

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 4

THE RELATIONAL ALGEBRA BINARY OPERATION OF DIVISION

CS3319

STUDENT OBJECTIVES

- Upon completion of this video, you should be able to:
 - Identify the symbol for DIVISION
 - Given 2 tables and a DIVISION relational algebra expression, show the new table that would be returned once the expression is performed.
 - Write a relational algebra expression that uses DIVISION given two tables and a query.

DIVISION

- $R \div S$ returns a new table that contains:
 - For Columns: only the columns (i.e. attributes) that were in R that were NOT in S
 - For Rows: only the rows (i.e. tuples) from the remaining columns in R that match EVERY SINGLE row in S
- The columns in S **MUST** be a subset of the columns in R .
- R **MUST** have more columns than S
- Division can be expressed as:
$$\begin{aligned} L1 &\leftarrow \pi_y(R) \\ L2 &\leftarrow \pi_y((S \times L1) - R) \\ L &\leftarrow L1 - L2 \end{aligned}$$
- Symbol $\rightarrow \div$
- Example Expression:

Table1 \div Table2

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First Table Name

Symbol for
DIVISION

Second Table Name

Example of Division:

QUESTION: What will $CC \leftarrow AA \div BB$ return?

Table AA:

A	B
a1	b1
a2	b1
a3	b1
a4	b1
a1	b2
a3	b2
a2	b3
a3	b3
a4	b3
a1	b4
a2	b4
a3	b4

Table BB:

A
a1
a2
a3

Table CC:

B
b1
b4

← No a2

← No a1

ANOTHER EXAMPLE

QUESTION: What will $CC \leftarrow AA \div BB$ return?

Table AA:

A	B	C	D
dog	2	77	pink
dog	3	77	yellow
cat	2	88	pink
pig	1	77	yellow
pig	5	99	red
cat	1	88	yellow
owl	1	66	yellow
owl	2	77	pink
owl	2	66	pink

Table BB:

B	D
1	yellow
2	pink

Table CC:

A	C
cat	88
owl	66

- Type of query might be: *Find SSN's of people who work on **all** of Smith's projects*
- Result of: $SSN_PNOS \div SMITH_PNO$

SSN_PNOS		SMITH_PNOS	
Essn	Pno	Pno	
123456789	1	1	
123456789	2	2	
666884444	3		
453453453	1		
453453453	2		
333445555	2		
333445555	3		
333445555	10		
333445555	20		
999887777	30		
999887777	10		
987987987	10		
987987987	30		
987654321	30		
987654321	20		
888665555	20		

SSNS	
Ssn	
123456789	
453453453	

- Useful for situations where the term "**ALL**" is used, for example:

- *Find the first and last names of employees who work on **all** the projects that Dave Leno works on.*

the answer would be like this:

Leno $\leftarrow \pi_{\text{EmpID}} (\sigma_{\text{LastName} = \text{"Leno"}} (\text{Employee}))$

Leno_Proj $\leftarrow \pi_{\text{ProjectNumber}} (\text{Works_On} \bowtie_{\text{EmpIDSSNum} = \text{EmpID}} \text{Leno})$

All_Proj $\leftarrow \pi_{\text{EmpIDSSNum}, \text{ProjectNumber}} (\text{Works_On})$

LenoPROJ $\leftarrow \text{All_Proj} \div \text{Leno_Proj}$

Result $\leftarrow \pi_{\text{FirstName}, \text{LastName}} (\text{LenoPROJ} \bowtie \text{Employee})$

QUESTION: Write the relational algebra to find the project names of any projects that also have all the employees working on them that work on the project named “Acct6”.

$\text{Acct6} \leftarrow \pi_{\text{ProjectNumber}}(\sigma_{\text{ProjectName}=\text{“Acct6”}}(\text{Project}))$

$\text{Acct6_Emp} \leftarrow \pi_{\text{EmpSSNum}}(\text{Works_On} \bowtie \text{Acct6})$

$\text{ProjNums} \leftarrow \pi_{\text{EmpSSNum}, \text{ProjectNumber}}(\text{Works_On})$

$\text{AllAcct6} \leftarrow \text{ProjNums} \div \text{Acct6_Emp}$

$\text{Result} \leftarrow \pi_{\text{ProjectName}}(\text{AllAcct6} \bowtie \text{Project})$

Project				
ProjectNu	ProjectName	ProjLocati	Managing	Clif
A1	Accounting Update	Toronto	S7G	
A3	Acc3	Springfield	G8H	
A6	Acct6	Toronto	S7G	
I1	Inventory	Toronto	G8H	
I2	Inventory2	London	S7G	
P1	Payroll	Springfield	G8H	
P2	Payroll2	London	G8H	
P3	Payroll3	London	G8H	
Record: 1 of 8				

Department				
DeptNun	DeptName	ManagerEmpID	ManagerStartdate	Clif
G8H	Head Office	4	12/12/1999	
S7G	Safety Department	3	11/11/1998	
Y5J	Research Department	6	12/24/1998	
Record: 1 of 3				

Employee							
EmpID	LastName	FirstName	DeptNumber	Sex	BDate	SuperSSN	Salary
1	Simpson	Bart	G8H	M	2/2/1995	2	\$1,000.00
2	Smithers	Waylan	S7G	M	1/1/1960	4	\$2,000.00
3	Beauvieu	Patty	Y5J	F	3/3/1959	6	\$4,000.00
4	Burns	Monty	S7G	M	7/7/2020		\$5,000.00
6	Simpson	Lisa	S7G	F	6/6/1990	2	\$1,000.00
12	Simpson	Homer	G8H	M	8/8/1961	2	\$2,000.00
Record: 1 of 16							

WorksOn		
EmpSSNu	ProjectNu	Hours
1 A3	45	
2 A1	56	
3 A3	3	
3 A6	45	
3 I1	43	
3 P1	9	
4 A1	6	
4 A3	5	
4 A6	6	
4 I1	43	
4 I2	8	
4 P1	67	
4 P2	77	
4 P3	67	
6 I2	6	
12 A3	56	
Record: 1 of 16		