# Databases and Storage System

Prepared By: Aatiz Ghimire, for Herald Center for AI.

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## 1 Learning Objectives.

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- Learn PostgreSQL and it's Administration.

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# 1. Foundational SQL and Querying

- Understand the structure of relational databases.
- Learn to write basic and advanced SQL queries using `SELECT`, `WHERE`, `JOIN`, `GROUP BY`, `HAVING`, and subqueries.
- Differentiate between `INNER`, `LEFT`, `RIGHT`, and `FULL OUTER` joins.
- Apply set operators like `UNION`, `INTERSECT`, and `EXCEPT` to combine query results.

# 2. Working with Data and Tables

- Create, modify, and delete tables using `CREATE`, `ALTER`, and `DROP`.
- Insert, update, and delete data from tables securely and efficiently.
- Define and enforce data integrity using constraints: `PRIMARY KEY`, `FOREIGN KEY`, `UNIQUE`, `CHECK`, `NOT NULL`.

# 3. Data Types and Functions

- Understand and apply PostgreSQL data types including numeric, text, boolean, date/time, UUID.
- Use PostgreSQL built-in functions: string, date, math, aggregate.
- Master type casting and expression evaluation: `CAST`, `COALESCE`, `CASE`, `NULLIF`.

# 4. Database Performance and Optimization

- Create and manage indexes to optimize query performance.
- Apply normalization and denormalization principles for data modeling.
- Evaluate query plans using `EXPLAIN`.
- Use views and materialized views to abstract and accelerate query logic.

# 5. Procedural Programming with PL/pgSQL

- Declare and manipulate variables and control structures: `IF`, `CASE`, `LOOP`, `WHILE`, `FOR`.
- Develop and invoke stored procedures and functions for modular logic.
- Handle exceptions and errors using `EXCEPTION` blocks and `RAISE`.

## 6. Triggers and Event Handling

- Design triggers to automate reactions to table-level changes (`INSERT`, `UPDATE`, `DELETE`).
- Integrate business logic directly within the database layer.

## 7. Advanced Transaction Management

- Understand transaction control using `BEGIN`, `COMMIT`, `ROLLBACK`, and savepoints.
- Ensure data consistency using isolation levels and locks.
- Work with cursors for row-by-row query processing.

## 8. PostgreSQL Administration

- Manage users, roles, and privileges securely using `GRANT` and `REVOKE`.
- Understand tablespaces and basic file-system-level configuration.
- Backup and restore PostgreSQL databases using `pg_dump`, `pg_restore`, and `psql`.
- Configure PostgreSQL parameters for performance tuning and logging.

## Reference Link:

- PostgreSQL Tutorial
- PL/pgSQL: procedural language of PostgreSQL
- PostgreSQL Database Administration

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