CS 338
SQL Updates, NULL Values

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Winter 2017
• Updating Databases using SQL
• The INSERT Command
• The DELETE Command
• The UPDATE Command
• Schema Change Statements in SQL
• NULL Semantics
• SQL Three-Valued Logic
• Effects on WHERE clause (IS NULL operator)
• Effects of NULL values on other SQL clauses/operators
The INSERT Command

• Adds tuple(s) to a relation
• Needs relation name and a list of values for the tuple
• DBMS that fully implements SQL supports integrity constraints during insertion
• Insert options
  ▪ Specify attribute values corresponding to the attributes

```
U1: INSERT INTO EMPLOYEE
    VALUES
    ( 'Richard', 'K', 'Marini', 653298653, '1962-12-30', '98
      Oak Forest, Katy, TX', 'M', 37000, 653298653, 4 );
```

▪ Insert results of some query in a new table

```
U3B: INSERT INTO WORKS_ON_INFO ( Emp_name, Proj_name,
    Hours_per_week )
    SELECT E.Lname, P.Pname, W.Hours
    FROM PROJECT P, WORKS_ON W, EMPLOYEE E
    WHERE P.Pnumber=W.Pno AND W.Essn=E.Ssn;
```
The DELETE Command

- Removes tuple(s) to a relation
- Needs a relation name
- Includes an optional WHERE clause to select tuples to be deleted
- Deletion may propagate to tuples in other relations based on the specified referential integrity constraints
- WHERE can contain nested SELECT statements

```
U4A:  DELETE FROM EMPLOYEE  
      WHERE Lname='Brown';
U4B:  DELETE FROM EMPLOYEE  
      WHERE Ssn='123456789';
U4C:  DELETE FROM EMPLOYEE  
      WHERE Dno=5;
U4D:  DELETE FROM EMPLOYEE;
```
The UPDATE Command

- Modifies attribute values of one or more selected values
- Needs a relation name
- Includes an optional WHERE clause to select tuples to be modified
- Primary key updates may propagate to foreign key values of tuples in other relations if specified in the referential integrity constraints
  - SET clause specifies the attributes to be modified and their new values

U5: UPDATE PROJECT
    SET Plocation = 'Bellaire', Dnum = 5
    WHERE Pnumber = 10;
The UPDATE Command

• May use old value(s) and relations to determine new values

```
UPDATE EMPLOYEE
SET Salary = Salary*1.10
WHERE Dno IN (SELECT Dnumber
FROM DEPARTMENT
WHERE Dname LIKE
'\%Research\%');
```
• Revise schema declaration as business needs evolve
  ▪ Adding or dropping tables, attributes and constraints
• Can be done while the database is operational
• Does not require recompilation of the database schema
The DROP Command

• Used to drop schema elements, such as tables, domains, types, constraints
• Drop behavior options:
  ▪ CASCADE – removes the database schema and all its tables, domains and constraints

Example

DROP SCHEMA COMPANY CASCADE;

▪ RESTRICT- schema is dropped only if it does not contain any elements in it
The ALTER Command

• Alter table actions
  ▪ Add a column
    Example:
    ```sql
    ALTER TABLE COMPANY.EMPLOYEE
    ADD COLUMN Job VARCHAR(12);
    ```
  ▪ Drop a column
    • Using CASCADE or RESTRICT
  ▪ Change a column definition
    • Change type, nullability, or default value
  ▪ Add or drop table constraints
    ```sql
    ALTER TABLE COMPANY.EMPLOYEE
    DROP CONSTRAINT EMPSUPERFK;
    ```
1. Consider the following relations:
   
   Emp(eno, ename, title, city)
   Proj(pno, pname, budget, city)
   Works(eno, pno, resp, dur)
   Pay(title, salary)

   where the primary keys are underlined, and Emp.title is a foreign key to Pay.title, Works.eno is a foreign key to Emp.eno, and Works.pno is a foreign key to Proj.pno.

   Write the following SQL updates:

   1) Populate the newly created table ProjectSalaryInfo(e_name, proj_name, title, salary) with the corresponding information using the existing relations.
Exercises

2) Delete all projects with budget less than $10000.
3) Update the title of employee with eno=365 to manager.
4) Delete the table Pay, dropping automatically all referencing elements.
5) Delete the old default value of city for each project and set it to Waterloo.
NULL Semantics

• Possible meaning
  ▪ Unknown value
  ▪ Unavailable (witheld) value
  ▪ Not applicable attribute

Not possible to determine intended meaning

• A stored NULL value is incomparable to any other stored value
  ▪ The result of such comparison is UNKNOWN (it may be TRUE or FALSE)

• Any operation involving an unknown value, produces an unknown value for the result
  ▪ Example: unknown+5 => unknown
**SQL Three-Valued Logic**

- Three values: TRUE, FALSE and UNKNOWN

<table>
<thead>
<tr>
<th>Logical Connectives in Three-Valued Logic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a) AND</strong></td>
</tr>
<tr>
<td>TRUE</td>
</tr>
<tr>
<td>TRUE</td>
</tr>
<tr>
<td>FALSE</td>
</tr>
<tr>
<td>UNKNOWN</td>
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<tr>
<td><strong>(b) OR</strong></td>
</tr>
<tr>
<td>TRUE</td>
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<tr>
<td>TRUE</td>
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<tr>
<td>FALSE</td>
</tr>
<tr>
<td>UNKNOWN</td>
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<tr>
<td><strong>(c) NOT</strong></td>
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<tr>
<td>TRUE</td>
</tr>
<tr>
<td>FALSE</td>
</tr>
<tr>
<td>FALSE</td>
</tr>
<tr>
<td>UNKNOWN</td>
</tr>
</tbody>
</table>
WHERE Evaluation

• WHERE evaluates all tuples, and returns only those that evaluate to TRUE

• Cannot use WHERE phone=NULL to test for NULL value in a tuple

• Example:

```
SELECT *
FROM Student
WHERE age > 18 OR NOT age > 18
```

might not return all Student tuples (tuples that have NULL value for age)
Comparison Operator IS NULL

IS [NOT] NULL – Compares an attribute value to NULL

Query 18. Retrieve the names of all employees who do not have supervisors.

Q18:   SELECT   Fname, Lname
       FROM   EMPLOYEE
       WHERE   Super_ssn IS NULL;

Most SQL operators return unknown if one of the operands is NULL.
NULL Values in SQL

- Aggregation functions – in general NULL values are ignored
  - Exception: COUNT (*)
- Grouping treats all NULL values equally
- Set operations (UNION, INTERSECTION, EXCEPT) treat NULL values equally
- SELECT DISTINCT (for duplicate elimination) treats NULL values equally
- Ordering (ORDER BY) sorts all NULL values together, but the sort order with respect to other values depends on the particular implementation
- INNER JOIN vs OUTER JOIN
- SQL DDL
  - CHECK and FOREIGN KEY constraints accept NULL values
  - Column can be declared NOT NULL
  - Primary key must be declared NOT NULL