

Relational Database Operators

- ❖ The degree of relational completeness can be defined by the extent to which **Relational Algebra** is supported
- ❖ **Relational Algebra** defines the theoretical way of manipulating table contents using eight relational functions:
UNION, INTERSECT, DIFFERENCE, SELECT, PROJECT, JOIN, PRODUCT, and DIVIDE.

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Union Relational Operator

- ❖ **UNION** combines all rows from two tables. The two tables must be **union compatible**
- ❖ **Union Compatible** means share same columns and domains

P_CODE	P_DESCRIPT	PRICE
123456	Flashlight	5.26
123457	Lamp	25.15
123458	Box Fan	10.99
213345	9v battery	1.92
254467	100W bulb	1.47
311452	Powerdrill	34.99

UNION

P_CODE	P_DESCRIPT	PRICE
345678	Microwave	160
345679	Dishwasher	500

yields

P_CODE	P_DESCRIPT	PRICE
123456	Flashlight	5.26
123457	Lamp	25.15
123458	Box Fan	10.99
213345	9v battery	1.92
254467	100W bulb	1.47
311452	Powerdrill	34.99
345678	Microwave	160
345679	Dishwasher	500

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Intersect Relational Operator

- ❖ **INTERSECT** produces a listing that contains only the rows that appear in both tables
- ❖ The two tables must be **union compatible**, that is share same columns and domains.

F_NAME
George
Jane
Elaine
Wilfred
Jorge

INTERSECT

F_NAME
Jane
William
Jorge
Dennis

yields

F_NAME
Jane
Jorge

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Difference Relational Operator

- ❖ **DIFFERENCE** yields all rows in one table that are NOT found in the other table
- ❖ Subtracts one table from the other
- ❖ The tables must be **union compatible**

F_NAME
George
Jane
Elaine
Wilfred
Jorge

DIFFERENCE

F_NAME
Jane
Jorge

yields

F_NAME
George
Elaine
Wilfred

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Product Relational Operator

❖ **PRODUCT** yields all possible pairs of rows from two tables

P_CODE	P_DESCRIPTION	PRICE
123456	Flashlight	5.26
123457	Lamp	25.15
123458	Box Fan	10.99
213345	9v battery	1.92
254467	100W bulb	1.47
311452	Powerdrill	34.99

PRODUCT

STORE	aisle	Shelf
23	W	5
24	K	9
25	Z	6

Yields

P_CODE	P_DESCRIPTION	PRICE	STORE	aisle	Shelf
123456	Flashlight	5.26	23	W	5
123456	Flashlight	5.26	24	K	9
123456	Flashlight	5.26	25	Z	6
123457	Lamp	25.15	23	W	5
123457	Lamp	25.15	24	K	9
123457	Lamp	25.15	25	Z	6
123458	Box Fan	10.99	23	W	5
123458	Box Fan	10.99	24	K	9
123458	Box Fan	10.99	25	Z	6
213345	9v battery	1.92	23	W	5
213345	9v battery	1.92	24	K	9
213345	9v battery	1.92	25	Z	6
311452	Powerdrill	34.99	23	W	5
311452	Powerdrill	34.99	24	K	9
311452	Powerdrill	34.99	25	Z	6
254467	100W bulb	1.47	23	W	5
254467	100W bulb	1.47	24	K	9
254467	100W bulb	1.47	25	Z	6

Select Relational Operator

❖ **SELECT** yields values for all rows found in a table that match a criterion

P_CODE	P_DESCRIPTION	PRICE
123456	Flashlight	5.26
123457	Lamp	25.15
123458	Box Fan	10.99
213345	9v battery	1.92
254467	100W bulb	1.47
311452	Powerdrill	34.99

SELECT ALL Yields

P_CODE	P_DESCRIPTION	PRICE
123456	Flashlight	5.26
123457	Lamp	25.15
123458	Box Fan	10.99
213345	9v battery	1.92
254467	100W bulb	1.47
311452	Powerdrill	34.99

SELECT PRICE < 2.00 Yields

P_CODE	P_DESCRIPTION	PRICE
213345	9v battery	1.92
254467	100W bulb	1.47

SELECT P_CODE= 311452 Yields

P_CODE	P_DESCRIPTION	PRICE
311452	Powerdrill	34.99

Project Relational Operator

❖ **PROJECT** yields all values of selected attributes

P_CODE	P_DESCRIPTION	PRICE
123456	Flashlight	5.26
123457	Lamp	25.15
123458	Box Fan	10.99
213345	9v battery	1.92
254467	100W bulb	1.47
311452	Powerdrill	34.99

PROJECT PRICE Yields

PRICE
5.26
25.15
10.99
1.92
1.47
34.99

PROJECT P_CODE and PRICE Yields

P_CODE	PRICE
123456	5.26
123457	25.15
123458	10.99
213345	1.92
254467	1.47
311452	34.99

Join Relational Operations

❖ **JOIN** operations allow us to combine information from two or more tables

- ◆ Power behind relational databases
- ◆ Allowing the use of independent tables linked by common attributes
- ◆ Several types of JOIN operations exist
 - ◆ Natural JOIN – No equality condition
 - ◆ Outer JOIN – Unmatched pairs left null

Natural Join Relational Operator

- ❖ **Natural JOIN** links tables by selecting only rows with common values in common attribute(s).
- ❖ Basically a M:1 operation where Foreign Key must match a Primary Key
- ❖ Three-stage process
 - ◆ Product creates one table
 - ◆ Select yields appropriate rows
 - ◆ Project yields single copy of each attribute to eliminate duplicate columns

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Natural Join Relational Operator

Table name: CUSTOMER

CUS_CODE	CUS_LNAME	CUS_ZIP	AGENT_CODE
1132445	vWalker	32145	231
1217782	Adares	32145	125
1312243	Rakowski	34129	167
1321242	Rodriguez	37134	125
1542311	Smithson	37134	421
1657399	Vanloo	32145	231

Table name: AGENT

AGENT_CODE	AGENT_PHONE
125	6152439887
167	6153426778
231	6152431124
333	9041234445

Natural JOIN for two tables yields

CUS_CODE	CUS_LNAME	CUS_ZIP	AGENT_CODE	AGENT_PHONE
1217782	Adares	32145	125	6152439887
1321242	Rodriguez	37134	125	6152439887
1312243	Rakowski	34129	167	6153426778
1132445	vWalker	32145	231	6152431124
1657399	Vanloo	32145	231	6152431124

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Outer Join Relational Operator

- ❖ **OUTER JOIN** links tables and retains unmatched pairs
- ❖ Values for the unmatched rows items would be left blank or null
- ❖ Note **Referential Integrity** is not enforced
- ❖ **CUSTOMER LEFT OUTER JOIN AGENT**

CUS_CODE	CUS_LNAME	CUS_ZIP	AGENT_CODE	AGENT_PHONE
1217782	Adares	32145	125	6152439887
1321242	Rodriguez	37134	125	6152439887
1312243	Rakowski	34129	167	6153426778
1132445	vWalker	32145	231	6152431124
1657399	Vanloo	32145	231	6152431124
1542311	Smithson	37134	421	

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Relational Operator Practice

Table name: CUSTOMER

CUS_CODE	CUS_LNAME	CUS_ZIP	AGENT_CODE
1132445	vWalker	32145	231
1217782	Adares	32145	125
1312243	Rakowski	34129	167
1321242	Rodriguez	37134	125
1542311	Smithson	37134	421
1657399	Vanloo	32145	231

Table name: AGENT

AGENT_CODE	AGENT_PHONE
125	6152439887
167	6153426778
231	6152431124
333	9041234445

- ❖ Perform the following operations using the tables above:
 - ◆ CUSTOMER INTERSECT AGENT
 - ◆ PROJECT CUS_ZIP AND AGENT_CODE
 - ◆ SELECT CUS_ZIP = 32145

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