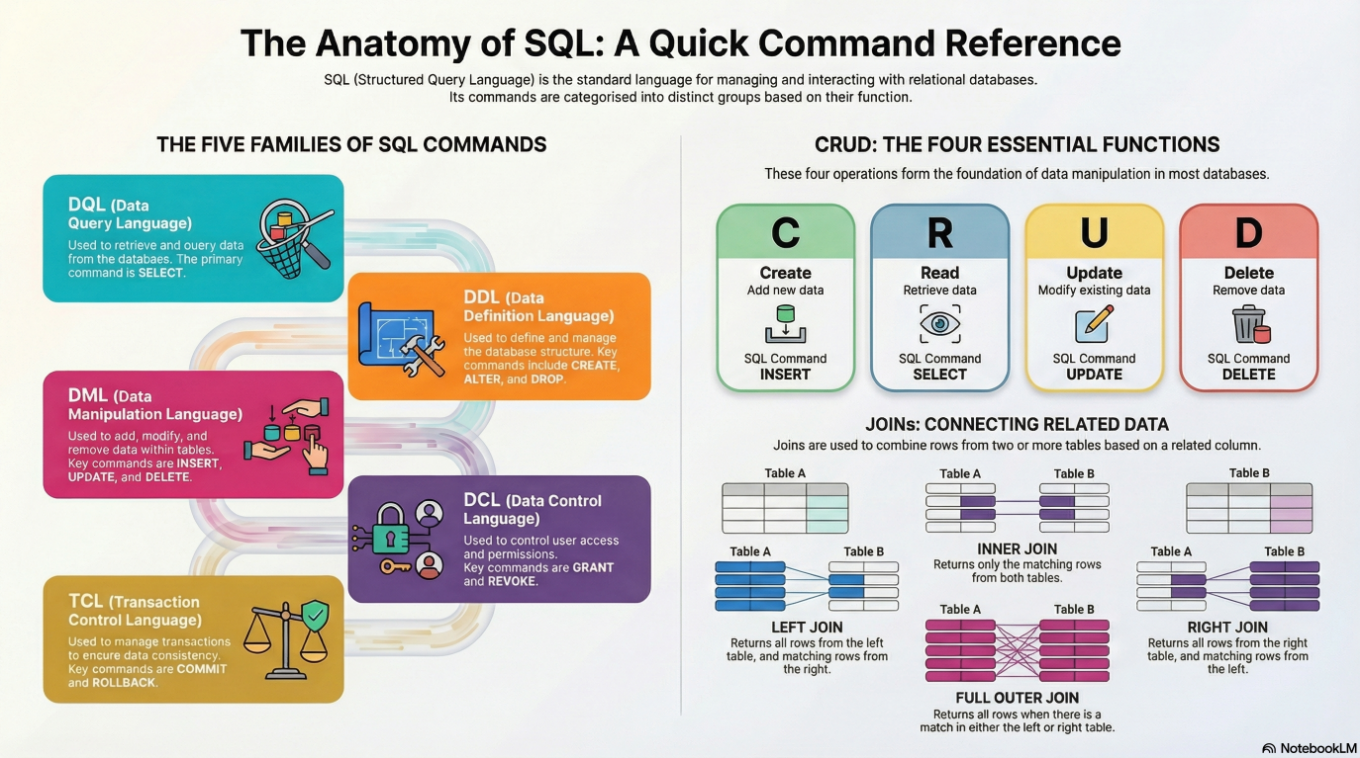
kintsugi-stack-sql

Comprehensive SQL Learning Guide for Data Analytics | Mastery in 50+ SQL Queries

> The relational model is founded on logic.

- Author: Kintsugi-Programmer



> Disclaimer: The content presented here is a curated blend of my personal learning journey, experiences, open-source documentation, and invaluable knowledge gained from diverse sources. I do not claim sole ownership over all the material; this is a community-driven effort to learn, share, and grow together.

Table of Contents

Overview

This guide covers mastery of SQL through 50 practical queries. Topics include SELECT operations, WHERE clauses, logical operators (AND, OR, NOT), JOINs, GROUP BY, ORDER BY, and advanced SQL techniques. The guide uses the "Awesome Chocolates" database with real-world examples and practical tips.

Getting Started with SQL

Setting Up Your Environment

Tool Used: MySQL Workbench / BeeKeeper Studio

Database: Awesome Chocolates (must be downloaded and loaded)

Instructions: Refer to video description for database setup instructions

Creating Your First Query

1. Click the **Plus SQL button** in the corner to open the query editor
2. View output results directly in the workbench grid
3. Execute queries using **Ctrl + Enter** or the Run command

Note: Shortcuts differ depending on your system and SQL management tool:

- **MySQL Workbench**: Ctrl + Enter
- **SQL Server Management Studio (SSMS)**: Different shortcut
- **Oracle**: Different shortcut

Understanding the Database Structure

Available Tables in Awesome Chocolates Database

The database contains four main tables:

- **Geography** table
- **People** table
- **Products** table
- **Sales** table

Exploring Table Contents

Before writing queries, understand your data structure.

View all tables in database:

```
SHOW TABLES;
```

Tables_in_awesome chocolates
geo
people
products
sales

View table structure and columns:

```
DESCRIBE sales;
```

Field	Type	Null	Key	Default	Extra
SPID	text	YES		null	
GeoID	text	YES		null	
PID	text	YES		null	
SaleDate	datetime	YES		null	
Amount	int	YES		null	

...

What this returns:

- Column names
- Data types
- Additional information about each column

Important Concept

Critical Rule: When writing SQL queries, you must be familiar with underlying tables and their relationships. Without this knowledge, writing SQL becomes extremely difficult.

Output Display

Query Limit: MySQL Workbench displays a maximum of 1000 rows at a time, even if the table contains more data.

Example: Sales table contains ~7000 rows, but only 1000 display in the workbench

When to Adjust Limits:

- When building queries: You only need to verify it works correctly
- When exporting data: You may need to remove or increase the limit to see all data
- When using data elsewhere: Export to Power BI or other systems

---

Part 1: SELECT Statements and Basic Queries

SELECT All Columns

Query:

```
SELECT * FROM sales;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP01	G4	P04	2021-01-01 00:00:00	8414	276	495
SP02	G3	P14	2021-01-01 00:00:00	532	317	54
SP12	G2	P08	2021-01-01 00:00:00	5376	178	269
SP01	G4	P15	2021-01-01 00:00:00	259	32	22
SP19	G2	P18	2021-01-01 00:00:00	5530	4	179

...

Explanation:

- `SELECT *` means select everything (all columns)
- `FROM sales` specifies the table name
- Displays all rows and all columns from the sales table

Output: Complete sales table with all data visible in grid format

SELECT Specific Columns

Query:

```
SELECT sale_date, amount, customers FROM sales;
```

SaleDate	Amount	Customers
2021-01-01 00:00:00	8414	276
2021-01-01 00:00:00	532	317
2021-01-01 00:00:00	5376	178
2021-01-01 00:00:00	259	32
2021-01-01 00:00:00	5530	4

...

Explanation:

- Specify only the columns you want to see
- Columns are separated by commas
- Result shows only these three columns for all rows

Auto-Suggest Feature: Type the table name first, then add columns. This enables auto-suggest to help prevent spelling mistakes.

Better Practice:

```
SELECT
FROM sales
```

Then come back and add columns between SELECT and FROM.

Reordering Columns

Query:

```
SELECT amount, customers, geo_id FROM sales;
```

Amount	Customers	GeoID
8414	276	G4
532	317	G3
5376	178	G2
259	32	G4
5530	4	G2

...

Explanation:

- Columns do not have to appear in their original database order
- They display in the order you specify in the SELECT statement
- Results are rearranged automatically based on your specification

Adding Calculations to Queries

Calculate Amount Per Box:

```
SELECT
  sale_date,
  amount,
  boxes,
  amount / boxes
FROM sales;
```

SaleDate	Amount	Boxes	Amount/Boxes
2021-01-01 00:00:00	8414	495	16.9980
2021-01-01 00:00:00	532	54	9.8519
2021-01-01 00:00:00	5376	269	19.9851
2021-01-01 00:00:00	259	22	11.7727
2021-01-01 00:00:00	5530	179	30.8939

...

Explanation:

- You can perform arithmetic operations directly in SELECT statements
- Operations include addition (+), subtraction (-), multiplication (*), division (/)
- Results appear as an extra column in the output
- The calculated column name defaults to the operation itself

Creating Aliases for Calculated Columns

Problem: Column name `amount / boxes` is not user-friendly

Solution: Add Column Aliases Using AS:

```
SELECT
  sale_date,
  amount,
  boxes,
```

```
  amount / boxes AS 'amount_per_box'
FROM sales;
```

SaleDate	Amount	Boxes	amount_per_box
2021-01-01 00:00:00	8414	495	16.9980
2021-01-01 00:00:00	532	54	9.8519
2021-01-01 00:00:00	5376	269	19.9851
2021-01-01 00:00:00	259	22	11.7727
2021-01-01 00:00:00	5530	179	30.8939

...

Alternative Without AS Keyword:

```
SELECT
  sale_date,
  amount,
  boxes,
  amount / boxes 'amount_per_box'
FROM sales;
```

SaleDate	Amount	Boxes	amount_per_box
2021-01-01 00:00:00	8414	495	16.9980
2021-01-01 00:00:00	532	54	9.8519
2021-01-01 00:00:00	5376	269	19.9851
2021-01-01 00:00:00	259	22	11.7727
2021-01-01 00:00:00	5530	179	30.8939

Note: Both methods produce identical results. The AS keyword creates a synonym for the column.

Key Takeaway on Aliases

The alias makes your output more readable and professional. Many times you want to give calculated columns proper names for clarity.

Part 2: WHERE Clauses - Filtering Data

Understanding WHERE Clauses

Definition: The WHERE clause allows you to impose conditions on your query results.

Concept: WHERE clause in SQL is like filtering in Excel. Set filter criteria to show only specific data.

Importance: WHERE clauses are one of the most important aspects of SQL for data analysis.

Basic WHERE Clause with Greater Than

Query:

```
SELECT * FROM sales
WHERE amount > 10000;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP06	G4	P01	2021-01-01 00:00:00	12894	115	478
SP10	G1	P06	2021-01-01 00:00:00	15596	32	975
SP25	G6	P05	2021-01-01 00:00:00	14273	335	752
SP18	G2	P21	2021-01-04 00:00:00	19229	64	1013
SP23	G1	P16	2021-01-05 00:00:00	17248	163	664

...

Explanation:

- `WHERE` specifies the filter condition
- `amount > 10000` means only rows where amount is greater than 10,000
- All rows where amount is NOT greater than 10,000 are excluded
- Only qualifying rows display in results

Comparison Operators:

- `>` Greater than
- `<` Less than
- `=` Equal to
- `>=` Greater than or equal to
- `<=` Less than or equal to
- `!=` or `<>` Not equal to

Combining WHERE with ORDER BY

Query:

```
SELECT * FROM sales
WHERE amount > 10000
ORDER BY amount;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP02	G1	P07	2021-09-17 00:00:00	10010	257	358
SP01	G2	P17	2021-08-30 00:00:00	10017	163	835
SP21	G3	P22	2021-11-18 00:00:00	10017	111	418
SP18	G5	P18	2021-10-27 00:00:00	10017	77	1113
SP23	G5	P03	2021-05-06 00:00:00	10024	32	627

...

Explanation:

- Filters results to show only amounts greater than 10,000
- Orders results by amount in ascending order (lowest to highest)
- Results start at 10,000+ and increase gradually

Ascending Order (Default):

```
ORDER BY amount;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP02	G1	P07	2021-09-17 00:00:00	10010	257	358
SP01	G2	P17	2021-08-30 00:00:00	10017	163	835
SP21	G3	P22	2021-11-18 00:00:00	10017	111	418
SP18	G5	P18	2021-10-27 00:00:00	10017	77	1113
SP23	G5	P03	2021-05-06 00:00:00	10024	32	627

...

Descending Order (Highest to Lowest):

```
ORDER BY amount DESC;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP23	G4	P03	2021-02-12 00:00:00	27146	329	1939
SP18	G5	P10	2021-04-22 00:00:00	25207	22	1483
SP03	G5	P22	2021-06-02 00:00:00	24633	39	986
SP18	G1	P11	2021-10-21 00:00:00	24451	472	1112

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP18	G2	P16	2021-03-30 00:00:00	24367	272	3481

...

Multiple Sort Criteria

Query:

```
SELECT * FROM sales
WHERE geo_id = 'g1'
ORDER BY pid, amount DESC;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP14	G1	P01	2022-02-25 00:00:00	22897	43	1347
SP21	G1	P01	2022-01-07 00:00:00	18130	24	1008
SP11	G1	P01	2021-01-27 00:00:00	17402	43	697
SP08	G1	P01	2021-09-13 00:00:00	16681	274	596
SP08	G1	P01	2022-01-10 00:00:00	16121	55	896

...

Explanation:

- Filters to show only geo_id 'g1' records
- First sorts by product ID (pid)
- Within each product ID, sorts by amount in descending order
- You can specify multiple ORDER BY columns separated by commas

Result Structure:

- All p01 items grouped together, sorted by amount (highest first)
- Then p02 items grouped together, sorted by amount
- Then p03, p04, etc.

WHERE Clause with AND Operator

Scenario: Find all sales with amount > 10,000 in the year 2022

Query Method 1 - Using Date Comparison:

```
SELECT * FROM sales
WHERE amount > 10000
AND sale_date >= '2022-01-01';
-- use quote in dates `2022-01-01' : correct, 2022-01-01' : incorrect
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP15	G3	P11	2022-01-05 00:00:00	14553	152	910
SP16	G3	P22	2022-01-28 00:00:00	10255	53	733
SP04	G4	P05	2022-01-28 00:00:00	16800	92	800
SP05	G1	P02	2022-01-21 00:00:00	16121	487	621
SP21	G2	P22	2022-01-11 00:00:00	12481	177	1041

...

Explanation:

- Filters to amount greater than 10,000
- AND date is within 2022 or later
- Both conditions must be true for rows to display

MySQL Date Format: YYYY-MM-DD

Date Example: `2022-01-01` represents January 1st, 2022

Using YEAR Function with WHERE

Query Method 2 - Using YEAR Function:

```
SELECT sale_date, amount
FROM sales
WHERE amount > 10000
AND YEAR(sale_date) = 2022
ORDER BY amount DESC;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP24	G4	P01	2022-02-16 00:00:00	23912	211	1993
SP09	G4	P20	2022-03-15 00:00:00	23184	123	1221
SP14	G1	P01	2022-02-25 00:00:00	22897	43	1347
SP16	G2	P13	2022-03-01 00:00:00	22603	32	3229
SP13	G4	P10	2022-02-25 00:00:00	22155	185	1055

...

Explanation:

- `YEAR()` is a built-in SQL function that extracts the year from a date

- Works similar to YEAR function in Excel
- Returns a number, so no quotes needed around 2022
- More flexible than date comparison method

Advantage: Cleaner and more maintainable than parsing dates manually

WHERE Clause with BETWEEN

Scenario: Find all sales with boxes between 0 and 50

Query Method 1 - Using AND:

```
SELECT * FROM sales
WHERE boxes > 0
AND boxes <= 50;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP01	G4	P15	2021-01-01 00:00:00	259	32	22
SP14	G5	P16	2021-01-01 00:00:00	1036	370	37
SP12	G6	P09	2021-01-04 00:00:00	147	9	11
SP04	G1	P20	2021-01-06 00:00:00	644	116	34
SP10	G2	P01	2021-01-08 00:00:00	420	196	14

...

Query Method 2 - Using BETWEEN(it includes limits):

```
SELECT * FROM sales
WHERE boxes BETWEEN 0 AND 50;
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP01	G4	P15	2021-01-01 00:00:00	259	32	22
SP14	G5	P16	2021-01-01 00:00:00	1036	370	37
SP12	G6	P09	2021-01-04 00:00:00	147	9	11
SP04	G1	P20	2021-01-06 00:00:00	644	116	34
SP10	G2	P01	2021-01-08 00:00:00	420	196	14

...

Explanation:

- BETWEEN is inclusive on both ends
- **Range includes 0 and 50**
- Both methods produce the same results
- BETWEEN is more concise and readable

Note: Both methods are valid. Use whichever is more comfortable for you.

Weekday Function Example

Scenario: Find all sales that occurred on Fridays

Query:

```
SELECT
  sale_date,
  amount,
  boxes,
  WEEKDAY(sale_date) AS day_of_week
FROM sales
WHERE WEEKDAY(sale_date) = 4;
```

SaleDate	Amount	Boxes	day_of_week
2021-01-01 00:00:00	8414	495	4
2021-01-01 00:00:00	532	54	4
2021-01-01 00:00:00	5376	269	4
2021-01-01 00:00:00	259	22	4
2021-01-01 00:00:00	5530	179	4

Explanation:

- `WEEKDAY()` is a built-in function that returns day of week as a number
- Weekday numbering: 0=Monday, 1=Tuesday, 2=Wednesday, 3=Thursday, 4=Friday, 5=Saturday, 6=Sunday
- Friday = 4, so the condition is `WEEKDAY(sale_date) = 4`
- Can also create alias `AS day_of_week` for clarity

Important Note: When using a calculated column in WHERE clause, you cannot reference the alias. You must repeat the calculation:

```
-- CORRECT:
WHERE WEEKDAY(sale_date) = 4

-- INCORRECT (will give error):
WHERE day_of_week = 4
```

Part 3: Logical Operators - AND, OR, NOT

The OR Operator

Scenario: Find all people in either "Delish" or "Juices" team

Query Method 1 - Using Multiple OR Conditions:

```
SELECT * FROM people
WHERE team = 'Delish'
OR team = 'Juices';
```

Salesperson	SPID	Team	Location
Wilone O'Kielt	SP04	Delish	Hyderabad
Gigi Bohling	SP05	Delish	Hyderabad
Curtice Advani	SP06	Delish	Hyderabad
Kaine Padly	SP07	Delish	Hyderabad
Andria Kimpton	SP09	Jucies	Hyderabad

...

Explanation:

- Shows results where team equals 'Delish' OR team equals 'Juices'
- Either condition being true includes the row
- Person cannot be in both teams, so OR is appropriate

Limitation: If you need many possible values, OR conditions become repetitive and difficult to maintain

The IN Operator

Query Method 2 - Using IN (Cleaner Approach):

```
SELECT * FROM people
WHERE team IN ('Delish', 'Juices');
```

Salesperson	SPID	Team	Location
Wilone O'Kielt	SP04	Delish	Hyderabad
Gigi Bohling	SP05	Delish	Hyderabad
Curtice Advani	SP06	Delish	Hyderabad

Salesperson	SPID	Team	Location
Kaine Padly	SP07	Delish	Hyderabad
Andria Kimpton	SP09	Jucies	Hyderabad

...

Explanation:

- `IN` is shorthand for multiple OR conditions
- Specify multiple values in parentheses, separated by commas
- All text values must be in single quotes
- More flexible when you have many possible values
- More readable and maintainable

Advantage over OR: When you need 5, 7, or 10+ possible values, IN is much cleaner than chaining multiple OR conditions.

The LIKE Operator - Pattern Matching

Scenario: Find all people whose name begins with 'B'

Query:

```
SELECT * FROM people
WHERE salesperson LIKE 'B%';
```

Salesperson	SPID	Team	Location
Barr Faughny	SP01	Yummies	Hyderabad
Brien Boise	SP10	Jucies	Wellington
Beverie Moffet	SP19	Jucies	Seattle
Benny Karolovsky	SP32	Jucies	Paris

...

Explanation:

- `LIKE` operator performs pattern matching
- `B%` means: starts with 'B', followed by anything (%)
- `%` is a wildcard meaning "any character, zero or more times"
- Names starting with B: Boris, Bonnie, etc.

Pattern Matching Examples:

Find names starting with B:

```
LIKE 'B%'
```

Salesperson	SPID	Team	Location
Barr Faughny	SP01	Yummies	Hyderabad
Brien Boise	SP10	Jucies	Wellington
Beverie Moffet	SP19	Jucies	Seattle
Benny Karolovsky	SP32	Jucies	Paris

Find names containing B anywhere:

```
LIKE '%B%'
```

Salesperson	SPID	Team	Location
Barr Faughny	SP01	Yummies	Hyderabad
Gigi Bohling	SP05	Delish	Hyderabad
Ches Bonnell	SP08		Hyderabad
Brien Boise	SP10	Jucies	Wellington
Marney O'Breen	SP16	Jucies	Wellington

...

Find names ending with B:

```
LIKE '%l'
```

Salesperson	SPID	Team	Location
Ches Bonnell	SP08		Hyderabad
Oby Sorrel	SP20	Jucies	Seattle
Van Tuxwell	SP23	Yummies	Seattle

...

Find names with B as second character:

```
LIKE '_B%'
```

Salesperson	SPID	Team	Location
Oby Sorrel	SP20	Jucies	Seattle
Ebonee Roxburgh	SP28		Paris

...

(Where _ means exactly one character)

The NOT Operator

Scenario: Find sales where the team is NOT equal to a specific value

Query:

```
select * from products
where Category != 'Bars';
-- OR --
select * from products
where Category <> 'Bars';
-- OR --
select * from products
where not (Category = 'Bars');
```

PID	Product	Category	Size	Cost_per_box
P02	50% Dark Bites	Bites	LARGE	2.57
P06	Eclairs	Bites	LARGE	2.24
P07	Drinking Coco	Other	LARGE	1.62
P10	Spicy Special Slims	Bites	LARGE	5.79
P11	After Nines	Bites	LARGE	4.43
P14	White Choc	Other	SMALL	0.16

...

Explanation:

- `!=` and `<>` both mean "not equal to"
- `NOT` operator reverses a condition
- All three queries produce identical results

Part 4: Conditional Logic with CASE

Understanding CASE Statements

Purpose: Create categorizations or conditional logic within SELECT statements

Scenario: Categorize sales amounts into different tiers:

- Under $1,000: "Under 1K"
- $1,000 to $5,000: "Under 5K"
- $5,000 to $10,000: "Under 10K"
- Over $10,000: "10K or More"

CASE Statement Structure

Query:

```
select SaleDate,Amount ,case when Amount < 1000 then 'Under 1K' when Amount
< 5000 then 'Under 2K' when Amount < 10000 then 'Under 10K' else '10K or
More' end as amount_category from sales ;
```

SaleDate	Amount	amount_category
2021-01-01 00:00:00	8414	Under 10K
2021-01-01 00:00:00	532	Under 1K
2021-01-01 00:00:00	5376	Under 10K
2021-01-01 00:00:00	259	Under 1K
2021-01-01 00:00:00	5530	Under 10K

...

Explanation:

- `CASE` begins the conditional logic
- `WHEN condition THEN result` checks each condition sequentially
- Conditions are evaluated in order from top to bottom
- First matching condition returns its result
- `ELSE` provides default value if no conditions match
- `END` terminates the CASE statement
- Assign alias `AS amount_category` to name the result column

CASE with Multiple Conditions

You can use multiple WHEN statements and combine conditions as needed.

Query Structure Best Practices:

For clarity in longer queries, break CASE statements into multiple lines:

```
SELECT
  sale_date,
  amount
```

```
    ,CASE
      WHEN amount < 1000 THEN 'Under 1K'
      WHEN amount < 5000 THEN 'Under 5K'
      WHEN amount < 10000 THEN 'Under 10K'
      ELSE '10K or More'
    END AS amount_category
  FROM sales;
```

SaleDate	Amount	amount_category
2021-01-01 00:00:00	8414	Under 10K
2021-01-01 00:00:00	532	Under 1K
2021-01-01 00:00:00	5376	Under 10K
2021-01-01 00:00:00	259	Under 1K
2021-01-01 00:00:00	5530	Under 10K

...

Use Cases for CASE

- Create numeric categorizations
- Create text-based categorizations
- Use in WHERE clause to filter on categorizations
- Map values for reporting and analysis
- Create custom display values

Part 5: JOINs - Combining Multiple Tables

Understanding JOINs

Definition: JOINs combine data from multiple tables based on related columns.

Concept: Similar to VLOOKUP in Excel, but SQL uses more optimized methods.

Critical Prerequisite: Understand how tables are linked through foreign keys before attempting JOINs.

Database Relationships in Awesome Chocolates

Table Relationships:

- Sales table contains: `sp_id` (links to People table)
- Sales table contains: `pid` (links to Products table)
- Sales table contains: `geo_id` (links to Geography table)

Principle: IDs that appear in multiple tables represent the same entity and can be used to JOIN tables.

Basic JOIN Example

Scenario: Show sales data with the person's name instead of just ID

Without JOIN - Problem:

```
SELECT * FROM sales;
-- Shows sp01, sp02, etc. but we don't know who these people are
```

SPID	GeoID	PID	SaleDate	Amount	Customers	Boxes
SP01	G4	P04	2021-01-01 00:00:00	8414	276	495
SP02	G3	P14	2021-01-01 00:00:00	532	317	54
SP12	G2	P08	2021-01-01 00:00:00	5376	178	269
SP01	G4	P15	2021-01-01 00:00:00	259	32	22
SP19	G2	P18	2021-01-01 00:00:00	5530	4	179

...

With JOIN - Solution:

```
select
  s.SaleDate,
  s.Amount,
  p.Salesperson
from sales s
join people p on p.SPID = s.SPID;
```

SaleDate	Amount	Salesperson
2021-01-01 00:00:00	8414	Barr Faughny
2021-01-01 00:00:00	532	Dennison Crosswaite
2021-01-01 00:00:00	5376	Karlen McCaffrey
2021-01-01 00:00:00	259	Barr Faughny
2021-01-01 00:00:00	5530	Beverie Moffet

...

Explanation:

- `FROM sales s` starts with sales table, aliased as 's'
- `JOIN people p` adds the people table, aliased as 'p'
- `ON p.sp_id = s.sp_id` specifies the join condition - matching IDs
- `s.` and `p.` prefixes specify which table a column comes from
- When IDs match, data from both tables appears on the same row

Table Aliases

Purpose: Shorten long table names and make queries more readable

Syntax:

```
FROM sales s
-- OR --
FROM sales AS s
```

Consistency Practice: Use consistent aliases within your query. Example:

- `s` for sales
- `p` for people
- `pr` for products
- `g` for geography

Column Qualification

Why Qualify Columns with Table Prefix?

When columns have the same name in multiple tables, prefix with table alias:

```
s.sp_id    -- sales table's sp_id
p.sp_id    -- people table's sp_id
```

Best Practice: Even when not required, qualify columns for clarity.

LEFT JOIN vs JOIN

JOIN (INNER JOIN):

- Returns only rows where IDs match in BOTH tables
- If sales table has sp_id that doesn't exist in people table, that row is excluded

LEFT JOIN:

- Returns ALL rows from the left table (first table after FROM)
- Includes matching rows from the right table
- If no match found, right table columns show as blank/NULL
- Used to preserve all data from the primary table

Visual Representation:

```
Sales table (LEFT) ----------- People table (RIGHT)
[Keep ALL from sales]
[If match in people → Include people data]
[If no match in people → Show blank for people columns]
```

When to Use LEFT JOIN: Most common in business situations because you want to preserve all sales data even if the person's record doesn't exist in the people table.

JOIN with WHERE Clause

Scenario: Show sales under $500 for people in the "Delish" team

Query:

```
SELECT
  s.sale_date,
  s.amount,
  p.salesperson,
  p.team
FROM sales s
JOIN people p ON p.sp_id = s.sp_id
WHERE s.amount < 500
AND p.team = 'Delish';
```

Explanation:

- JOIN combines the tables
- WHERE clause filters results on joined data
- Can filter on any column from either table

Multiple JOINs

Scenario: Show sales with person name, product name, and team

Query:

```
SELECT
  s.sale_date,
  s.amount,
  p.salesperson,
  pr.product,
  p.team
FROM sales s
JOIN people p ON p.sp_id = s.sp_id
JOIN products pr ON pr.pid = s.pid;
```

Explanation:

- Chain multiple JOINs by adding additional JOIN clauses
- Each JOIN specifies its own ON condition
- Data from all three tables appears in result
- Order of JOINs: START with FROM clause, then add each JOIN sequentially

JOIN with Null Handling

Problem: Some people records might not have a team assigned (blank or NULL)

Query:

```
SELECT
  s.sale_date,
  s.amount,
  p.salesperson,
  p.team
FROM sales s
LEFT JOIN people p ON p.sp_id = s.sp_id
WHERE s.amount < 500
AND p.team IS NULL;
```

Explanation:

- `IS NULL` checks for NULL values (true null, not blank spaces)
- `IS NOT NULL` checks for non-null values

Database Nuance: Null vs Blank

- **NULL**: Truly no value assigned (appears as "NULL" in results)
- **Blank**: Empty string or spaces (appears as empty in results)

Different filtering required for each:

- NULL: `WHERE column IS NULL`
- Blank: `WHERE column = ''`

Three-Table JOIN Example

Complete Query with Multiple Filters:

```
SELECT
  s.sale_date,
  s.amount,
  p.salesperson,
  pr.product,
  g.geo
FROM sales s
JOIN people p ON p.sp_id = s.sp_id
JOIN products pr ON pr.pid = s.pid
JOIN geography g ON g.geo_id = s.geo_id
WHERE s.amount < 500
AND p.team IS NOT NULL
AND g.geo IN ('New Zealand', 'India')
ORDER BY s.sale_date;
```

Explanation:

- Combines data from 4 tables
- Multiple WHERE conditions filter results
- ORDER BY sorts by date chronologically
- Results show only sales meeting all criteria

Part 6: GROUP BY and Aggregation Functions

Understanding GROUP BY

Purpose: Summarize data at a higher level by grouping rows and applying aggregation functions.

Concept: Similar to Pivot Table in Excel - takes detailed data and creates summary reports.

When to Use: You have data at a detailed level but want to see it at a higher level.

Aggregation Functions

Common SQL aggregation functions:

Function	Purpose
`SUM()`	Add values together
`AVG()`	Calculate average
`COUNT()`	Count number of rows
`MIN()`	Find minimum value
`MAX()`	Find maximum value

Basic GROUP BY Example

Scenario: Total sales amount by geography

Query:

```
SELECT
  geo_id,
  SUM(amount) AS total_amount
FROM sales
GROUP BY geo_id;
```

Explanation:

- `SUM(amount)` adds up all amounts within each group
- `GROUP BY geo_id` creates one row for each unique geo_id value
- Results show: g1, g2, g3, g4, etc. with their total amounts

Multiple Aggregation Functions

Query:

```
SELECT
  geo_id,
  SUM(amount) AS total_amount,
  AVG(amount) AS average_amount,
  SUM(boxes) AS total_boxes
FROM sales
GROUP BY geo_id;
```

Explanation:

- Multiple aggregation functions on same GROUP BY
- Each function operates within the group
- Results show summary statistics for each geography

GROUP BY with JOINs

Scenario: Total sales amount by country (using geography table)

Query:

```
SELECT
  g.geo,
  SUM(s.amount) AS total_amount
FROM sales s
JOIN geography g ON g.geo_id = s.geo_id
GROUP BY g.geo;
```

Explanation:

- JOIN merges tables first
- Then GROUP BY operates on joined data
- GROUP BY uses the column being displayed (geo name from geography table)
- Results are more readable with actual country names instead of IDs

Multi-Level Grouping

Scenario: Total sales by product category AND team

Query:

```
SELECT
  pr.category,
  p.team,
  SUM(s.boxes) AS total_boxes,
```

```
  SUM(s.amount) AS total_amount
FROM sales s
JOIN people p ON p.sp_id = s.sp_id
JOIN products pr ON pr.pid = s.pid
GROUP BY pr.category, p.team
ORDER BY pr.category, p.team;
```

Explanation:

- `GROUP BY pr.category, p.team` groups by two levels
- Creates combinations like: Bars-Team1, Bars-Team2, Chocolate-Team1, etc.
- Any column displayed must either be:
  - In the GROUP BY clause, OR
  - Wrapped in an aggregation function (SUM, AVG, COUNT, etc.)

Critical Rule: You cannot display columns not in GROUP BY unless they're aggregated. This will cause an error.

Correct Structure: Display = GROUP BY + Aggregated Columns

Filtering GROUP BY Results with WHERE

Query:

```
SELECT
  pr.category,
  p.team,
  SUM(s.boxes) AS total_boxes,
  SUM(s.amount) AS total_amount
FROM sales s
JOIN people p ON p.sp_id = s.sp_id
JOIN products pr ON pr.pid = s.pid
WHERE p.team IS NOT NULL
GROUP BY pr.category, p.team
ORDER BY total_amount DESC;
```

Explanation:

- `WHERE` filters BEFORE grouping
- Removes blank team records before aggregation
- Results only include non-null teams

Note: WHERE filters individual rows BEFORE aggregation. For filtering AFTER aggregation, use HAVING (not covered in detail here).

Sorting GROUP BY Results

Query:

```
SELECT
  g.geo,
  SUM(s.amount) AS total_amount
FROM sales s
JOIN geography g ON g.geo_id = s.geo_id
GROUP BY g.geo
ORDER BY total_amount DESC;
```

Explanation:

- `ORDER BY total_amount DESC` sorts results by aggregated column
- DESC = descending (highest to lowest)
- Highest total amount countries appear first

LIMIT for Top N Results

Scenario: Show only top 10 products by sales

Query:

```
SELECT
  pr.product,
  SUM(s.amount) AS total_amount
FROM sales s
JOIN products pr ON pr.pid = s.pid
GROUP BY pr.product
ORDER BY total_amount DESC
LIMIT 10;
```

Explanation:

- `LIMIT 10` restricts output to first 10 rows
- Works on sorted data, so first 10 are the TOP 10
- Applies AFTER ordering

Query Execution Order:

1. FROM/JOIN (get data and combine tables)
2. WHERE (filter rows)
3. GROUP BY (aggregate)
4. ORDER BY (sort)
5. LIMIT (restrict output)

Advanced Tips and Best Practices

Query Writing Best Practices

1. Write FROM clause first:

```
SELECT
FROM table_name
```

Then fill in SELECT columns using auto-suggest.

2. Format for readability:

- Put SELECT, FROM, WHERE, GROUP BY, ORDER BY on separate lines
- Use proper indentation
- Use table aliases consistently

3. Use meaningful aliases:

```
FROM sales s        -- Clear alias
JOIN people p ON ... -- Consistent naming
```

4. Always qualify columns:

```
s.amount         -- Clear which table
p.salesperson    -- No ambiguity
```

5. Include semicolons:

```
SELECT * FROM sales;
SELECT * FROM people;
```

Semicolon marks end of statement, allows multiple queries in one file.

Common Mistakes to Avoid

Mistake 1: Forgetting GROUP BY

```
-- WRONG:
SELECT category, amount FROM sales;
-- Error or incomplete results

-- CORRECT:
SELECT category, SUM(amount) FROM sales GROUP BY category;
```

Mistake 2: Using unaggregated column in GROUP BY

```sql
-- WRONG:
SELECT category, product, SUM(amount)
FROM sales
GROUP BY category;
-- Error: product not in GROUP BY

-- CORRECT:
SELECT category, product, SUM(amount)
FROM sales
GROUP BY category, product;
```

Mistake 3: Referencing alias in WHERE clause

```sql
-- WRONG:
SELECT amount AS amt
WHERE amt > 1000;
-- Error: alias not recognized in WHERE

-- CORRECT:
SELECT amount AS amt
WHERE amount > 1000;
```

Mistake 4: Missing ON condition in JOIN

```sql
-- WRONG:
SELECT * FROM sales JOIN people;
-- Result: Cartesian product (too many rows!)

-- CORRECT:
SELECT * FROM sales
JOIN people ON people.sp_id = sales.sp_id;
```

Understanding NULL in SQL

NULL vs Blank:

- **NULL**: No value assigned in database
- **Blank**: Empty string or spaces

Checking for NULL:

```sql
WHERE column IS NULL        -- Check for true NULL
WHERE column IS NOT NULL    -- Check for non-NULL
WHERE column != NULL        -- WRONG! Always false
```

Important: Use IS NULL, not = NULL. Never use != NULL.

Date Functions

Extract components:

```
YEAR(sale_date)      -- Returns year as number
MONTH(sale_date)     -- Returns month as number
DAY(sale_date)       -- Returns day as number
WEEKDAY(sale_date)   -- Returns day of week (0-6)
```

Date format: YYYY-MM-DD (Year-Month-Day)

Saving Your Work

To save queries:

1. Go to File menu
2. Select "Save Script"
3. Choose location and filename
4. File saves as .sql format

Purpose: Reuse queries later, share with colleagues, maintain query library.

Learning Resources and Next Steps

Recommended Learning Path

1. **Master the basics** covered in this guide
2. **Practice with provided homework problems** (shown in video)
3. **Study JOINs deeper** - read additional resources for complex scenarios
4. **Learn HAVING clause** - for filtering aggregated data
5. **Explore advanced functions** - window functions, subqueries, etc.

Where to Use SQL

After mastering SQL queries, use your data with:

- **Power BI**: Data visualization and analysis
- **Excel**: Data analysis and reporting
- **Python**: Data science and machine learning
- **Tableau**: Advanced visualization

Practice Importance

Key Principle: Learning SQL requires consistent practice. Without practice, you will forget most concepts.

Practice Strategy:

- Download provided homework problems
- Solve easy problems first
- Progress to hard problems
- Hard problems require investigation beyond basic concepts
- Consistent practice builds mastery

Quick Reference

Comparison Operators

```
>     Greater than
<     Less than
=     Equal to
>=    Greater than or equal to
<=    Less than or equal to
!=    Not equal to
<>    Not equal to (alternative)
```

Logical Operators

```
AND   Both conditions must be true
OR    At least one condition must be true
NOT   Reverses condition
IN    Value is in list
BETWEEN    Value is between two numbers
LIKE   Pattern matching
```

Aggregation Functions

```
SUM(column)     Total of values
AVG(column)     Average of values
COUNT(column)   Number of rows
MIN(column)     Minimum value
MAX(column)     Maximum value
```

Key Clauses

```
SELECT      Specify columns to return
FROM        Specify primary table
WHERE       Filter rows before grouping
JOIN        Combine multiple tables
ON          Specify join condition
GROUP BY    Group rows for aggregation
```

```
ORDER BY    Sort results
LIMIT       Restrict number of rows
```

Query Structure (Proper Order)

```sql
SELECT columns
FROM table
WHERE conditions
GROUP BY columns
ORDER BY columns
LIMIT number;
```

Conclusion

SQL is a powerful tool for data analysis. The 50 queries and concepts covered in this guide provide a strong foundation for working with databases. Success with SQL requires:

1. Understanding table structures and relationships
2. Mastering basic clauses (SELECT, WHERE, FROM)
3. Using JOINs to combine related data
4. Aggregating data with GROUP BY
5. Consistent practice and exploration

End-of-File

The KintsugiStack repository, authored by Kintsugi-Programmer, is less a comprehensive resource and more an Artifact of Continuous Research and Deep Inquiry into Computer Science and Software Engineering. It serves as a transparent ledger of the author's relentless pursuit of mastery, from the foundational algorithms to modern full-stack implementation.

> Made with 💚 Kintsugi-Programmer