Dependent

<u>ESSN*</u>	<u>DependentName</u>	Sex	BDate	Relationship
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) :

for the

number =

- For every project located in 'London', list the project number, the controlling employee's last name.

$\{p.PNumber, p.PLocation \mid p.PLocation = p.Dnumber\}$

Employee

FName	Minit	Lname	<u>SSN</u>	BDate	Address	Sex	Salary	SuperSSN*	DNO*
-------	-------	-------	------------	-------	---------	-----	--------	-----------	------

Department

DName	<u>DNumber</u>	MGRSSN*	MgrStartDate
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Works On

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DepartmentLocation

<u>Dnumber*</u>	<u>Dlocation</u>
-----------------	------------------

Project

PName	<u>PNumber</u>	Plocation	Dnum*
-------	----------------	-----------	-------

Dependent

<u>ESSN*</u>	<u>DependentName</u>	Sex	BDate	Relationship
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YEE(e) and
d.Dnumber

Find the name of employees who have no dependents:

$\{e.Fname, e.lname \mid EMPLOYEE(e) \text{ and } (NOT (\exists d) (DEPENDENT(d) \text{ and } e.SSN = d.ESSN)))\}$

OR

$\{e.Fname, e.lname \mid EMPLOYEE(e) \text{ and } ((\forall d) (NOT DEPENDENT(d)) \text{ or } NOT(e.SSN = d.ESSN))\}$

Employee

FName	Minit	Lname	<u>SSN</u>	BDate	Address	Sex	Salary	SuperSSN*	DNO*
-------	-------	-------	------------	-------	---------	-----	--------	-----------	------

Department

DName	<u>DNumber</u>	MGRSSN*	MgrStartDate
-------	----------------	---------	--------------

Works On

<u>ESSN*</u>	<u>PNO*</u>	Hours
--------------	-------------	-------

DepartmentLocation

<u>Dnumber*</u>	<u>Dlocation</u>
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Project

PName	<u>PNumber</u>	Plocation	Dnum*
-------	----------------	-----------	-------

Dependent

<u>ESSN*</u>	<u>DependentName</u>	Sex	BDate	Relationship
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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}

Employee

FName	Minit	Lname	<u>SSN</u>	BDate	Address	Sex	Salary	SuperSSN*	DNO*
-------	-------	-------	------------	-------	---------	-----	--------	-----------	------

Department

DName	<u>DNumber</u>	MGRSSN*	MgrStartDate
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Works On

<u>ESSN*</u>	<u>PNO*</u>	Hours
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DepartmentLocation

<u>Dnumber*</u>	<u>Dlocation</u>
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Project

PName	<u>PNumber</u>	Plocation	Dnum*
-------	----------------	-----------	-------

Dependent

<u>ESSN*</u>	<u>DependentName</u>	Sex	BDate	Relationship
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QUESTION: Write the tuple relation calculus to find any employee lastname and project name of employees who work on projects:

$\{e.Lname, p.Pname \mid EMPLOYEE(e) \text{ and } PROJECT(p) \text{ and } ((\exists w) (WORKSON(w) \text{ and } p.PNumber=w.PNO \text{ and } w.ESSN=e.SSN))\}$

Employee

FName	Minit	Lname	<u>SSN</u>	BDate	Address	Sex	Salary	SuperSSN*	DNO*
-------	-------	-------	------------	-------	---------	-----	--------	-----------	------

Department

DName	<u>DNumber</u>	MGRSSN*	MgrStartDate
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DepartmentLocation

<u>Dnumber*</u>	<u>Dlocation</u>
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Project

PName	<u>PNumber</u>	Plocation	Dnum*
-------	----------------	-----------	-------

Dependent

<u>ESSN*</u>	<u>DependentName</u>	Sex	BDate	Relationship
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AA

A	B	C
Pig	22	Pink
Cat	22	Green
Cat	55	Blue

BB

A	B	C	D
Pig	22	Blue	14
Cat	22	Green	33
Cat	22	Blue	22

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

A	B	C
Cat	22	Green
Cat	55	Blue

C
Blue

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

A	C
Cat	Green
Cat	Blue