

CS 338  
Lecture 05  
Relational Algebra and Calculus - Part 2  
Additional Slides

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## In-Class Exercise #3 - Statement of the Problem

Consider these tables.

Account

<u>Number</u>	Owner	Balance	Type
101	J. Smith	1000.00	checking
102	W. Wei	2000.00	checking
103	J. Smith	5000.00	savings
104	M. Jones	1000.00	checking
105	H. Martin	10,000.00	checking

Deposit

Account	<u>Transaction-id</u>	Date	Amount
102	1	10/22/00	500.00
102	2	10/29/00	200.00
104	3	10/22/00	1000.00
105	4	11/2/00	10,000.00

Compute  $\pi_{\text{Number}} (\text{Account} \bowtie_{\text{Number} > \text{Account}} \text{Deposit})$ .

# In-Class Exercise #3 - Step 1

We start by computing  $Account \bowtie_{Number > Account} Deposit$ , first, its underlying cross-product,  $Account \times Deposit$ .

Number	Owner	Balance	Type	Account	Transaction-id	Date	Amount
101	J. Smith	1000.00	checking	102	1	10/22/00	500.00
101	J. Smith	1000.00	checking	102	2	10/29/00	200.00
101	J. Smith	1000.00	checking	104	3	10/22/00	1000.00
101	J. Smith	1000.00	checking	105	4	11/2/00	10,000.00
102	W. Wei	2000.00	checking	102	1	10/22/00	500.00
102	W. Wei	2000.00	checking	102	2	10/29/00	200.00
102	W. Wei	2000.00	checking	104	3	10/22/00	1000.00
102	W. Wei	2000.00	checking	105	4	11/2/00	10,000.00
103	J. Smith	5000.00	savings	102	1	10/22/00	500.00
103	J. Smith	5000.00	savings	102	2	10/29/00	200.00
103	J. Smith	5000.00	savings	104	3	10/22/00	1000.00
103	J. Smith	5000.00	savings	105	4	11/2/00	10,000.00
104	M. Jones	1000.00	checking	102	1	10/22/00	500.00
104	M. Jones	1000.00	checking	102	2	10/29/00	200.00
104	M. Jones	1000.00	checking	104	3	10/22/00	1000.00
104	M. Jones	1000.00	checking	105	4	11/2/00	10,000.00
105	H. Martin	10,000.00	checking	102	1	10/22/00	500.00
105	H. Martin	10,000.00	checking	102	2	10/29/00	200.00
105	H. Martin	10,000.00	checking	104	3	10/22/00	1000.00
105	H. Martin	10,000.00	checking	105	4	11/2/00	10,000.00

## In-Class Exercise #3 - Step 2

Next we finish computing *Account*  $\bowtie_{\text{Number} > \text{Account}}$  *Deposit*,  
by applying the Boolean condition *Number* > *Account*.

Number	Owner	Balance	Type	Account	Transaction-id	Date	Amount
103	J. Smith	5000.00	savings	102	1	10/22/00	500.00
103	J. Smith	5000.00	savings	102	2	10/29/00	200.00
104	M. Jones	1000.00	checking	102	1	10/22/00	500.00
104	M. Jones	1000.00	checking	102	2	10/29/00	200.00
105	H. Martin	10,000.00	checking	102	1	10/22/00	500.00
105	H. Martin	10,000.00	checking	102	2	10/29/00	200.00
105	H. Martin	10,000.00	checking	104	3	10/22/00	1000.00

## In-Class Exercise #3 - Step 3

Finally, we compute  $\pi_{Number} (Account \bowtie_{Number > Account} Deposit)$ ,  
by applying the projection  $\pi_{Number} (\cdot)$  to the previous result,  
eliminating duplicates as usual.

Number
103
104
105

## In-Class Exercise #4 - Statement of the Problem

Consider these tables.

Account

<u>Number</u>	Owner	Balance	Type
101	J. Smith	1000.00	checking
102	W. Wei	2000.00	checking
103	J. Smith	5000.00	savings
104	M. Jones	1000.00	checking
105	H. Martin	10,000.00	checking

Deposit

Account	<u>Transaction-id</u>	Date	Amount
102	1	10/22/00	500.00
102	2	10/29/00	200.00
104	3	10/22/00	1000.00
105	4	11/2/00	10,000.00

Compute  $\pi_{\text{Number}} (\text{Account} \bowtie_{\text{Balance}=\text{Amount}} \text{Deposit})$ .

# In-Class Exercise #4 - Step 1

We start by computing  $Account \bowtie_{Balance=Amount} Deposit$ , first, its underlying cross-product,  $Account \times Deposit$ .

Number	Owner	Balance	Type	Account	Transaction-id	Date	Amount
101	J. Smith	1000.00	checking	102	1	10/22/00	500.00
101	J. Smith	1000.00	checking	102	2	10/29/00	200.00
101	J. Smith	1000.00	checking	104	3	10/22/00	1000.00
101	J. Smith	1000.00	checking	105	4	11/2/00	10,000.00
102	W. Wei	2000.00	checking	102	1	10/22/00	500.00
102	W. Wei	2000.00	checking	102	2	10/29/00	200.00
102	W. Wei	2000.00	checking	104	3	10/22/00	1000.00
102	W. Wei	2000.00	checking	105	4	11/2/00	10,000.00
103	J. Smith	5000.00	savings	102	1	10/22/00	500.00
103	J. Smith	5000.00	savings	102	2	10/29/00	200.00
103	J. Smith	5000.00	savings	104	3	10/22/00	1000.00
103	J. Smith	5000.00	savings	105	4	11/2/00	10,000.00
104	M. Jones	1000.00	checking	102	1	10/22/00	500.00
104	M. Jones	1000.00	checking	102	2	10/29/00	200.00
104	M. Jones	1000.00	checking	104	3	10/22/00	1000.00
104	M. Jones	1000.00	checking	105	4	11/2/00	10,000.00
105	H. Martin	10,000.00	checking	102	1	10/22/00	500.00
105	H. Martin	10,000.00	checking	102	2	10/29/00	200.00
105	H. Martin	10,000.00	checking	104	3	10/22/00	1000.00
105	H. Martin	10,000.00	checking	105	4	11/2/00	10,000.00

## In-Class Exercise #4 - Step 2

Next we finish computing  $Account \bowtie_{Balance=Amount} Deposit$ ,  
by applying the Boolean condition  $Balance = Amount$ .

Number	Owner	Balance	Type	Account	Transaction-id	Date	Amount
101	J. Smith	1000.00	checking	104	3	10/22/00	1000.00
104	M. Jones	1000.00	checking	104	3	10/22/00	1000.00
105	H. Martin	10,000.00	checking	105	4	11/2/00	10,000.00

## In-Class Exercise #4 - Step 3

Finally, we compute  $\pi_{Number} (Account \bowtie_{Balance=Amount} Deposit)$ , by applying the projection  $\pi_{Number} (\cdot)$  to the previous result, eliminating duplicates as usual.

Number
101
104
105

## Closing Remarks

1. We have worked out each of these examples from scratch, step-by-step.
2. Note that the cross-product,  $Account \times Deposit$ , was an ingredient in both solutions.
3. Therefore we could have streamlined the presentation by computing and naming this relation once, then using it in each place where we need it, later on.

## In-Class Exercise #5 - Tables

Consider these tables.

AB

A	B
a1	b1
a2	b2

CD1

C	D	X
c1	d1	x1
c2	d2	x2

CD2

A	D	X
a1	d1	x1
a2	d2	x2

CD3

A	B	X
a1	b1	x1
a2	b2	x2

CD4

AA1	BB1	X
a1	b1	x1
a2	b2	x2

CD5

A	B	X
a1	d1	x1
a2	d2	x2

# In-Class Exercise #5 Question #1 - Compute

$AB \bowtie_{A="a1"} CD1$

- ▶ Cross-Product  $AB \times CD1$ :

A	B	C	D	X
a1	b1	c1	d1	x1
a1	b1	c2	d2	x2
a2	b2	c1	d1	x1
a2	b2	c2	d2	x2

- ▶ Filter to compute  $AB \bowtie_{A="a1"} CD1$

A	B	C	D	X
a1	b1	c1	d1	x1
a1	b1	c2	d2	x2

## In-Class Exercise #5 Question #2 - Compute

$AB \bowtie_{A="a1"} CD2$

- ▶ Cross-Product  $AB \times CD2$ :  
Invalid due to duplicate column name, A.

## In-Class Exercise #5 Question #3 - Compute $AB * CD1$

- ▶ Cross-Product  $AB \times CD1$ :

A	B	C	D	X
a1	b1	c1	d1	x1
a1	b1	c2	d2	x2
a2	b2	c1	d1	x1
a2	b2	c2	d2	x2

- ▶ No filtering is needed.
- ▶ No column names match.

# In-Class Exercise #5 Question #4 - Compute $AB * CD^2$

▶

A	B	D	X
a1	b1	d1	x1
a2	b2	d2	x2

# In-Class Exercise #5 Question #5 - Compute $AB * CD^3$

▶

A	B	X
a1	b1	x1
a2	b2	x2

## In-Class Exercise #5 Question #6 - Compute $AB * CD4$

- ▶ Cross-Product  $AB \times CD4$ :

A	B	AA1	BB1	X
a1	b1	a1	b1	x1
a1	b1	a2	b2	x2
a2	b2	a1	b1	x1
a2	b2	a2	b2	x2

- ▶ No filtering is needed.
- ▶ No column names match.

## In-Class Exercise #5 Question #7 - Compute $AB * CD$

- ▶ The common column names are A,B.
- ▶ No pairs of values from these two columns match.
- ▶ Hence the instance is empty.
- ▶ There are 3 columns in total, after matching column names.