

ENSF 608: SQL

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Basic Retrieval Queries in SQL

- SQL allows a table to have two or more tuples that are identical in all their attribute values
 - Unlike relational model (relational model is strictly set-theory based)
 - Multiset or bag behavior
 - Tuple-id may be used as a key
- `SELECT` statement
 - One basic statement for retrieving information from a database

The SELECT-FROM-WHERE Structure of Basic SQL Queries (1 of 2)

- Basic form of the SELECT statement:

```
SELECT    <attribute list>  
FROM      <table list>  
WHERE     <condition>;
```

where

- <attribute list> is a list of attribute names whose values are to be retrieved by the query.
- <table list> is a list of the relation names required to process the query.
- <condition> is a conditional (Boolean) expression that identifies the tuples to be retrieved by the query.

The SELECT-FROM-WHERE Structure of Basic SQL Queries (2 of 2)

- Logical comparison operators
 - =, <, <=, >, >=, and <>
- **Projection attributes**
 - Attributes whose values are to be retrieved
- **Selection condition**
 - Boolean condition that must be true for any retrieved tuple. Selection conditions include join conditions (see Ch 8) when multiple relations are involved.

Basic Retrieval Queries (1 of 2)

(a)

Bdate	Address
1965-01-09	731Fondren, Houston, TX

(b)

Fname	Lname	Address
John	Smith	731 Fondren, Houston, TX
Franklin	Wong	638 Voss, Houston, TX
Ramesh	Narayan	975 Fire Oak, Humble, TX
Joyce	English	5631 Rice, Houston, TX

Query 0. Retrieve the birth date and address of the employee(s) whose name is 'John B. Smith'.

Q0: **SELECT** Bdate, Address
 FROM EMPLOYEE
 WHERE Fname='John' AND Minit='B' AND Lname='Smith';

Query 1. Retrieve the name and address of all employees who work for the 'Research' department.

Q1: **SELECT** Fname, Lname, Address
 FROM EMPLOYEE, DEPARTMENT
 WHERE Dname='Research' AND Dnumber=Dno;

Basic Retrieval Queries (2 of 2)

(c)

Pnumber	Dnum	Lname	Address	Bdate
10	4	Wallace	291Berry, Bellaire, TX	1941-06-20
30	4	Wallace	291Berry, Bellaire, TX	1941-06-20

Query 2. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date.

```
Q2:  SELECT  Pnumber, Dnum, Lname, Address, Bdate
      FROM    PROJECT, DEPARTMENT, EMPLOYEE
      WHERE   Dnum=Dnumber AND Mgr_ssn=Ssn AND
              Plocation='Stafford';
```

Ambiguous Attribute Names

- Same name can be used for two (or more) attributes in different relations
 - As long as the attributes are in different relations
 - Must **qualify** the attribute name with the relation name to prevent ambiguity

```
Q1A:  SELECT  Fname, EMPLOYEE.Name, Address
        FROM    EMPLOYEE, DEPARTMENT
        WHERE   DEPARTMENT.Name='Research' AND
                DEPARTMENT.Dnumber=EMPLOYEE.Dnumber;
```

Aliasing, Renaming and Tuple Variables (1 of 2)

- **Aliases or tuple variables**

- Declare alternative relation names E and S to refer to the EMPLOYEE relation twice in a query:

Query 8. For each employee, retrieve the employee's first and last name and the first and last name of his or her immediate supervisor.

```
Q8:  SELECT  E.Fname, E.Lname, S.Fname, S.Lname
      FROM    EMPLOYEE AS E, EMPLOYEE AS S
      WHERE   E.Super_ssn = S.Ssn;
```

- Recommended practice to abbreviate names and to prefix same or similar attribute from multiple tables.

Aliasing, Renaming and Tuple Variables (2 of 2)

- The attribute names can also be renamed

```
EMPLOYEE AS E(Fn, Mi, Ln, Ssn, Bd,  
Addr, Sex, Sal, Sssn, Dno)
```

- Note that the relation EMPLOYEE now has a variable name E which corresponds to a tuple variable
- The “AS” may be dropped in most SQL implementations

Unspecified WHERE Clause and Use of the Asterisk (1 of 2)

- Missing WHERE clause
 - Indicates no condition on tuple selection
- Effect is a CROSS PRODUCT
 - Result is all possible tuple combinations (or the Algebra operation of Cartesian Product— see Ch 8) result

Queries 9 and 10. Select all EMPLOYEE Ssns (Q9) and all combinations of EMPLOYEE Ssn and DEPARTMENT Dname (Q10) in the database.

Q9: **SELECT** Ssn
 FROM EMPLOYEE;

Q10: **SELECT** Ssn, Dname
 FROM EMPLOYEE, DEPARTMENT;

Unspecified WHERE Clause and Use of the Asterisk (2 of 2)

- Specify an asterisk (*)
 - Retrieve all the attribute values of the selected tuples
 - The * can be prefixed by the relation name; e.g., EMPLOYEE.*

Q1C: **SELECT** *

FROM EMPLOYEE

WHERE Dno=5;

Q1D: **SELECT** *

FROM EMPLOYEE, DEPARTMENT

WHERE Dname='Research' **AND** Dno=Dnumber;

Q10A: **SELECT** *

FROM EMPLOYEE, DEPARTMENT;

Tables as Sets in SQL (1 of 2)

- SQL does not automatically eliminate duplicate tuples in query results
- For aggregate operations (See sec 7.1.7) duplicates must be accounted for
- Use the keyword **DISTINCT** in the `SELECT` clause
 - Only distinct tuples should remain in the result

Query 11. Retrieve the salary of every employee (Q11) and all distinct salary values (Q11A).

Q11: **SELECT** ALL Salary
 FROM EMPLOYEE;

Q11A: **SELECT** DISTINCT Salary
 FROM EMPLOYEE;

Tables as Sets in SQL (2 of 2)

- Set operations
 - **UNION**, **EXCEPT** (difference), **INTERSECT**
 - Corresponding multiset operations: **UNION ALL**, **EXCEPT ALL**, **INTERSECT ALL**)
 - Type compatibility is needed for these operations to be valid

Query 4. Make a list of all project numbers for projects that involve an employee whose last name is 'Smith', either as a worker or as a manager of the department that controls the project.

```
Q4A: (SELECT DISTINCT Pnumber
      FROM PROJECT, DEPARTMENT, EMPLOYEE
      WHERE Dnum=Dnumber AND Mgr_ssn=Ssn
            AND Lname='Smith' )

      UNION
      ( SELECT DISTINCT Pnumber
        FROM PROJECT, WORKS_ON, EMPLOYEE
        WHERE Pnumber=Pno AND Essn=Ssn
              AND Lname='Smith' );
```

Substring Pattern Matching and Arithmetic Operators

- **LIKE** comparison operator
 - Used for string **pattern matching**
 - % replaces an arbitrary number of zero or more characters
 - underscore (_) replaces a single character
 - Examples: **WHERE** Address **LIKE** '%Houston,TX%';
 - **WHERE** Ssn **LIKE** '__ 1__ 8901';
- **BETWEEN** comparison operator

E.g., in Q14 :

WHERE(Salary **BETWEEN** 30000 **AND** 40000) **AND** Dno = 5;

Arithmetic Operations

- Standard arithmetic operators:
 - Addition (+), subtraction (−), multiplication (*), and division (/) may be included as a part of **SELECT**
- **Query 13.** Show the resulting salaries if every employee working on the 'ProductX' project is given a 10 percent raise.

```
Q13:  SELECT  E.Fname, E.Lname, 1.1 * E.Salary AS Increased_sal
      FROM    EMPLOYEE AS E, WORKS_ON AS W, PROJECT AS P
      WHERE   E.Ssn = W.Essn AND W.Pno = P.Pnumber AND
              P.Pname = 'ProductX';
```

Ordering of Query Results

- Use **ORDER BY** clause
 - Keyword **DESC** to see result in a descending order of values
 - Keyword **ASC** to specify ascending order explicitly
 - Typically placed at the end of the query

```
ORDER BY D.Dname DESC, E.Lname ASC, E.F  
name ASC
```


Basic SQL Retrieval Query Block

```
SELECT      <attribute list>  
FROM        <table list>  
[ WHERE      <condition> ]  
[ ORDER BY <attribute list> ];
```