Lecture 09: Inspecting and Modifying Data

DATA 351: Data Management with SQL

Lucas P. Cordova, Ph.D.

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This lecture covers how to inspect raw data for quality issues and modify it using SQL. We continue with our music catalog dataset, finding duplicates, missing values, inconsistent casing, and typos in a staging table, then fixing them with UPDATE, ALTER TABLE, DELETE, and transactions before migrating data into normalized tables.

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1 Learning Objectives

1.1 What You Will Be Able to Do

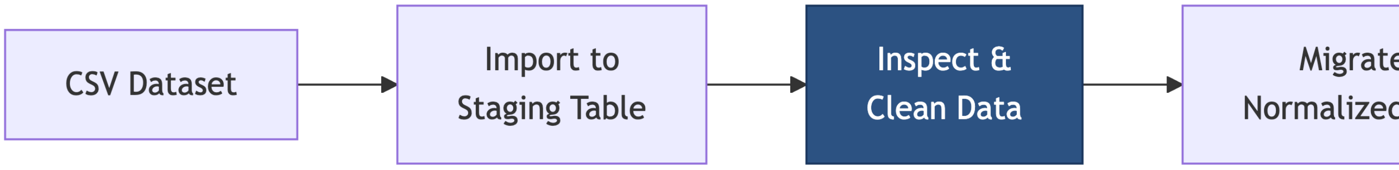
By the end of this lesson, you will be able to:

- **Identify** (Remember) common data quality issues: duplicates, NULLs, inconsistencies, and typos in a staging table
- **Analyze** (Analyze) raw data using GROUP BY, count(), length(), and WHERE to find anomalies
- **Apply** (Apply) UPDATE, ALTER TABLE ADD/DROP COLUMN, and DELETE to fix data quality issues
- **Create** (Apply) backup copies of tables and temporary columns as safety nets before modifying data
- **Evaluate** (Evaluate) when to use transactions (START TRANSACTION, COMMIT, ROLLBACK) to protect against mistakes
- **Construct** (Create) a multi-step data cleaning workflow that prepares staging data for migration into normalized tables

2 The Big Picture

2.1 Where We Are

Last time we built tables with constraints. Now we clean the data that goes into them.



This is the step most people skip and then regret. Constraints will reject dirty data at the door, so we need to clean it first.

2.2 Today's Agenda

We are data janitors today. No cap, this is 80% of real data work:

- Setting up exercise data
- Finding duplicates, NULLs, inconsistencies, and typos
- Backup strategies (because mistakes happen)

- UPDATE for fixing data
- ALTER TABLE for temporary columns
- DELETE for removing bad rows
- Transactions for safety
- Preparing data for migration

3 Setting Up the Exercise Data

3.1 Creating the Database

Open **Beekeeper Studio** or **pgAdmin** and run:

```sql
CREATE DATABASE lc_music;
```

Then **connect to the lc_music database** before running the next step.

3.2 Loading the Script

1. Download `music_staging_setup.sql` from the course site
2. Open it in Beekeeper or pgAdmin (connected to `lc_music`)
3. Select all (Ctrl+A) and execute (Ctrl+Enter in Beekeeper, or click Execute in pgAdmin)

The script creates:

- `music_catalog_staging` – our messy raw data (40+ rows of chaos)
- `artists`, `albums`, `tracks` – our clean normalized target tables (empty, waiting)

3.3 Verify the Setup

```sql
SELECT count(*) FROM music_catalog_staging;
```

You should see **40 rows**. If you see 0, you did not run the INSERT statements. If you see 80, you ran the script twice. Either way, drop and re-run.

```sql
SELECT * FROM music_catalog_staging LIMIT 10;
```

Take a look. Notice anything suspicious? We are about to find out.

4 Phase 1: Inspecting the Data

4.1 The Inspection Mindset

Before you fix anything, you need to **understand what is broken**. Think of it like a doctor's exam before surgery. Every good data cleaning workflow starts with questions:

- How many rows do we have?
- Are there duplicates?
- Are there NULL values?
- Is the casing consistent?

- Are there typos?
- Are values in valid ranges?
- Do categorical values match?
- Are related fields consistent?

4.2 Finding Duplicates

The most common data quality issue. Let us check for duplicate catalog IDs:

```
SELECT catalog_id,
       count(*) AS id_count
FROM music_catalog_staging
GROUP BY catalog_id
HAVING count(*) > 1
ORDER BY id_count DESC;
```

`CAT-1001` appears twice – an exact duplicate row. But duplicates are not always that obvious.

4.3 Sneaky Duplicates

Sometimes the catalog_id is different but the data is the same:

```
SELECT artist_name, album_title, track_title, track_number,
       count(*) AS dupe_count
FROM music_catalog_staging
GROUP BY artist_name, album_title, track_title, track_number
HAVING count(*) > 1;
```

The Beatles' "Come Together" appears with both `CAT-1010` and `CAT-1099`. Same song, different ID. This is real-world data distribution drama.

4.4 Knowledge Check 1

True or False: If every row has a unique catalog_id, then the table has no duplicates.

Think about it.

4.5 Answer: Knowledge Check 1

False!

Duplicate *data* can exist even with unique IDs. A duplicate is about the *content*, not just the identifier. Always check for duplicates on the **meaningful columns**, not just the ID.

4.6 Finding NULL Values

NULLs are the ghosts of your database – invisible until they break something:

```sql
SELECT
    count(*) AS total_rows,
    count(*) - count(genre) AS missing_genre,
    count(*) - count(label) AS missing_label,
    count(*) - count(track_title) AS missing_track_title,
    count(*) - count(track_number) AS missing_track_number,
    count(*) - count(track_duration_sec) AS missing_track_duration
FROM music_catalog_staging;
```

`count(column)` skips NULLs while `count(*)` counts all rows. The difference reveals the gaps.

4.7 Which Rows Have NULLs?

```sql
SELECT catalog_id, artist_name, album_title, genre, label,
       track_title
FROM music_catalog_staging
WHERE genre IS NULL
   OR label IS NULL
   OR track_title IS NULL;
```

Daft Punk is missing genre and label info. Amy Winehouse has a NULL track. These need decisions: fill them in, or remove them?

4.8 Inconsistent Casing

This is low-key the most annoying data problem:

```
SELECT artist_name,
       count(*) AS name_count
FROM music_catalog_staging
GROUP BY artist_name
ORDER BY artist_name;
```

You will see entries like:

- `Beyonce` vs `BEYONCE`
- `the rolling stones` vs `The Rolling Stones` vs `THE ROLLING STONES`
- `Taylor Swift` vs `Taylor swift`
- `kendrick lamar` vs `Kendrick Lamar`

Same artist, different vibes. The database treats them as completely different values.

4.9 Inconsistent Genre and Label

It is not just artist names. Check genres:

```
SELECT genre, count(*) AS genre_count
FROM music_catalog_staging
WHERE genre IS NOT NULL
GROUP BY genre
ORDER BY genre;
```

`Hip-Hop` vs `hip-hop`, `Alternative` vs `alternative`, `Pop` vs `pop`. Same energy, different casing.

Labels too:

```
SELECT label, count(*) AS label_count
FROM music_catalog_staging
WHERE label IS NOT NULL
GROUP BY label
ORDER BY label;
```

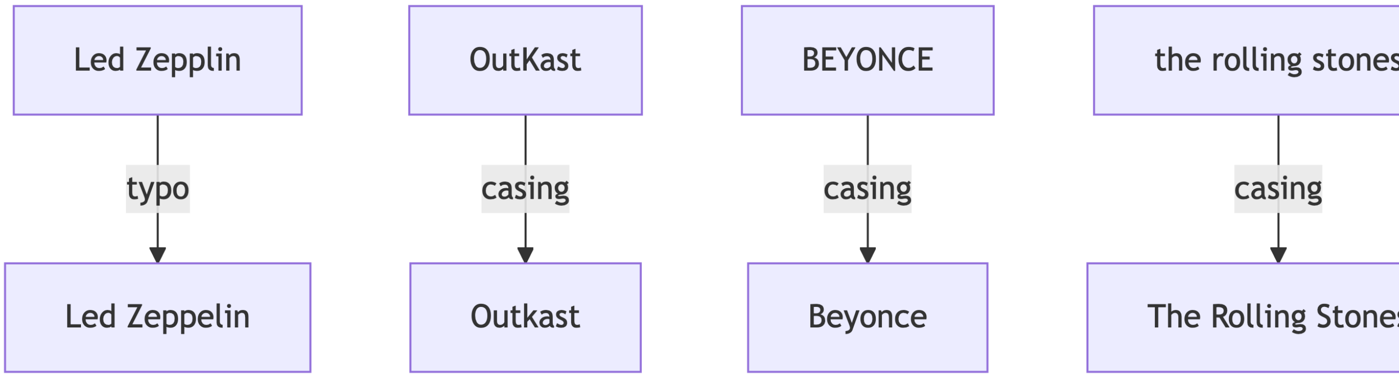
`LaFace` vs `Laface Records`, `Capitol` vs `Capitol Records`, `TDE` vs `Top Dawg Entertainment`. Absolute chaos.

4.10 Finding Typos

Check for misspellings by looking at distinct values:

```sql
SELECT DISTINCT artist_name
FROM music_catalog_staging
ORDER BY artist_name;
```

Spot it? `Led Zepplin` – missing the second 'e'. Also `OutKast` vs `Outkast`.



4.11 Validating Numeric Ranges

Check for values that are clearly wrong:

```sql
SELECT catalog_id, artist_name, album_title, release_year
FROM music_catalog_staging
WHERE release_year NOT BETWEEN 1900 AND 2100
   OR release_year IS NULL;
```

Nirvana with `release_year = 9119`? Grunge was ahead of its time, but not *that* far ahead.

```sql
SELECT catalog_id, artist_name, album_title, duration_min
FROM music_catalog_staging
WHERE duration_min <= 0;
```

Pink Floyd with `duration_min = -42.5`. Albums cannot have negative runtime. Not even conceptually.

4.12 Knowledge Check 2

Which SQL function helps you find rows where zip codes or text fields have unexpected lengths?

A) `count()`

B) `length()`

C) `trim()`

D) `upper()`

4.13 Answer: Knowledge Check 2

B) `length()`

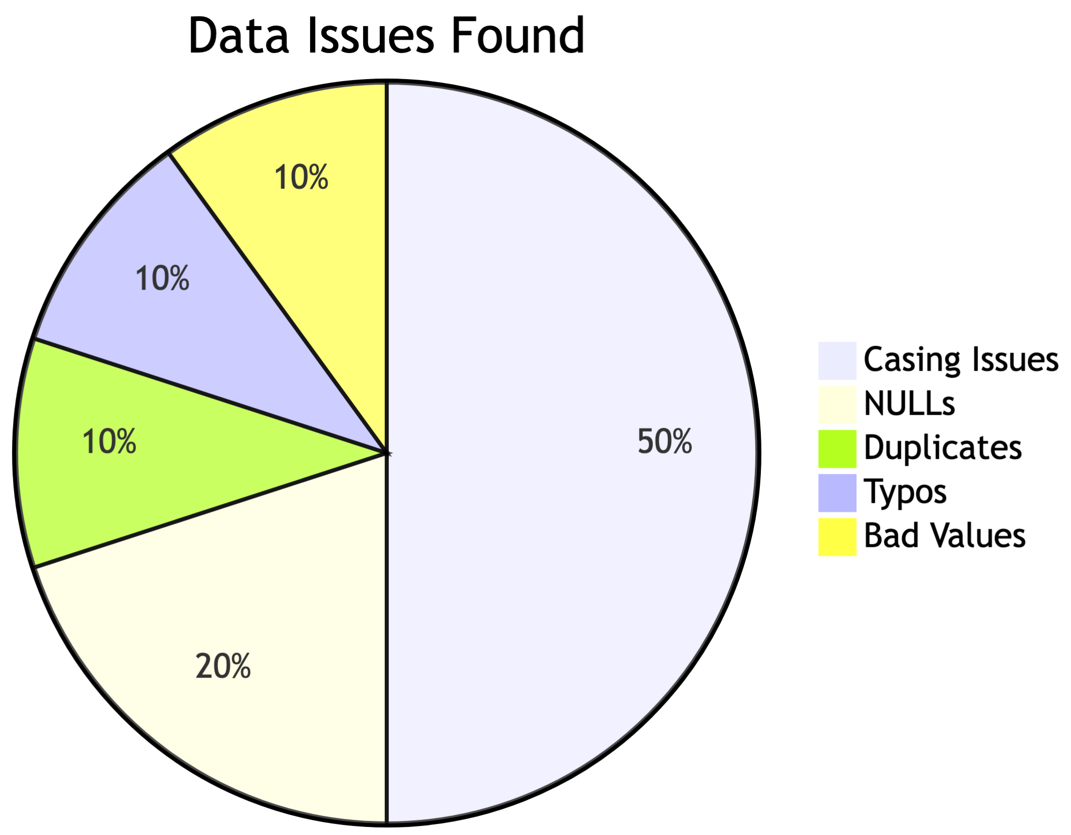
The `length()` function returns the number of characters in a string. Useful for spotting truncated data, padded values, or fields that are suspiciously short or long.

```sql
SELECT catalog_id, length(catalog_id) AS id_length
FROM music_catalog_staging
GROUP BY catalog_id, length(catalog_id)
ORDER BY id_length;
```

4.14 Data Quality Summary

Here is what we found:

Issue	Count
Duplicate catalog_id	1 row
Sneaky content duplicates	1 row
NULL genre	2 rows
NULL label	1 row
NULL track info	1 row
Inconsistent casing	10+ rows
Typos	2+ rows
Bad release year	1 row
Negative duration	1 row



That is a lot of mess for 40 rows. Imagine a dataset with 6 million. This is why inspection matters.

5 Phase 2: Safety First – Backups

5.1 Why Backups Before Changes

We are about to start modifying data. Before you UPDATE or DELETE anything, **make a backup**. This is non-negotiable. It is the database equivalent of saving your game before the boss fight.

5.2 Creating a Table Backup

```
CREATE TABLE music_catalog_staging_backup AS
SELECT * FROM music_catalog_staging;
```

This creates an exact copy. Verify it:

```sql
SELECT
    (SELECT count(*) FROM music_catalog_staging) AS original,
    (SELECT count(*) FROM music_catalog_staging_backup) AS backup;
```

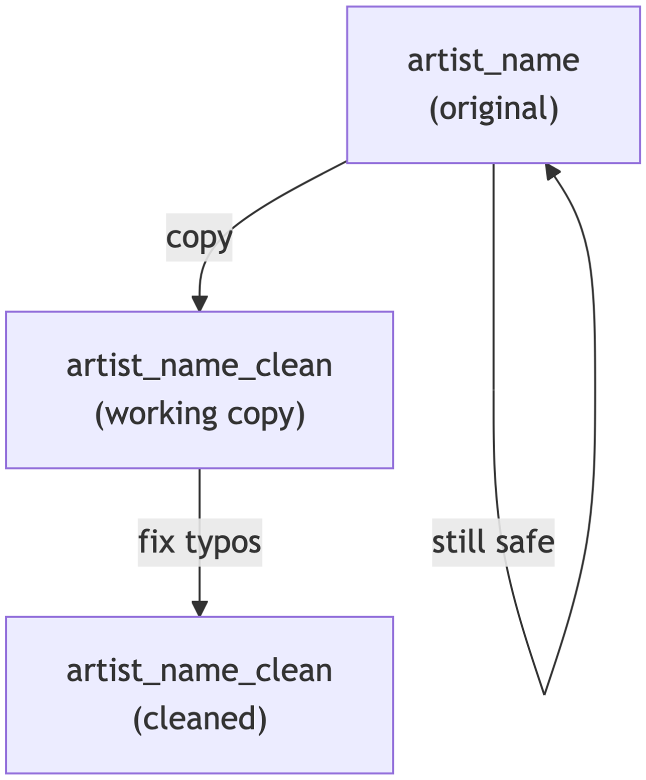
Both should show **40**. If they match, you are safe to proceed.

5.3 Using Temporary Columns

Instead of modifying a column directly, create a copy first:

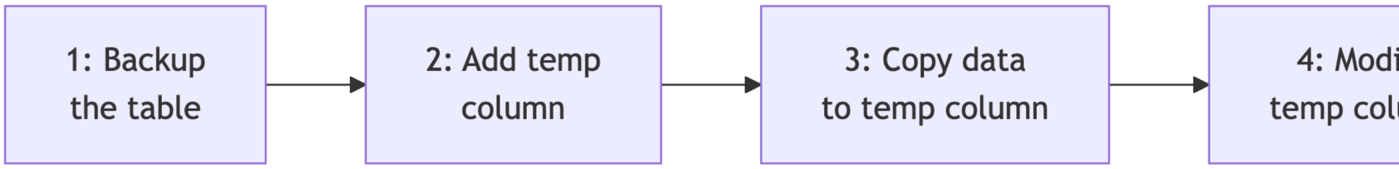
```sql
ALTER TABLE music_catalog_staging
    ADD COLUMN artist_name_clean varchar(200);

UPDATE music_catalog_staging
SET artist_name_clean = artist_name;
```

Now you can modify `artist_name_clean` while keeping the original `artist_name` intact. If you mess up, you still have the original.



5.4 The Safety Pattern

Every modification should follow this pattern:



This is not paranoia. This is professionalism.

5.5 Knowledge Check 3

You need to fix typos in the `artist_name` column. What should you do FIRST?

A) Run UPDATE directly on `artist_name`

B) Create a backup copy of the table

C) Delete all the bad rows

D) Drop the column and recreate it

5.6 Answer: Knowledge Check 3

B) Create a backup copy of the table

Always create a backup before modifying data. If your UPDATE goes wrong (and it will, eventually), you want a way to restore the original. No backup = no undo = no sleep tonight.

6 Phase 3: Fixing the Data

6.1 The UPDATE Statement

`UPDATE` modifies existing rows. The basic syntax:

```sql
UPDATE table_name
SET column = value
WHERE condition;
```

The WHERE clause is critical. Without it, every row gets updated. That is almost never what you want.

```sql
-- Updates ALL rows (probably bad)
UPDATE music_catalog_staging
SET genre = 'Rock';

-- Updates only matching rows (probably good)
UPDATE music_catalog_staging
SET genre = 'Rock'
WHERE catalog_id = 'CAT-1095';
```

6.2 Fixing Inconsistent Artist Casing

Let us standardize artist names. First, add and populate our working column:

```sql
ALTER TABLE music_catalog_staging
    ADD COLUMN artist_name_clean varchar(200);

UPDATE music_catalog_staging
SET artist_name_clean = artist_name;
```

Now fix the casing issues one artist at a time:

```sql
UPDATE music_catalog_staging
SET artist_name_clean = 'Beyonce'
WHERE lower(artist_name) = 'beyonce';

UPDATE music_catalog_staging
SET artist_name_clean = 'The Rolling Stones'
WHERE lower(artist_name) = 'the rolling stones';

UPDATE music_catalog_staging
SET artist_name_clean = 'Taylor Swift'
WHERE lower(artist_name) = 'taylor swift';

UPDATE music_catalog_staging
SET artist_name_clean = 'Kendrick Lamar'
WHERE lower(artist_name) = 'kendrick lamar';

UPDATE music_catalog_staging
SET artist_name_clean = 'Outkast'
WHERE lower(artist_name) = 'outkast';
```

6.3 Fixing Typos

The `Led Zepplin` typo needs a targeted fix:

```sql
UPDATE music_catalog_staging
SET artist_name_clean = 'Led Zeppelin'
WHERE artist_name_clean = 'Led Zepplin';
```

Verify it:

```sql
SELECT DISTINCT artist_name, artist_name_clean
FROM music_catalog_staging
ORDER BY artist_name_clean;
```

Every artist should now have a single clean name in `artist_name_clean`.

6.4 Fixing Inconsistent Genres

Same pattern – add a clean column, then standardize:

```sql
ALTER TABLE music_catalog_staging
    ADD COLUMN genre_clean varchar(50);

UPDATE music_catalog_staging
SET genre_clean = initcap(genre)
WHERE genre IS NOT NULL;
```

`initcap()` capitalizes the first letter of each word. But check the results:

```sql
SELECT DISTINCT genre, genre_clean
FROM music_catalog_staging
ORDER BY genre_clean;
```

`Hip-Hop` becomes `Hip-Hop` (correct). `alternative` becomes `Alternative` (correct). `R&B` becomes... `R&b`. Not ideal. Fix it:

```sql
UPDATE music_catalog_staging
SET genre_clean = 'R&B'
WHERE lower(genre) = 'r&b';
```

6.5 Fixing Inconsistent Labels

Labels have variations like `LaFace` vs `Laface Records` and `TDE` vs `Top Dawg Entertainment`:

```sql
ALTER TABLE music_catalog_staging
    ADD COLUMN label_clean varchar(100);

UPDATE music_catalog_staging
SET label_clean = label;

UPDATE music_catalog_staging
SET label_clean = 'LaFace Records'
WHERE label_clean LIKE 'LaFace%'
   OR label_clean LIKE 'Laface%';

UPDATE music_catalog_staging
SET label_clean = 'Capitol Records'
WHERE label_clean LIKE 'Capitol%';

UPDATE music_catalog_staging
SET label_clean = 'Big Machine Records'
WHERE label_clean LIKE 'Big Machine%';

UPDATE music_catalog_staging
SET label_clean = 'Top Dawg Entertainment'
WHERE label_clean IN ('TDE', 'Top Dawg Entertainment');

UPDATE music_catalog_staging
SET label_clean = 'Rolling Stones Records'
WHERE label_clean LIKE 'Rolling Stones%';
```

6.6 Knowledge Check 4

What does this query do?

```sql
UPDATE music_catalog_staging
SET genre_clean = initcap(genre);
```

A) Capitalizes every letter in the genre

B) Lowercases the entire genre

C) Capitalizes the first letter of each word

D) Removes all spaces from the genre

6.7 Answer: Knowledge Check 4

C) Capitalizes the first letter of each word

`initcap('hip-hop')` returns `'Hip-Hop'`. It is PostgreSQL's built-in title-case function. Super useful for standardizing casing, but watch out for edge cases like `R&B`.

6.8 Fixing Bad Numeric Values

The Nirvana release year `9119` should be `1991`:

```sql
UPDATE music_catalog_staging
SET release_year = 1991
WHERE catalog_id = 'CAT-1095';
```

The Pink Floyd negative duration:

```sql
UPDATE music_catalog_staging
SET duration_min = 42.5
WHERE catalog_id = 'CAT-1105';
```

Always use the most specific WHERE clause possible. Using `catalog_id` targets exactly one row, which is what we want.

6.9 Filling NULL Values

Daft Punk's genre is Electronic. We know this, so we fill it in:

```sql
UPDATE music_catalog_staging
SET genre_clean = 'Electronic'
WHERE artist_name_clean = 'Daft Punk'
  AND genre_clean IS NULL;
```

The missing label:

```sql
UPDATE music_catalog_staging
SET label_clean = 'Columbia'
WHERE artist_name_clean = 'Daft Punk'
  AND label_clean IS NULL;
```

6.10 Using UPDATE with Concatenation

The textbook shows a useful pattern for fixing padded or truncated values using the concatenation operator `||`:

```sql
-- Example: If zip codes were too short, you could pad them:
-- SET zip = '0' || zip WHERE length(zip) = 4;

-- In our data, we could build a full catalog reference:
SELECT catalog_id || ' - ' || artist_name_clean || ' - ' ||
       album_title AS full_reference
FROM music_catalog_staging
LIMIT 5;
```

The `||` operator glues strings together. `'abc' || '123'` gives `'abc123'`. Useful for building composite values or fixing formatting issues.

7 Phase 4: Removing Bad Rows

7.1 DELETE FROM

`DELETE` removes rows. Like UPDATE, it needs a WHERE clause unless you want to nuke everything:

```sql
-- Delete specific rows
DELETE FROM table_name
WHERE condition;

-- Delete ALL rows (the nuclear option)
DELETE FROM table_name;
```

7.2 Removing Exact Duplicates

Remember our duplicate `CAT-1001`? We need to remove one copy. PostgreSQL has a hidden column called `ctid` (the physical row location) that helps:

```sql
DELETE FROM music_catalog_staging
WHERE ctid NOT IN (
    SELECT min(ctid)
    FROM music_catalog_staging
    GROUP BY catalog_id, artist_name, album_title, track_title,
                  track_number
);
```

This keeps the first occurrence of each unique combination and deletes the rest.

7.3 Removing Content Duplicates

The Beatles' "Come Together" exists with two different catalog IDs. Keep one, remove the other:

```
DELETE FROM music_catalog_staging
WHERE catalog_id = 'CAT-1099';
```

7.4 Handling the Amy Winehouse NULL Row

The row with NULL track info is incomplete. Depending on your business rules, you might:

```
-- Option A: Delete it
DELETE FROM music_catalog_staging
WHERE catalog_id = 'CAT-1100';

-- Option B: Keep it and fill in the data later
-- (leave it alone for now)
```

For our exercise, let us delete it since we need track info for our normalized tables:

```
DELETE FROM music_catalog_staging
WHERE track_title IS NULL;
```

7.5 Verify After Deletion

```
SELECT count(*) FROM music_catalog_staging;
```

We started with 40 rows. After removing 1 exact duplicate, 1 content duplicate, and 1 NULL track row, we should have **37 rows**.

7.6 Knowledge Check 5

What happens if you run `DELETE FROM music_catalog_staging;` without a WHERE clause?

A) It deletes the table structure and all data

B) It deletes all rows but keeps the table structure

C) It raises an error because WHERE is required

D) It deletes only NULL rows

7.7 Answer: Knowledge Check 5

B) It deletes all rows but keeps the table structure

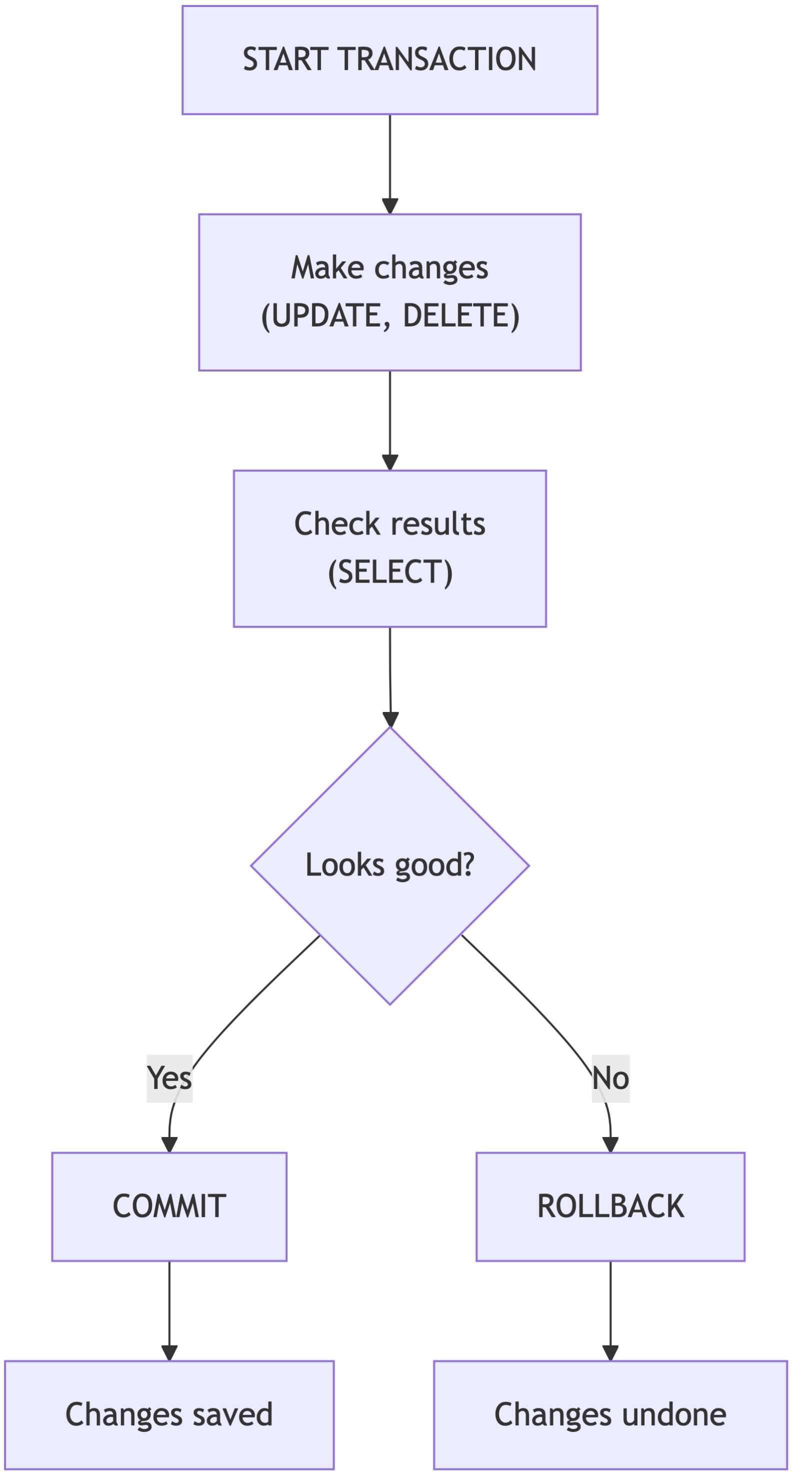
`DELETE FROM` without WHERE removes every row but the table still exists (empty). If you want to remove the table entirely, that is `DROP TABLE`. Big difference. One empties the house, the other demolishes it.

8 Phase 5: Transactions

8.1 Why Transactions Matter

Every UPDATE and DELETE is **permanent** by default. Transactions let you preview changes before committing them.

Think of it like trying on clothes before buying. You can put them back if they do not fit.


START TRANSACTION
Make changes (UPDATE, DELETE)
Check results (SELECT)
Looks good?
Yes
No
COMMIT
ROLLBACK
Changes saved
Changes undone

8.2 Transaction Syntax

```sql
START TRANSACTION;

UPDATE music_catalog_staging
SET artist_name_clean = 'Beyoncee'  -- oops, typo!
WHERE artist_name_clean = 'Beyonce';

-- Check what we did
SELECT DISTINCT artist_name_clean
FROM music_catalog_staging
ORDER BY artist_name_clean;

-- Nope, that is wrong. Undo everything.
ROLLBACK;
```

After ROLLBACK, the data is exactly as it was before START TRANSACTION. Crisis averted.

8.3 COMMIT: Making It Permanent

If the changes look correct, use COMMIT:

```sql
START TRANSACTION;

UPDATE music_catalog_staging
SET artist_name_clean = 'Beyonce'
WHERE lower(artist_name) = 'beyonce';

-- Verify
SELECT DISTINCT artist_name_clean
FROM music_catalog_staging
WHERE lower(artist_name) = 'beyonce';

-- Looks right. Lock it in.
COMMIT;
```

After COMMIT, the changes are permanent. No going back (unless you have that backup table we made earlier).

8.4 When to Use Transactions

Use a Transaction	Skip Transaction
Bulk UPDATEs on many rows	Single-row changes with backup
Any DELETE operation	SELECT queries (read-only)
Multi-step changes that must succeed together	Adding columns (ALTER TABLE)
When you are not 100% sure about the WHERE clause	When you have a backup and are confident

Pro tip: if you are asking yourself "should I use a transaction?" the answer is yes.

8.5 Knowledge Check 6

You ran START TRANSACTION, then an UPDATE that changed 500 rows incorrectly. What command undoes the damage?

A) `UNDO;`

B) `REVERT;`

C) `ROLLBACK;`

D) `CTRL+Z;`

8.6 Answer: Knowledge Check 6

C) `ROLLBACK;`

ROLLBACK reverses all changes made since START TRANSACTION. There is no UNDO or CTRL+Z in SQL. And `CTRL+Z` only works in your text editor, not on your data.

9 Phase 6: Cleanup and Preparation

9.1 Dropping Temporary Columns

Once you have verified your clean columns are correct, you can either:

1. Drop the old columns and rename the clean ones
2. Keep both for reference

```sql
-- Drop the original messy columns
ALTER TABLE music_catalog_staging DROP COLUMN artist_name;
ALTER TABLE music_catalog_staging DROP COLUMN genre;
ALTER TABLE music_catalog_staging DROP COLUMN label;

-- Rename clean columns to the standard names
ALTER TABLE music_catalog_staging
    RENAME COLUMN artist_name_clean TO artist_name;
ALTER TABLE music_catalog_staging
    RENAME COLUMN genre_clean TO genre;
ALTER TABLE music_catalog_staging
    RENAME COLUMN label_clean TO label;
```

9.2 Dropping the Backup Table

Once you are confident in your cleaned data and have migrated it to the normalized tables, you can remove the backup:

```sql
DROP TABLE music_catalog_staging_backup;
```

Only do this when you are truly done. There is no recovering a dropped table (unless you have database-level backups, which you should in production).

9.3 The Table Swap Trick

The textbook shows a clever pattern for replacing a table with an updated version:

```sql
-- Create an improved copy with an extra column
CREATE TABLE music_catalog_staging_v2 AS
SELECT *,
       now()::date AS cleaned_date
FROM music_catalog_staging;

-- Swap the tables using rename
ALTER TABLE music_catalog_staging
    RENAME TO music_catalog_staging_old;
ALTER TABLE music_catalog_staging_v2
    RENAME TO music_catalog_staging;
ALTER TABLE music_catalog_staging_old
    RENAME TO music_catalog_staging_backup;
```

This adds a `cleaned_date` column and swaps the tables without downtime. The old version becomes the new backup.

9.4 Knowledge Check 7

What is the difference between `DELETE FROM table_name;` and `DROP TABLE table_name;`?

Think about what survives each command.

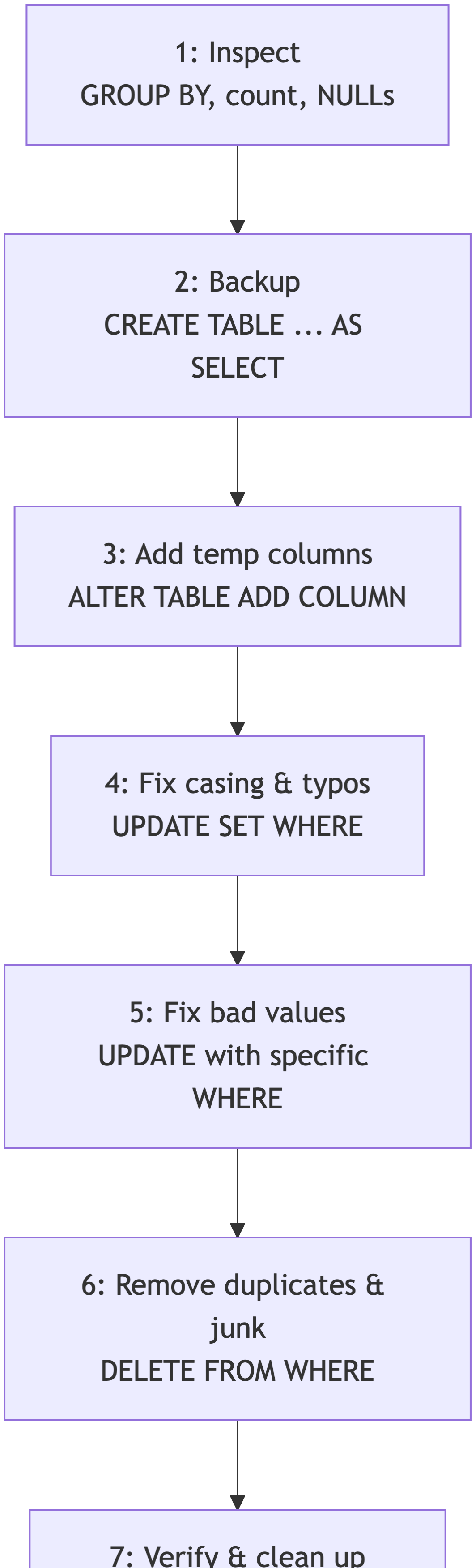
9.5 Answer: Knowledge Check 7

- `DELETE FROM table_name;` removes all **rows** but the table structure (columns, constraints, indexes) still exists. You can INSERT new data immediately.
- `DROP TABLE table_name;` removes the table **entirely** – structure, data, constraints, indexes, everything. Gone. Reduced to atoms.

One is emptying a filing cabinet. The other is throwing the filing cabinet in a dumpster.

10 Phase 7: The Full Cleaning Workflow

10.1 Summary: Our Data Cleaning Pipeline



10.2 Key SQL Commands Cheat Sheet

Inspection:

Task	SQL
Count rows	`count(*)`
Find dupes	`GROUP BY ... HAVING count(*) > 1`
Find NULLs	`WHERE col IS NULL`
Check lengths	`length(col)`
Distinct values	`SELECT DISTINCT col`

Modification:

Task	SQL
Update data	`UPDATE SET WHERE`
Add column	`ALTER TABLE ADD COLUMN`
Drop column	`ALTER TABLE DROP COLUMN`
Rename column	`ALTER TABLE RENAME COLUMN`
Delete rows	`DELETE FROM WHERE`
Drop table	`DROP TABLE`

10.3 Key SQL Commands Cheat Sheet (cont.)

Safety:

Task	SQL
Backup table	`CREATE TABLE backup AS SELECT * FROM original`
Start transaction	`START TRANSACTION;`
Save changes	`COMMIT;`
Undo changes	`ROLLBACK;`
Title case	`initcap(col)`
Concatenate	`col1 || col2`
Lowercase	`lower(col)`

10.4 Knowledge Check 8 (Open Answer)

You receive a CSV with 50,000 rows of customer data. Before loading it into your production tables, describe the **first five things** you would do to inspect and prepare the data. Use what we learned today.

Take 2 minutes. Write it down. Compare with a neighbor.

10.5 Sample Answer: Knowledge Check 8

1. **Import into a staging table** (no constraints yet)
2. **Count rows** to verify the full file loaded
3. **Check for duplicates** using GROUP BY + HAVING on key columns
4. **Check for NULLs** in required fields using count(*) - count(col)
5. **Check for inconsistencies** in categorical columns (casing, typos) using DISTINCT and GROUP BY

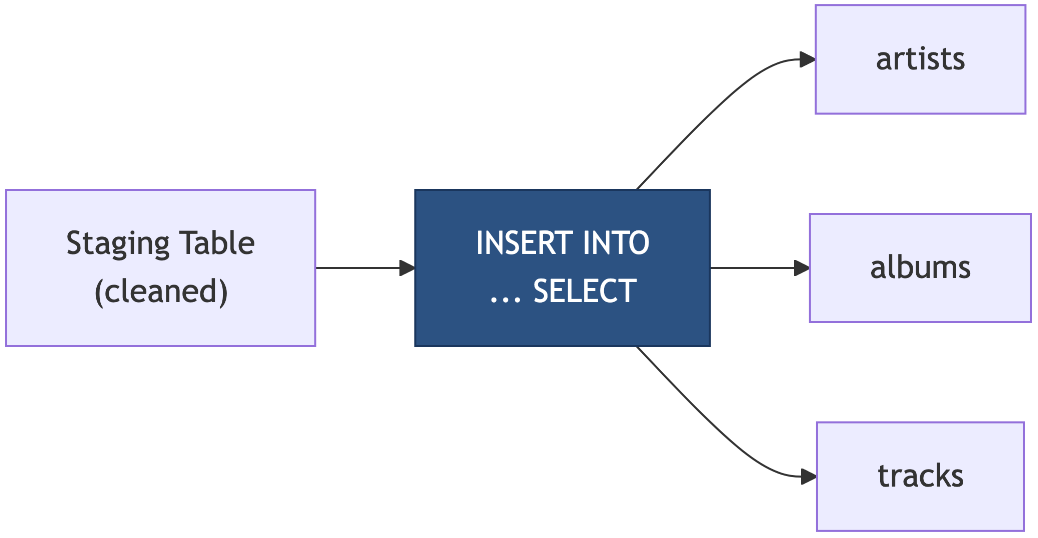
Then: backup, fix, verify, migrate. In that order. Always.

11 What Is Next

11.1 Coming Up

Now that we can inspect and clean staging data, next time we will:

- Use `INSERT INTO ... SELECT` to migrate cleaned data into normalized tables
- Handle the artist/album/track relationships during migration
- Verify referential integrity after migration
- Celebrate with clean, normalized data



12 References

12.1 Sources

1. DeBarros, A. (2022). *Practical SQL: A Beginner's Guide to Storytelling with Data* (2nd ed.). No Starch Press. Chapter 9: Inspecting and Modifying Data.
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