PostgreSQL Learning Roadmap

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1. Basics / Getting Started

- What is PostgreSQL? Introduction & Features
- Installing PostgreSQL
- Connecting to PostgreSQL (psql, pgAdmin, other clients)
- PostgreSQL architecture overview (basic concepts: server, database, roles)

2. Basic SQL Operations

- Creating a database
- Creating tables (data types, constraints)
- Inserting data (`INSERT`)
- Querying data (`SELECT`)
- Filtering data (`WHERE`, comparison operators)
- Sorting data (`ORDER BY`)
- Limiting results (`LIMIT`, `OFFSET`)

3. Intermediate SQL Queries

- Aggregate functions (`COUNT`, `SUM`, `AVG`, `MIN`, `MAX`)
- Grouping data (`GROUP BY`, `HAVING`)
- Joins (INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN)
- Subqueries and nested queries
- Set operations (`UNION`, `INTERSECT`, `EXCEPT`)

4. Data Modification & Transactions

- Updating data (`UPDATE`)

- Deleting data (`DELETE`)
- Transaction control (`BEGIN`, `COMMIT`, `ROLLBACK`)
- Savepoints

5. Constraints and Indexes

- Primary keys and foreign keys
- Unique and check constraints
- Creating and using indexes (B-tree, Hash, GIN, GiST)
- Understanding query performance with `EXPLAIN` and `ANALYZE`

6. Advanced SQL Features

- Views (simple and materialized)
- Functions and Stored Procedures (PL/pgSQL basics)
- Triggers (before, after, instead of)
- Window functions (`ROW_NUMBER()`, `RANK()`, `LEAD()`, `LAG()`)
- Common Table Expressions (CTEs) and Recursive queries

7. Data Types & Extensions

- Arrays, JSON, JSONB
- UUID, XML, hstore
- Using and creating extensions (PostGIS, pg_trgm, etc.)

8. Performance Tuning

- Vacuuming and autovacuum
- Analyzing and optimizing queries
- Partitioning tables (range, list, hash)
- Connection pooling (pgbouncer)

9. Security

- Roles, users, and permissions
- Row-level security (RLS)
- SSL/TLS setup
- Audit logging

10. Backup & Recovery

- Dumping and restoring databases (`pg_dump`, `pg_restore`)
- PITR (Point-in-time recovery) and WAL files
- Replication basics (streaming replication, logical replication)

11. Replication & High Availability

- Setting up streaming replication
- Failover and switchover

- Using tools like Patroni, repmgr

12. Advanced Topics

- Logical replication and logical decoding
- Foreign Data Wrappers (FDW)
- Sharding and scaling techniques
- Custom aggregates and procedural languages (PL/Python, PL/Perl)
- Server programming and extensions development

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- **Using VSCode:** Open this Markdown file, open the Markdown Preview, press `Ctrl+Shift+P`, select `Markdown: Export (pdf)`.
- **Using Typora:** Paste content, then `File -> Export -> PDF`.
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- **Google Docs:** Paste into Google Docs and download as PDF.

Happy learning PostgreSQL! 🚀