PostgreSQL: Database Management Guide

Here's a step-by-step guide to using PostgreSQL, a powerful open-source relational database management system:

1. Installation

- **Windows**: Download from postgresql.org/download (includes pgAdmin GUI)

- **macOS**: Use Homebrew (`brew install postgresql`) or download the installer

- **Linux** (Debian/Ubuntu):

```
sudo apt update
sudo apt install postgresql postgresql-contrib
sudo systemctl start postgresql.service
```

2. Connect to PostgreSQL

- Default admin user: `postgres`

```
sudo -u postgres psql    # Linux/macOS
psql -U postgres         # Windows (via PSQL command line)
```

- Connect to a specific database:

```
psql -U username -d dbname -h localhost -p 5432
```

3. Basic Database Operations

- **Create User/Role**:

```
CREATE USER myuser WITH PASSWORD 'mypassword';
ALTER ROLE myuser WITH CREATEDB;
```

- **Create Database**:

```
CREATE DATABASE mydb;
GRANT ALL PRIVILEGES ON DATABASE mydb TO myuser;
```

- **Basic SQL Commands**:

```
-- Create table
CREATE TABLE users (
    id SERIAL PRIMARY KEY,
```

```sql
    name VARCHAR(50),
    email VARCHAR(100) UNIQUE
);


-- Insert data
INSERT INTO users (name, email) VALUES ('Alice', 'alice@example.com');


-- Query data
SELECT * FROM users WHERE name LIKE 'A%';


-- Update data
UPDATE users SET email = 'new@email.com' WHERE id = 1;


-- Delete data
DELETE FROM users WHERE id = 2;
```

4. Advanced Features

- **Joins**:

```sql
SELECT orders.id, users.name
FROM orders
INNER JOIN users ON orders.user_id = users.id;
```

- **JSON Support**:

```sql
CREATE TABLE products (
    id SERIAL PRIMARY KEY,
    details JSONB
);
```

- **Full-Text Search**:

```sql
SELECT * FROM documents
WHERE to_tsvector('english', content) @@ to_tsquery('search & term');
```

5. Maintenance

- **Backup**:

```
pg_dump mydb > backup.sql
pg_dumpall > all_databases.sql
```

- **Restore**:

```
psql -U username -d mydb -f backup.sql
```

- **Vacuum** (reclaim storage):

```
VACUUM ANALYZE;
```

6. Security

- Create read-only user:

```
CREATE USER readonly WITH PASSWORD 'readpass';
GRANT CONNECT ON DATABASE mydb TO readonly;
GRANT USAGE ON SCHEMA public TO readonly;
GRANT SELECT ON ALL TABLES IN SCHEMA public TO readonly;
```

7. Useful Commands

- List databases: `\l`
- Switch database: `\c dbname`
- List tables: `\dt`
- Describe table: `\d tablename`
- Show users: `\du`
- Exit psql: `\q`

8. GUI Tools

- **pgAdmin**: Included with Windows installer
- **DBeaver**: Popular cross-platform GUI
- **TablePlus**: Modern interface with native feel

9. Learning Resources

- Official Documentation: postgresql.org/docs
- Interactive Tutorial: postgresqltutorial.com
- Practice: pgexercises.com

Tip: Always test changes in a development environment before applying to production. Use transactions (`BEGIN`/`COMMIT`) for critical operations.