

## Relational Database Languages

Tuple relational calculus

- •ALPHA (Codd, 1970s)
  - •QUEL (based on ALPHA)
  - •Datalog (rule-based, like PROLOG)

Domain relational calculus
•QBE (used in Access)

25/202	MARKET STATE
1	ere Villa
S (48)	
300	
	499
	1888
	1 355
	1000
-2008	
2.596.50	10000
	10000
	1
Salari Carrie	27

# History of SQL

- •Developed by IBM as SEQUEL in early 70s (Structured English Query Language)
- •Renamed SQL (Structured Query Language)
- •SQL-86 (ANSI, ISO)
- •SQL-89
- •SQL-92 (SQL2)
- •SQL:1999 (SQL3)
- •SQL 2003
- •SQL 2006

Many different flavors of SQL: sqlplus, SQLServer, MySQL, etc.

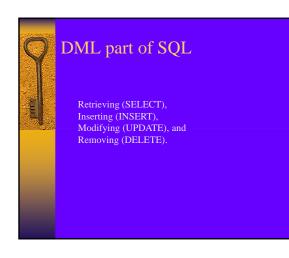
**Here:** Accesss (roughly corresponds to SQL-89)



# DDL part of SQL

Creating (CREATE), Modifying (ALTER), and Removing (DROP)

Catalogs
Schemas
Relations (Tables)









## **SELECT Examples**

#### Company

- •List the SSNs of all managers
- •List the names of all projects
- •List the names of all employees working for the research department.
- •List the names of all departments managed by somebody with a salary less than 30.000.
- •List employees with names of dependents.
- •List the salaries of all employees working in Houston.



## SELECT Examples

Pine Valley Furniture

- •List the names of all product lines
  •List the states in which customers reside
- •List all products and their finish
- •List salespersons with their phone and fax numbers •List products with a cherry finish
- •What products belong to the 'Country Look' product line?
- •Which salespeople work in the NorthWest territory?



### Duplicates in SQL

Duplicates can occur if key attributes are not selected

SQL keeps duplicates, for several reasons:

- Cheaper to implement
- (duplicate elimination is expensive)
- Duplicates might be required (e.g., aggregate functions)

Removal of duplicates can be forced using DISTINCT

SELECT DISTINCT SELECT ALL

List the states in which customers reside (Pine Valley)



### Renaming

If necessary we can rename relations or attributes:

SELECT fname AS First\_Name FROM employee;

SELECT d.dname, e.dlocation FROM department AS d, dept\_locations AS e WHERE d.dnumber = e.dnumber;



# Renaming Examples

- •List the names of all employees in columns called
- First\_Name, Last\_Name
- •List the names of all departments located in Houston.
  •List the names of all employees supervised by Franklin
- •List the names of all employees with the names of their supervisors.

#### Pine Valley

- •List employees with supervisors
- •List employees and their skills



# Types in Access

Numbers: 'Pine Valley' Date/Time:



## Comparisons

- Equality Less than
- Less than or equal Greater than
  Greater than or equal
- not equal (depends on system) LIKE
  - \* (any number of characters)
  - ? (single character)
  - # (single digit)
  - [a-z] (range of charactes)
    [#] (special character, here: #)



## **Operators**

- Subtraction (works for dates in Oracle/Access)
  - Multiplication
    Division
- Concatenation (for strings)



### Functions (Access)

Length(s) Right(s,n), Left(s,n)
Rtrim(s), Ltrim(s) Length of string s Last (first) n letters of string s Delete trailing (leading) spaces

Numeric type:

Floor(x) Ceiling(x) Abs(x) Mod(x,k)

Round x down Round x up Absolute value of x

Remainder of dividing x by k



### Functions (Access)

#### Date/Time type:

DateDiff('d', d1, d2) month(d) monthname(d) year(d)

Number of days between d1 and d2 Day of date d Month (1-12) of date d Name of month of date d Year of date d



### Examples

- •Full names of employees
  •Managers who started before 1990
- •Dependents who are not spouses
- •List employees that are younger than 40
- •Employees and their start dates (formatted)
- •Employees and their salaries in Euros

#### Pine Valley:

- •Products and prices with sales tax
- •Number of days since order was placed •Products that are less than \$350 with a 10% discount



### Between and Ordering

For number types, ranges can be defined using BETWEEN.

SELECT \*

FROM employee

WHERE salary BETWEEN 30000 and 40000;

The ORDER BY clauses allows ordered output

SELECT \* FROM employee ORDER BY lname, fname ASC, salary DESC;



## SQL Examples (Company)

- •Names and addresses of all employees working for the research department
  •Names and addresses of all employees who do not work
- for the research department
  •List project number, controlling department number, and department manager's last name, address, and birth date for all projects located in `Stafford'
- •List SSNs of managers with at least one dependent



# SQL Examples (Pine Valley)

- •List product descriptions, finishes and their product lines
- List salespeople and the territories they work in

  List customers that placed an order after 2003

  List all employees that can use a 12in band saw
- •List all products ordered in order 1006, how many copies were ordered, and the subtotal for each product
- •List all products that are tables

 ·	