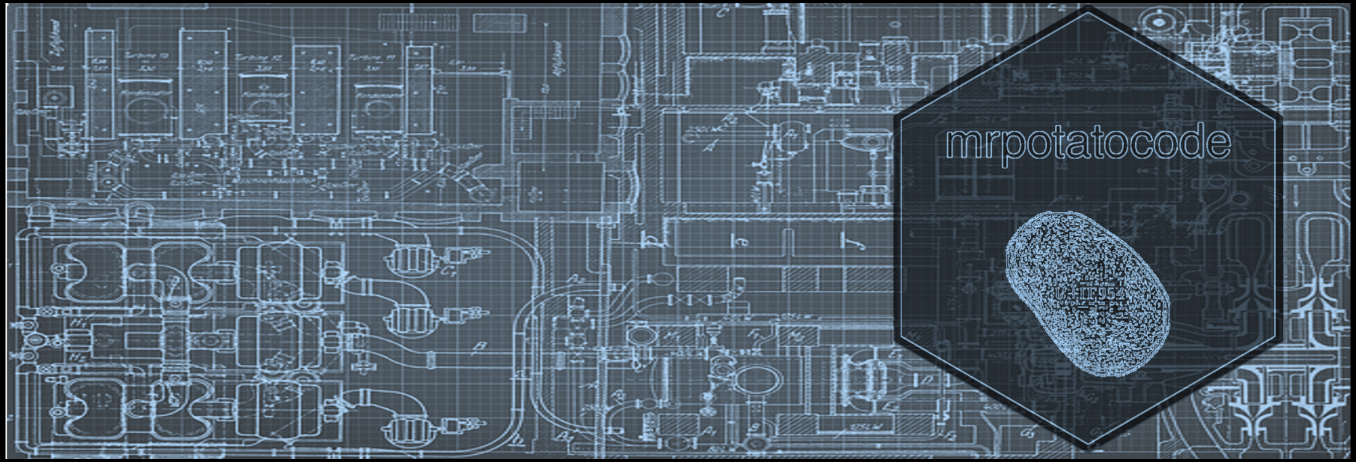

Introduction to Data Access and Storage

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Module 05

Expanding your Database:

INSERT, UPDATE, DELETE

Importing and Exporting Data

CROSS & Self Joins

Views

Expanding your Database:

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INSERT, UPDATE, DELETE

Prior to this, we've focused solely on retrieving values from tables:

- Tables can also be manipulated with `INSERT`, `UPDATE`, and/or `DELETE`
- *A word of warning...these commands are PERMANENT* 😱
    - Generally, follow a policy that avoids altering data
    - Make backups of tables before you run a query
    - Never hurts to test on a temporary table first!
- But they are useful, and sometimes the correct solution
- There is no `SELECT` statement for these types of queries

INSERT, UPDATE, DELETE

INSERT

- `INSERT` allows you to add a record
- Specify where you want to add:
  - `INSERT INTO [some_table_name]`
- ...and what you want to add:
  - `VALUES(column_one_value, column_two_value)`

- `VALUES` come in the order of the columns within the tables
- `VALUES` must respect table constraints
  - e.g. NULLs, UNIQUE, data types, etc

- `INSERT` can help create small helper tables
  - Can we think of any scenarios?

INSERT, UPDATE, DELETE

UPDATE

- `UPDATE` allows you to change a record
- Specify where you are making your change:
    - `UPDATE [some_table_name]`
- ...and what you want to change:
    - `SET column_one = value1, column_one = value2`
- *SPECIFY A* `WHERE` *CONDITION*
    - `WHERE condition`

- You can change a single column, a few columns, all the columns, etc
    - (Respecting table constraints)

- What happens if you don't specify a WHERE condition?

INSERT, UPDATE, DELETE

DELETE

- `DELETE` allows you to remove a record
- Specify where you want to delete:
    - `DELETE FROM [some_table_name]`
- *SPECIFY A* `WHERE` *CONDITION*
    - `WHERE condition`

- **What happens if you don't specify a WHERE condition?!?**

- `DELETE` doesn't *remove* a table from a database
    - Instead it removes the data from it, leaving the table structure and constraints in place
        - `DROP TABLE` instead if you want to remove it altogether

Quick Mentimeter

INSERT, UPDATE, DELETE

(`INSERT`, `UPDATE`, `DELETE` live coding with a TEMP TABLE)

What questions do you have about INSERT UPDATE DELETE?

What happens if you don't specify a `WHERE` condition

Expanding your Database:

INSERT, UPDATE, DELETE

Importing and Exporting Data

CROSS & Self Joins

Views

Importing and Exporting Data

Import & Export

CSV

JSON

Importing and Exporting Data

Import & Export

CSV

JSON

Import & Export

- RDBMs allow data to flow into and out of them
  - Some processes are easy:
    - e.g. exporting a table as a CSV file
  - ...while others are complex
    - e.g. writing a CRM to a normalized data warehouse on a nightly basis

- In DB Browser for SQLite, we can make use of the following:
  - Import and export CSV files
  - Manipulate and export JSON files
- SQLite more broadly can:
  - Produce CSVs from queries (using the command line, which we won't do)
  - Connect to other programming languages

Importing and Exporting Data

Import & Export

CSV

JSON

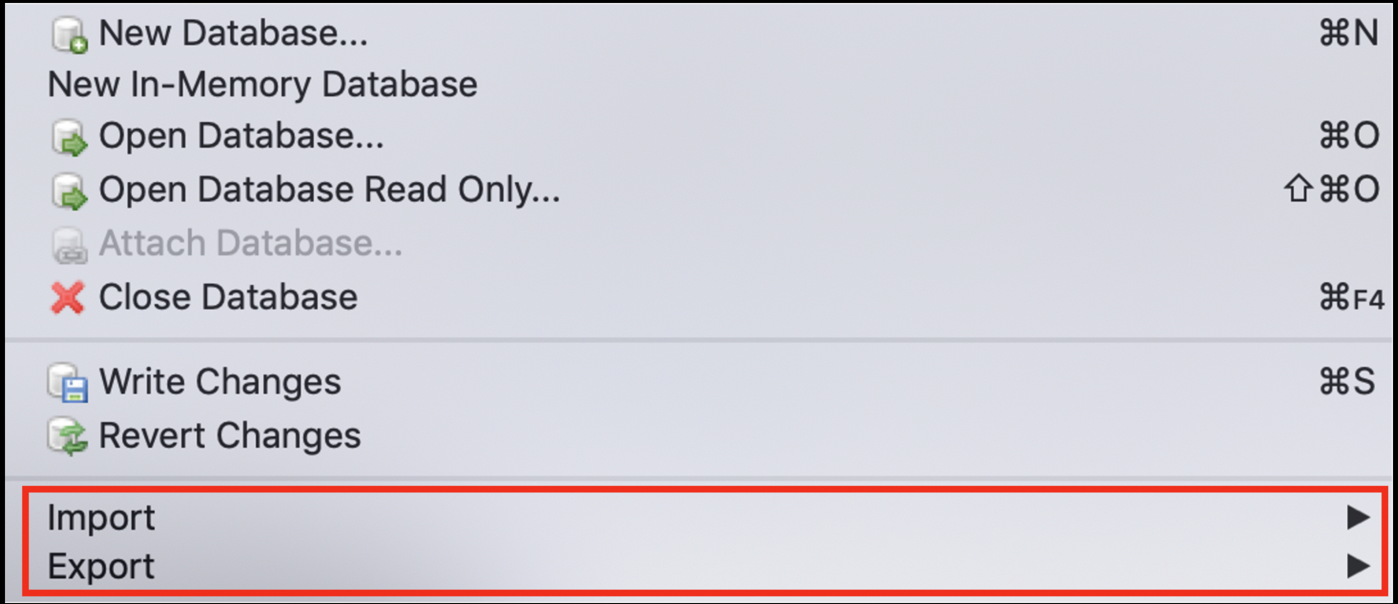
CSV

- CSV stands for "Comma Separated Values"
- CSVs are file formats well designed to store SQL tables
    - The values of each row are separated by commas
        - Sometimes it makes more sense to use a "|" (pipe), if there is complex text data stored, which might be more sensitive to the presence of commas and/or line breaks

- They are a common file format for transporting structured data
- CSVs can be opened by:
    - Excel
    - Simple text editors (e.g. notepad++, sublime)
    - Programming languages (e.g. python, R)

CSV

DB Browser for SQLite natively supports CSV importing and exporting for tables:



You can also export queries if they are stored in Temporary Tables

CSV

DB Browser for SQLite allows us to extract a query result in a somewhat roundabout method:

- First, write a query

```
SELECT * FROM product p
JOIN product_category pc ON p.product_category_id = pc.product_category_id
```

- Second, right click the results, and select "Copy as SQL"
- Third, instantiate a table with `CREATE`

```
CREATE TABLE "example" ("product_id", "product_name", "product_size",
"product_category_id", "product_qty_type", "product_category_name") ;
```

- Fourth, paste the results from your clipboard

```
INSERT INTO "example" ("product_id", "product_name", "product_size",
"product_category_id", "product_qty_type", "product_category_name")
VALUES ('1', 'Habanero Peppers - Organic', 'medium', '1', 'lbs', 'Fresh Fruits & Vegetables');
...etc for each row
```

- Finally, export the table to CSV

CSV

We can also extract a query result to CSV with python:

```
import pandas as pd
import sqlite3

#set your location, slash direction will change for windows and mac
DB = '/Users/thomas/Documents/GitHub/DSI_SQL/SQL/FarmersMarket.db'

#establish your connection
conn = sqlite3.connect(DB, isolation_level=None,
                       detect_types=sqlite3.PARSE_COLNAMES)

#run your query, use "\" to allow line breaks
db_df = pd.read_sql_query("SELECT p.*,pc.product_category_name \
                          FROM product p \
                          JOIN product_category pc \
                             ON p.product_category_id = pc.product_category_id"
                          ,conn)

#save
db_df.to_CSV('database-py.CSV', index=False)
```

CSV

...or extract with R instead:

```
library(DBI)
library(RSQLite)

#set your location, slash direction will change for windows and mac
DB = '/Users/thomas/Documents/GitHub/DSI_SQL/SQL/FarmersMarket.db'

#establish your connection
conn <- dbConnect(SQLite(), DB)

#run your query
db_df <- dbGetQuery(conn, "SELECT p.*,pc.product_category_name
                           FROM product p
                           JOIN product_category pc
                             ON p.product_category_id = pc.product_category_id")

#save
write.CSV(db_df, file = "database-R.CSV")
```

CSV

(CSV live importing/exporting)

Importing and Exporting Data

Import & Export

CSV

JSON

JSON

- JSON stands for "JavaScript Object Notation"
- JSONs are file formats well designed to store tables, lists, arrays, and nested objects
    - Their syntax follows specific rules:
        - Data is in name/value pairs
        - Data is separated by columns
        - Curly brackets '{ }' hold objects
        - Square brackets '[ ]' hold arrays
    - e.g. `{"first_name":"Thomas", "last_name":"Rosenthal"}`
    - or for tables:

```
[ {"first_name":"A", "last_name":"Mahfouz"}
{"first_name":"Thomas", "last_name":"Rosenthal"} ]
```

- JSON can be opened by:
    - Web browsers
    - Simple text editors (e.g. notepad++, sublime)
    - Programming languages (e.g. python, R)
- SQLite also provides support for JSON value query and manipulation

JSON

DB Browser for SQLite supports a lot of JSON functions:

- Some are helper functions:
  - `JSON` and `JSON_VALID`, which confirm whether or not a string is JSON and/or in a valid JSON format
  - `JSON_TYPE`
    - When using extracting, type will help to inform column types that SQL will assume, based on the JSON

- Other functions can be used for manipulation or extraction:
- `JSON_EXTRACT` will allow you to return the values of a well-formed JSON string into desired parts
  - Importing JSON into SQL will use either `JSON_EXTRACT` or `JSON_EACH`
  - SQLite gives the following (fairly comprehensive) example set:
    - `json_extract('{"a":2,"c":[4,5,{"f":7}]}', '$')` → '{"a":2,"c":[4,5,{"f":7}]}'
    - `json_extract('{"a":2,"c":[4,5,{"f":7}]}', '$.c')` → '[4,5,{"f":7}]'
    - `json_extract('{"a":2,"c":[4,5,{"f":7}]}', '$.c[2]')` → '{"f":7}'
    - `json_extract('{"a":2,"c":[4,5,{"f":7}]}', '$.c[2].f')` → 7
    - `json_extract('{"a":2,"c":[4,5],"f":7}','$.c','$.a')` → '[[4,5],2]'
    - `json_extract('{"a":2,"c":[4,5],"f":7}','$.c[#-1]')` → 5
    - `json_extract('{"a":2,"c":[4,5,{"f":7}]}', '$.x')` → NULL
    - `json_extract('{"a":2,"c":[4,5,{"f":7}]}', '$.x', '$.a')` → '[null,2]'
    - `json_extract('{"a":"xyz"}', '$.a')` → 'xyz'
    - `json_extract('{"a":null}', '$.a')` → NULL

JSON

Importing a JSON array (table) into SQL with DB Browser for SQLite requires a bit more of nuanced approach:

- First copy and paste your JSON table array into SQLite, and put it in a temp table:

```
CREATE TEMP TABLE IF NOT EXISTS temp.[new_json]
(col BLOB);

INSERT INTO temp.[new_json](col)
VALUES('[{"a": 7, "b": "string"}]')
```

- Second, use the `JSON_EACH` function as a table-valued function

```
SELECT key,value
FROM new_json,JSON_EACH(new_json.col, '$' )
```

- Third, use this previous query as a subquery and combine with `JSON_EXTRACT`, using the value column `JSON_EACH` generated

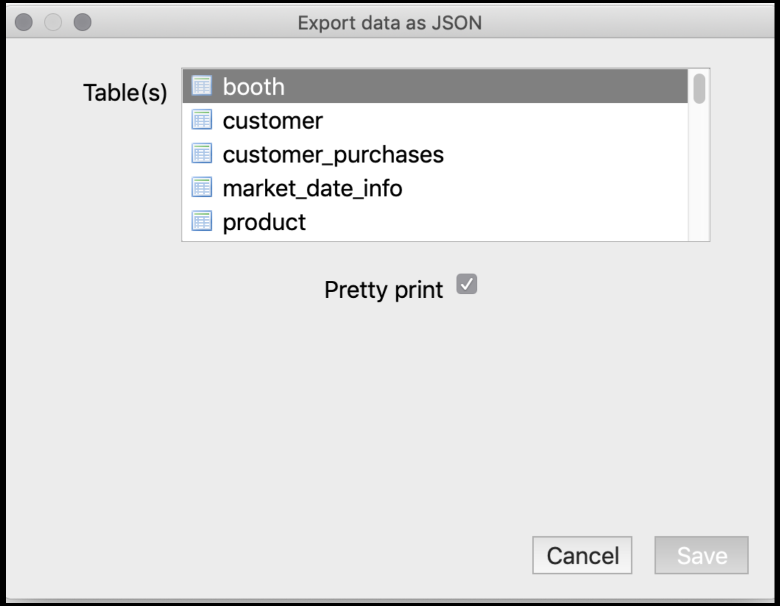
```
SELECT * ,
JSON_EXTRACT(value, '$.a') AS a,
JSON_EXTRACT(value, '$.b') AS b

FROM (...{subquery goes here}...)
```

- You now have a normal SQL table from a JSON array!

JSON

DB Browser for SQLite natively supports JSON exporting for tables:



This also works for Temporary Tables, so queries can be exported as well

JSON

(JSON live exporting)

What questions do you have about Importing and Exporting data into SQL?

Expanding your Database:

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Importing and Exporting Data

CROSS & Self Joins

Views

CROSS JOIN

- `CROSS JOIN` creates an unfiltered Cartesian Product
- They are not joined on any columns

- Recall our deck of cards example in Module 2:

```
SELECT suit, rank
FROM suits
CROSS JOIN ranks
```

- Because tables 'suits' and 'ranks' contain no common columns, we would have no other means to join

- I love to `CROSS JOIN`!
- They can be super useful when used correctly
  - What are some good examples that could be useful? 💭 💬 Think, Pair, Share

CROSS JOIN

(`CROSS JOIN` live coding)

> No complex query is complete without at least one `CROSS JOIN`
>
> (me, jokingly)

What questions do you have about CROSS JOIN?

Self Joins

- Self Joins are somewhat uncommon, but are the last type of possible join
- They are useful for comparison:
  - Determine maximum to-date
  - Generating pairings
- They can help with hierarchy
  - Child-to-Parent relationships
- The syntax is as we might expect:

```
SELECT
e.name as employee_name,
m.name as manager_name

FROM people e
LEFT JOIN people m ON e.manager_id = m.id
```

FROM Questions? JOIN Questions?

Quick Mentimeter

Expanding your Database:

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Views

Views

- Views instantiate a query result permanently
- They are particularly useful in highly normalized databases, where reproducing a query is tiresome or prone to query errors

- In databases that have live data flowing in:
  - Tables that are created from queries need to be continuously updated whenever there is new data
    - This requires either downtime where the table is empty
    - Or the chance of a "dirty read" (where a table is read before the data is fully updated)
  - Views, on the other hand, will always show the most up-to-date values!

- Views are created just like tables:

```
CREATE VIEW history AS
SELECT ...
```

Views Performance

- Views can be very slow if poorly created
- Always use primary keys and indexing to make them more performative
- Select the most important columns

- Avoid stacking views (views within a view)

- In commercial RDBMs, use execution plans and/or performance dashboards to analyze the underlying engine mechanisms the view uses for instantiation

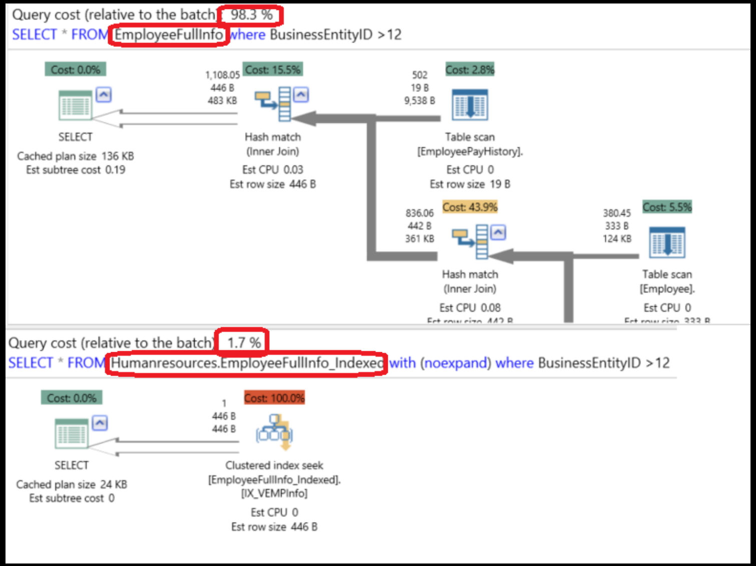

Image: Yaseen, SQLShack

Views

(Views live coding)

What questions do you have about anything from today?