

# INTRODUCTION TO SQL

SFWR ENG 3DB3 – FALL 2016

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## WHY SQL?

- SQL is a very-high-level language.
  - Structured Query Language
  - Say “what to do” rather than “how to do it.”
  - Avoid a lot of data-manipulation details needed in procedural languages like C++ or Java.
- DBMSs determine the “best” method of executing a query.
  - This is called “query optimization”.

## DATABASE SCHEMAS IN SQL

- SQL is primarily a query language, used for retrieving data from a database.
  - Data Manipulation Language (DML)
- But SQL also includes a data-definition component for describing database schemas.
  - Data Definition Language (DDL)

## SELECT-FROM-WHERE STATEMENTS

**SELECT** → desired attribute(s)

**FROM** → one or more tables (i.e. entity-sets)

**WHERE** → condition about tuples of the tables

## RECALL OUR EXAMPLE

- Our SQL queries will be based on the following database schema.
- Underlines indicate key attributes.

Beers (name, manf)  
 Bars (name, addr, license)  
 Drinkers (name, addr, phone)  
 Likes (drinker, beer)  
 Sells (bar, beer, price)  
 Frequents (drinker, bar)

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## EXAMPLE

- Using Beers(name, manf), what beers are made by Anheuser-Busch?

```
SELECT name
FROM Beers
WHERE manf = 'Anheuser-Busch';
```

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## RESULT OF QUERY

name
Bud
Bud Light
Michelob
...

- The answer is a relation with a single attribute, name, and tuples with the name of each beer by Anheuser-Busch, such as Bud.

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## MEANING OF SINGLE-RELATION QUERY

- Begin with the relation in the FROM clause.
- Apply the selection indicated by the WHERE clause.
- Apply the extended projection indicated by the SELECT clause.

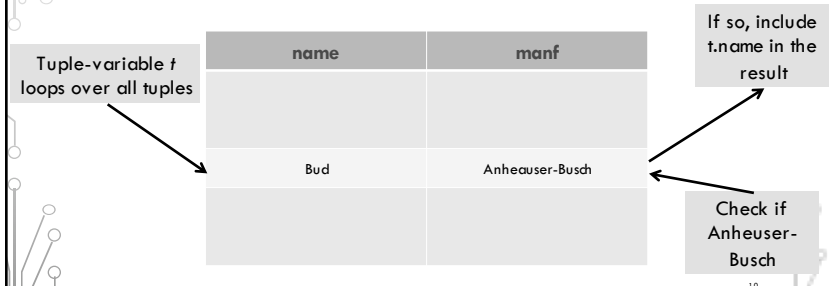
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## OPERATIONAL SEMANTICS - GENERAL

- Think of a *tuple variable* visiting each tuple of the relation mentioned in FROM
- Check if the tuple assigned to the tuple variable satisfies the WHERE clause.
- If so, compute the attributes or expressions of the SELECT clause using the components of this tuple.

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## OPERATIONAL SEMANTICS



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## EXAMPLE

- What beers are made by Anheuser-Busch?

```
SELECT name
FROM Beers
WHERE manf = 'Anheuser-Busch';
```

OR

```
SELECT t.name
FROM Beers t
WHERE t.manf = 'Anheuser-Busch';
```

**NOTE:** these two queries are identical.

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## ASTERISKS ( \* ) IN SELECT CLAUSES

- When there is one relation in the **FROM** clause, \* in the **SELECT** clause stands for "all attributes of this relation".

- **Example:** Using Beers(name, manf):

```
SELECT *
FROM Beers
WHERE manf = 'Anheuser-Busch';
```

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## RESULT OF QUERY

name	manf
Bud	Anheuser-Busch
Bud Light	Anheuser-Busch
Michelob	Anheuser-Busch
...	...

- The result now has each of the attributes of Beers.

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## RENAMING ATTRIBUTES

- If you want the result to have different attribute names, use "AS <new name>" to rename an attribute.

- **Example:** Using Beers(name, manf):

```
SELECT  name AS beer, manf
FROM    Beers
WHERE   manf = 'Anheuser-Busch';
```

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## RESULT OF QUERY

beer	manf
Bud	Anheuser-Busch
Bud Light	Anheuser-Busch
Michelob	Anheuser-Busch
...	...

- The result now has each of the attributes of Beers.

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## EXPRESSIONS IN SELECT CLAUSES

- Any valid expression can appear as an element of a SELECT clause.

- **EXAMPLE:** Using Sells(bar, beer, price):

```
SELECT  bar, beer, price*80 AS priceInJPY
FROM    Sells;
```

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## RESULT OF QUERY

bar	beer	priceInJPY
Joe's	Bud	285
Sue's	Miller	342
John's	Michelob	532
...	...	...

- The result now has each of the attributes of Beers.

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## EXAMPLE: CONSTANTS AS EXPRESSIONS

- Using Likes(drinker, beer):

```
SELECT drinker, 'likes Bud' AS whoLikesBud
FROM Likes
WHERE beer = 'Bud';
```

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## RESULT OF QUERY

drinker	whoLikesBud
George	likes Bud
Frank	likes Bud
Jenny	likes Bud
...	...

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## COMPLEX CONDITIONS IN WHERE CLAUSE

- Boolean operators: **AND, OR, NOT**.
- Comparison operators: **=, <>, <, >, <=, >=**.

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## EXAMPLE: COMPLEX CONDITION

- Using Sells(bar, beer, price), find the price that Joe's Bar charges for Bud.

```
SELECT price
FROM Sells
WHERE bar = 'Joe's Bar' AND beer = 'Bud';
```

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## PATTERNS

- A condition can compare a string to a pattern by:
  - <Attribute> **LIKE** <pattern> or <Attribute> **NOT LIKE** <pattern>
- Pattern is a quotes string:
  - % = "any string";
  - \_ = "any character".

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## EXAMPLE: LIKE

- Using Drinkers(name, addr, phone) find the drinkers with exchange 555:

```
SELECT name
FROM DRINKERS
WHERE phone LIKE '%555-____';
```

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## NULL VALUES

- Tuples in SQL relations can have NULL as a value for one or more components.
- The meaning is dependent on the context. In general, there are two common cases:
  - Missing Values*: e.g., we know Joe's Bar has some address, but we don't know what it is.
  - Inapplicable*: e.g., the value of attribute spouse for an unmarried person.

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## COMPARING NULL'S TO VALUES

- The logic of a conditions in SQL are 3 pronged:

1. **TRUE**
2. **FALSE**
3. **UNKNOWN**

- Comparing any value (including NULL) with NULL yields UNKNOWN.

A tuple is in a query answer iff the **WHERE** clause is **TRUE**  
(not **FALSE** or **UNKNOWN**).

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