

# **1.264 Lecture 8**

**SQL: Basics, SELECT**

# SQL

- **Structured query language (SQL) used for**
  - **Data definition (DDL): tables and views (virtual tables)**
  - **Data manipulation (DML): user or program can INSERT, DELETE, UPDATE or retrieve (SELECT) data**
  - **Access control: security**
  - **Data sharing: by concurrent users**
  - **Data integrity: referential integrity and transactions**
- **Not a complete language like Java, Visual Basic or C++**
  - **SQL is sub-language of about 30 statements**
  - **Usually embedded in another language or tool for database access**
  - **SQL has several inconsistencies; NULLs are problematic**
  - **Portable across operating systems and somewhat among vendors**

# Things that vary among SQL implementations

- Error codes
- Data types supported (dates/times, currency, string variations)
- System tables, about the structure of the database itself
- Interactive SQL
- Programming interface: no vendor follows the standard
- Dynamic SQL, used for report writers and query tools
- Implementer-defined variations within the standard
- Database initialization, opening and connection

# SQL SELECT

- **SELECT** constructed of clauses to get columns and rows from one or more tables or views. Clauses must be in order:
  - **SELECT** *columns*
  - **INTO** *new table*
  - **FROM** *table or view*
  - **WHERE** *specific rows or a join is created*
  - **GROUP BY** *grouping conditions (columns)*
  - **HAVING** *group-property (specific rows)*
  - **ORDER BY** *ordering criterion ASC | DESC*

## Example tables

### Orders

OrderNbr	Cust	Prod	Qty	Amt	Disc
1	211	Bulldozer	7	\$31,000.00	0.2
2	522	Riveter	2	\$4,000.00	0.3
3	522	Crane	1	\$500,000.00	0.4

### Customers

CustNbr	Company	CustRep	CreditLimit
211	Connor Co	89	\$50,000.00
522	AmaratungaEnterprise	89	\$40,000.00
890	Feni Fabricators	53	\$1,000,000.00

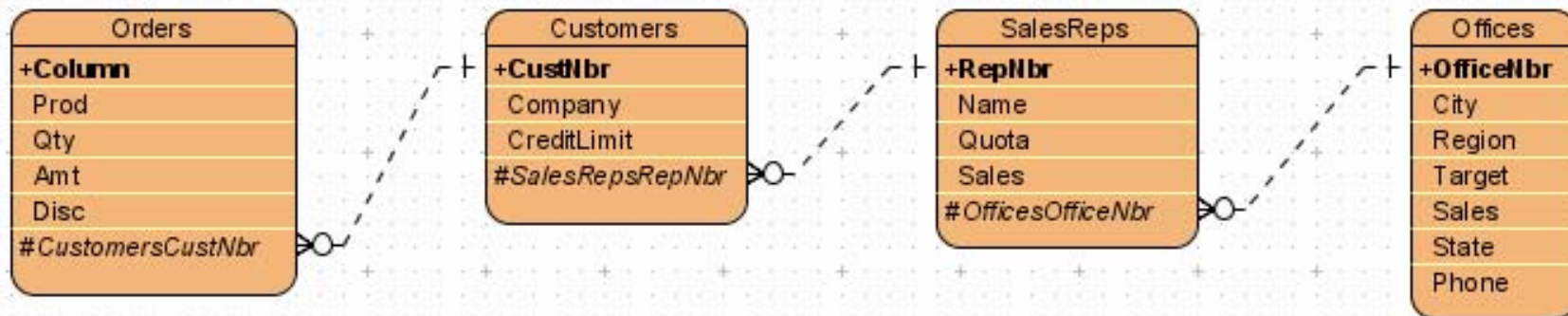
### SalesReps

RepNbr	Name	RepOffice	Quota	Sales
53	Bill Smith	1	\$100,000.00	\$0.00
89	Jen Jones	2	\$50,000.00	\$130,000.00

### Offices

OfficeNbr	City	State	Region	Target	Sales	Phone
1	Denver	CO	West	\$3,000,000.00	\$130,000.00	970.586.3341
2	New York	NY	East	\$200,000.00	\$300,000.00	212.942.5574
57	Dallas	TX	West	\$0.00	\$0.00	214.781.5342

# Example schema



# Using SQL Server and Management Studio Express

- Your SQL Server database engine should start by default when your system starts
  - Ask TAs for help if needed
- Start Management Studio Express (MSE) from Start->Programs
- Open Lecture7OrderDB.sql with MSE in Windows Explorer
  - Download the .sql file from the MIT Server
- Select 'Execute' from toolbar
  - Database should be created and data inserted for exercises during this class

# SQL queries: SELECT

- Click 'New Query' in MSE; type these statements:
- List the sales reps
  - **SELECT Name, Sales, Quota FROM SalesReps;**
- Find the amount each rep is over or under quota
  - **SELECT Name, Sales, Quota, (Sales-Quota) FROM SalesReps;**
- Find the slackers
  - **SELECT Name, Sales, Quota, (Sales-Quota) FROM SalesReps WHERE Sales < Quota;**

RepNbr	Name	RepOffice	Quota	Sales
53	Bill Smith	1	\$100,000.00	\$0.00
89	Jen Jones	2	\$50,000.00	\$130,000.00



# SQL queries: calculation, insert, delete, update

- Find the average sale
  - **SELECT AVG(Amt) FROM Orders;**
- Find the average sale for a customer
  - **SELECT AVG(Amt) FROM Orders WHERE Cust = 211;**
- Add an office
  - **INSERT INTO Offices (OfficeNbr, City, State, Region, Target, Sales, Phone) VALUES ('55', 'Dallas', 'TX', 'West', 20000, 0, '214.333.2222');**
- Delete a customer
  - **DELETE FROM Customers WHERE Company = 'Connor Co';**
  - (Syntax is valid but command will fail due to referential integrity)
- Raise a credit limit
  - **UPDATE Customers  
SET CreditLimit = 75000 WHERE Company = 'Amaratunga Enterprises';**

## **SELECT: \* and duplicates**

- **Select all columns (fields)**
  - **SELECT \* FROM Offices;**
- **Duplicate rows: query will get two instances of 'West'**
  - **SELECT Region FROM Offices;**
- **Eliminate duplicates:**
  - **SELECT DISTINCT Region FROM Offices;**

# NULLs

- **NULL values evaluate to NOT TRUE in all cases.**
  - Insert 'NewRep' with NULL (blank or empty) Quota
  - **Write this statement yourself!**
- **The following two queries will not give all sales reps:**
  - **SELECT Name FROM SalesReps WHERE Sales > Quota;**
  - **SELECT Name FROM SalesReps WHERE Sales <= Quota;**
  - A new rep with a NULL quota will not appear in either list
- **Check for NULLS by:**
  - **SELECT Name FROM SalesReps WHERE Quota IS NULL;**

# SELECT Operators

- SELECT \* FROM <table>
  - WHERE Disc\*Amt > 50000; (Orders)
  - WHERE Quota BETWEEN 50000 AND 100000; (SalesReps)  
Range is inclusive (>=50000 and <=100000)
  - WHERE State IN ('CO', 'UT', 'TX'); (Offices)
  - WHERE RepNbr IS NOT NULL; (SalesReps)
  - WHERE Phone NOT LIKE '21%'; (Offices)
- SQL standard only has 2 wildcards
  - % any string of zero or more characters (\* in Access)
  - \_ any single character (? in Access)
- Most databases have additional/different wildcards.  
SQL Server has:
  - [list] match any single character in list, e.g., [a-f]
  - [^list] match any single character not in list, e.g. [^h-m]

# SELECT: COUNT, GROUP BY

Parts

PartID	Vendor
123	A
234	A
345	B
362	A
2345	C
3464	A
4533	C

- Number of parts from vendor A
  - **SELECT COUNT(\*) FROM Parts WHERE Vendor = 'A';**
  - Result: 4
- Number of parts from each vendor
  - **SELECT Vendor, COUNT(\*) AS PartsCount FROM Parts GROUP BY Vendor;**
  - Result:

Vendor	PartsCount
A	4
B	1
C	2

## Exercises

- **What is the average credit limit of customers whose credit limit is less than \$1,000,000?**
- **How many sales offices are in the West region?**
- **Increase the price of bulldozers by 30% in all orders**
- **Delete any sales rep with a NULL quota**

# Exercises

- What is the average credit limit of customers whose credit limit is less than \$1,000,000?
  - **SELECT AVG(CreditLimit) FROM Customers WHERE CreditLimit < 1000000;**
- How many sales offices are in the West region?
  - **SELECT Count(\*) FROM Offices WHERE Region= 'West';**
- Increase the price of bulldozers by 30% in all orders
  - **UPDATE Orders SET Amt= Amt\*1.3 WHERE Prod= 'Bulldozer';**
- Delete any sales rep with a NULL quota
  - **DELETE FROM SalesReps WHERE Quota IS NULL;**