Outline

1. What is a Query? Query Language?
2. Example Database Tables
3. SQL Overview: 3 Components
4. SELECT statement with 1 table
5. Multi-table SELECT statements
6. Why spatial extensions are needed?
7. 1-table spatial queries
8. Multi-table spatial queries
9. Trends

Learning Objectives

- Upon completion of this module, students will be able to
  - Determine output of a single-Table SQL query
  - Compose a single-Table SQL query

SQL Data Manipulation Language: SELECT Statement

- Purpose: Query data from database tables
  - Returns a table as result
- Features
  - Has many clauses
  - Can refer to many operators and functions
  - Allows nested queries

SQL SELECT Statement: Scope of Our Discussion

- Learn enough to appreciate spatial aspects
  - Observe example queries
- Read & compose simple SELECT statement
  - With frequently used clauses
    - e.g., SELECT, FROM, WHERE, …
  - And a few operators and functions

Clauses of SELECT Statement

- Mandatory Clauses
  - SELECT specifies desired columns
  - FROM specifies relevant tables
- Optional Clauses
  - WHERE specifies qualifying conditions for results
  - ORDER BY specifies sorting columns for results
  - GROUP BY, HAVING specifies aggregation and statistics

SELECT Statement- operators, functions

- Arithmetic operators, e.g. +, -, …
- Comparison operators, e.g. =, <, >, BETWEEN, LIKE, …
- Logical operators, e.g. AND, OR, NOT, EXISTS,
- Statistical functions, e.g. SUM, COUNT, …
- Set operators, e.g. UNION, IN, ALL, ANY,…
- Many other operators on strings, data, currency, …

Ex. 1: Simplest SELECT query

- **Query**: List all the cities with their country.

CITY	Name	Country	Pop (millions)	Captial	Shape
	Havana	Cuba	2.1	Y	Pointid-1
	Washington, D.C.	USA	3.2	Y	Pointid-2
	Monterrey	Mexcio	2.0	N	Pointid-3
	Toronto	Canada	3.4	N	Pointid-4
	Brasilia	Brazil	1.5	Y	Pointid-5
	Rosario	Argentina	1.1	N	Pointid-6
	Ottawa	Canada	0.8	Y	Pointid-7
	Mexico City	Mexico	14.1	Y	Pointid-8
	Buenos Aires	Argentina	10.75	Y	Pointid-9

SELECT with WHERE Clause

Commonly 3 clauses (SELECT, FROM, WHERE) are used

- **Query**: List the names of the capital cities in the CITY table.

```
SELECT *
FROM CITY
WHERE CAPITAL='Y'
```

Result →

Name	Country	Pop (millions)	Captial	Shape
Havana	Cuba	2.1	Y	Point
Washington, D.C.	USA	3.2	Y	Point
Brasilia	Brazil	1.5	Y	Point
Ottawa	Canada	0.8	Y	Point
Mexico City	Mexico	14.1	Y	Point
Buenos Aires	Argentina	10.75	Y	Point

SELECT with Aliasing

Query: List names and Life-expectancy for countries, where the life-expectancy is less than seventy years.

SELECT Co.Name, Co.Life-Exp
FROM Country Co
WHERE Co.Life-Exp < 70

Result

Name	Life-Exp
Mexico	69.36
Brazil	65.60

Note: use of alias 'Co' for Table 'Country'

SELECT: Aggregate Queries

Query: What is the average population of the capital cities?

```
SELECT AVG(Ci.Pop)
FROM City Ci
WHERE Ci.Capital = 'Y'
```

Query: For each continent, find the average GDP.

```
SELECT Co.Cont, Avg (Co.GDP) AS Continent-GDP
FROM Country Co
GROUP BY Co.Cont
```


SELECT: HAVING Clause

Query: For each country in which at least two rivers originate, find the length of the smallest river.

```
SELECT R.Origin, MIN (R.length) AS Min-length
FROM River
GROUP BY R.Origin
HAVING COUNT(*) > 1
```