

Operations on Databases



Tables are useful, but they become much more powerful when we can manipulate them to create new tables from existing tables. For that, we need special operations.



Tables that Produce Other Tables

- ❖ Table operations can involve one or many tables
- ❖ These basic operations are usually used together to create specific “views” of the database
 - ❑ These views are tables created from other tables. They do not exist by themselves in the database
 - ❑ They are created to show certain rows and columns of data
- ❖ Let’s look at the basic operations performed on tables...
 - ❑ **Select, Project, Union, Difference, Product**

Selection Operator

Employee ID	Last Name	First Name	Hire Date	Address
1	Davolio	Nancy	01-May-1992	507 - 20th Ave. E.
2	Fuller	Andrew	14-Aug-1992	908 W. Capital Way
3	Leverling	Janet	01-Apr-1992	722 Moss Bay Blvd.
4	Peacock	Margaret	03-May-1993	4110 Old Redmond Rd
5	Buchanan	Steven	17-Oct-1993	14 Garrett Hill
6	Suyama	Michael	17-Oct-1993	Coventry House

Table A: Employee

We could create a subset from the Employee table of just those employees hired in 1992

Employee ID	Last Name	First Name	Hire Date	Address
1	Davolio	Nancy	01-May-1992	507 - 20th Ave. E.
2	Fuller	Andrew	14-Aug-1992	908 W. Capital Way
3	Leverling	Janet	01-Apr-1992	722 Moss Bay Blvd.

Subset of Table A, 3 rows only

Projection Operator

Employee ID	Last Name	First Name	Hire Date	Address
1	Davolio	Nancy	01-May-1992	507 - 20th Ave. E.
2	Fuller	Andrew	14-Aug-1992	908 W. Capital Way
3	Leverling	Janet	01-Apr-1992	722 Moss Bay Blvd.
4	Peacock	Margaret	03-May-1993	4110 Old Redmond Rd
5	Buchanan	Steven	17-Oct-1993	14 Garrett Hill
6	Suyama	Michael	17-Oct-1993	Coventry House

Table A: Employee

Project extracts columns from a table, but you get all rows

Last Name	First Name
Davolio	Nancy
Fuller	Andrew
Leverling	Janet
Peacock	Margaret
Buchanan	Steven
Suyama	Michael

Subset of Table A, 2 columns only

FIT 100 Union Operator

Union combines two tables with like attributes: $\langle \text{table} \rangle + \langle \text{table} \rangle$

Snum	Name	Major
123	JONES	HISTORY
158	PARKS	MATH
271	SMITH	HISTORY

(a) Table: Junior

Number	Name	Interest
105	ANDERSON	MANAGEMENT
123	JONES	HISTORY

(b) Table: Honor_Student

Snum or Number	Name	Major or Interest
123	JONES	HISTORY
158	PARKS	MATH
271	SMITH	HISTORY
105	ANDERSON	MANAGEMENT

(c) Union of Junior with Honor_Student

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FIT 100 Difference Operator

Difference removes a table from a table with like attributes
 $\langle \text{table} \rangle - \langle \text{table} \rangle$

Snum	Name	Major
123	JONES	HISTORY
158	PARKS	MATH
271	SMITH	HISTORY

(a) Table: Junior

Number	Name	Interest
105	ANDERSON	MANAGEMENT
123	JONES	HISTORY

(b) Table: Honor_Student

Snum	Name	Major
158	PARKS	MATH
271	SMITH	HISTORY

(c) Junior minus Honor_Student

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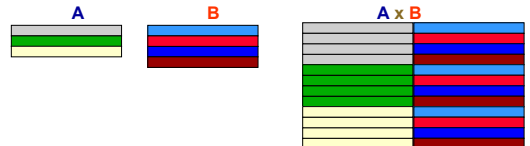
FIT 100 Table Operation: Product

- ❖ Product multiplies two tables together creating a "super table"
- ❖ For each row in the first table, concatenate every row in the second table
 $\langle \text{table} \rangle \times \langle \text{table} \rangle$
- ❖ Product creates a table of "all pairs"
- ❖ **Column Rule:** If TableA has m columns and TableB has n columns, then the product of TableA and TableB has $m + n$ columns
- ❖ **Row Rule:** If TableA has m rows and TableB has n rows, then the product of TableA and TableB has mn rows

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FIT 100 Product: The Rules Always Apply

- ❖ Visualize a Product ...



- ❖ The row and column rules always apply
- ❖ **Column Rule:** If TableA has m columns and TableB has n columns, then the product of TableA and TableB has $m + n$ columns
- ❖ **Row Rule:** If TableA has m rows and TableB has n rows, then the product of TableA and TableB has mn rows

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FIT 100 Product Example

Table A

StudentID	LName	FName	AdvisorID
1	Crowley	Caro	2
2	Jordan	Michael	1
12	Jennings	Waylan	2

Table B

AdvisorID	LName	FName
1	Dickey	Martin
2	Whiteaker	Grace
3	Oyler	Mel
4	Borning	Alan
5	Cusak	John

Table AB

StudentID	tblStudent.LName	tblStudent.FName	tblStudent.A	tblAdvisor.LName	tblAdvisor.FName	
1	Crowley	Caro	2	1	Dickey	Martin
2	Jordan	Michael	1	1	Dickey	Martin
12	Jennings	Waylan	2	1	Dickey	Martin
1	Crowley	Caro	2	2	Whiteaker	Grace
2	Jordan	Michael	1	2	Whiteaker	Grace
12	Jennings	Waylan	2	2	Whiteaker	Grace
1	Crowley	Caro	2	3	Oyler	Mel
2	Jordan	Michael	1	3	Oyler	Mel
12	Jennings	Waylan	2	3	Oyler	Mel
1	Crowley	Caro	2	4	Borning	Alan
2	Jordan	Michael	1	4	Borning	Alan
12	Jennings	Waylan	2	4	Borning	Alan
1	Crowley	Caro	2	5	Cusak	John
2	Jordan	Michael	1	5	Cusak	John
12	Jennings	Waylan	2	5	Cusak	John

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FIT 100 Join – Product With a Match

- ❖ The *join operator* also combines tables and is actually a combination of the product, selection, and projection operators
- ❖ Natural Join... suppose two tables have the same attribute, then use the Product operation to pair all rows of the two tables, but keep only those rows that match on the common attribute and remove duplicates
- ❖ Other joins are those done with other relational operators: $<$, $>$, $<=$, etc.
- ❖ Join is very useful because it allows us to construct more complete database views from small tables

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FIT 100 Join Example

Table A

StudentID	LName	FName	AdvisorID
1	Crowley	Caro	2
2	Jordan	Michael	1
12	Jennings	Waylan	2

Table B

AdvisorID	LName	FName
1	Dickey	Martin
2	Whiteaker	Grace
3	Oyler	Mel
4	Borning	Alan
5	Cusak	John

Natural Join of Table A and Table B

StudentID	tblStudent.LName	tblStudent.FName	AdvisorID	tblAdvisor.LName	tblAdvisor.FName
2	Jordan	Michael	1	Dickey	Martin
1	Crowley	Caro	2	Whiteaker	Grace
12	Jennings	Waylan	2	Whiteaker	Grace

Joins between tables reveal stored relationships and provide the data users want to see

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FIT 100 Summary Of Table Operations

- ❖ The five basic operations on tables are
 - ❑ Select
 - ❑ Project
 - ❑ Union
 - ❑ Difference
 - ❑ Product
- ❖ Join is a powerful operation created from product/project/select
- ❖ Table operations allow the data to be exhibited to users in whatever form they want

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