Quick Notes for SI564

SQL and Databases

Week 1

Basic Queries describing databases and tables.
`SHOW DATABASES;` shows all the databases on a server
`USE database_name;` selects a database to use
`SHOW TABLES;` shows all the tables in a database
`DESCRIBE table_name;` shows the columns in a table
`SELECT * FROM table_name;` shows all the rows in a table
`SELECT column_name FROM table_name;` shows all the rows in a column

Week 2

Structured Query Language: `__VERB__ WHAT FROM LOCATION WHERE CONDITION;` 4 basic queries in SQL:

- `SELECT`
  - Get data from the database for display: `SELECT (*) FROM table_name;`
  - Not all queries select data from a database
    - `SELECT NOW()` returns the current time.
    - `SELECT 2+2` returns 4.
  - Rather than query all the data, choose the specific fields of interest.
  - Use `AS` to rename columns or tables: `SELECT column_name AS new_name FROM table_name AS new_table_name;`

  - `DISTINCT` is used to return unique values in a column. `SELECT DISTINCT column_name FROM table_name;`
  - `LIMIT` is used to limit the number of rows returned. `SELECT column_name FROM table_name LIMIT 5;`
    - `LIMIT` should be the last part of the query to avoid limiting the results.
  - `ORDER BY` is used to sort the results. `SELECT column_name FROM table_name ORDER BY column_name ASC/DESC;`
    - We can also order by functions, e.g. `ORDER BY LENGTH(column_name) DESC;` or `ORDER BY RAND();`
- CRUD: Create, Read, Update and Delete
- `WHERE`

Everything you do should have a documentation behind it.

- It has to be clear and communicative.
- It needs to ensure that the next person can understand what you did.
- If you don't have a documentation, create one.

Primary keys: unique identifier for each row in a table.

Week 3

WHERE clauses

`WHERE` applies to `SELECT`, `UPDATE`, `DELETE` and `INSERT` statements.

- `SELECT column_name FROM table_name WHERE condition;`

`conditions` use **single** equal sign.

We can use `BETWEEN .. AND ...` to select a range of values.

`LIKE` is used to search for a specified pattern in a column.

- `%` is a wildcard character that represents zero or more characters.
- `_` is a wildcard character that represents a single character.
- `\` is used to escape special characters.
- Use `REGEXP` for regular expression matching.
- `LIKE` is case-**insensitive**. `%states` matches `United States` and `United states`.
- E.g. `SELECT column_name FROM table_name WHERE column1 LIKE 'a%' AND column2 LIKE '%b';`
- `LIKE` can be slow in matching.
- DON'T use `LIKE` for exact matches as `LIKE` operator is not efficient.

Subqueries

A subquery is a query nested in another query. Another query result serves as the condition as the main query. For example, `SELECT column_name FROM table_name WHERE column_name IN (SELECT column_name FROM table_name WHERE condition);`
The column in the main query should be matched with the column in the subquery.

Subqueries can only return **one** field. Field selected in subquery needs to be the same as the field in the `WHERE` statement.

NOT operator

`NOT` is used to negate a condition but not in logical expressions.

- `NOT` can be used in `IN`, `BETWEEN...AND...`, `LIKE`, `NULL`
- `NOT` **cannot** be used in `NOT =` or any arithmetic logical expression.

NULL

`NULL` is a special value that represents missing data.
`IS NULL` or `IS NOT NULL`
Empty string `''` is not the same as `NULL`.

Date

`DATE` is a data type that stores the date.

- `SELECT DATE('2020-01-01');` returns `2020-01-01`.
- `SELECT NOW();` returns the current date and time.
- `SELECT CURDATE();` returns the current date.
- `SELECT CURTIME();` returns the current time.

We can also select the year, month and day from a date.

- `SELECT YEAR('2020-01-01');` returns `2020`.
- `SELECT MONTH('2020-01-01');` returns `1`.
- `SELECT DAY('2020-01-01');` returns `1`.
- These functions can also be used in `WHERE` clauses.
  - `SELECT column_name FROM table_name WHERE YEAR(column_name) = 2020;`

`DATE_FORMAT()` is used to format dates.

- `SELECT DATE_FORMAT('2020-01-01', '%Y-%m-%d');` returns `2020-01-01`.
- Also we can use `STR_TO_DATE()` to convert a string to a date.
  - `SELECT STR_TO_DATE('2020-01-01', '%Y-%m-%d');` returns `2020-01-01`.

SLEEP()

`SLEEP()` is used to pause the execution of a query for a specified number of seconds.

- `SELECT SLEEP(5);` pauses the execution for 5 seconds.

COUNT()

`COUNT()` is used to count the number of rows in a table.

- `COUNT(*)` returns the total number of rows in a table.
- `COUNT(column)` returns the number of non-NULL values in a column.

- `SELECT COUNT(1) AS total_count FROM table_name;` returns the total number of rows in a table and renames the column as `total_count`.

Use `COUNT(1)` instead. Don't use `COUNT(*)` to count the number of rows in a table as it is not efficient. It pulls all the data from the database and counts the observations.

Week 4

Aggregate Functions

- `SUM()`: returns the sum of a numeric column.
- `AVG()`: returns the average of a numeric column.
- `COUNT()`: returns the number of rows in a table.

Week 5

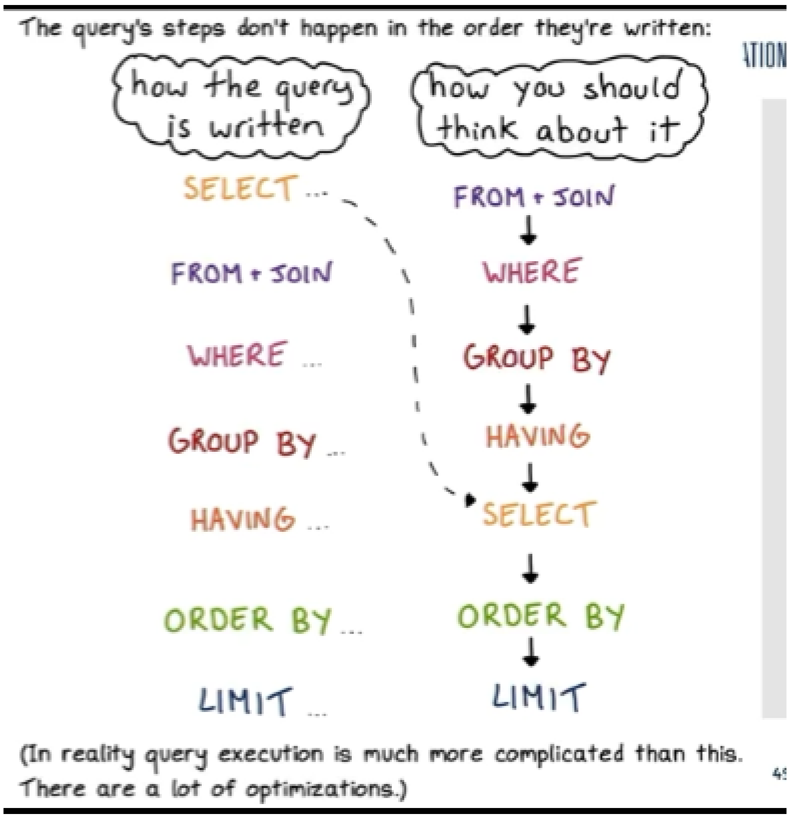
GROUP BY

Aggregation Functions applied with `GROUP BY` clause. Summarize those values after GROUP BY.

- `COUNT()`
- `SUM()`
- `AVERAGE()`/`AVG()`
- `MAXIMUM()`
- `MINIMUM()`

Example queries: `SELECT Continent, AVG(Population) FROM Country GROUP BY Continent;`

When `GROUP BY` joined tables, `GROUP BY` the field in the primary table.


The query's steps don't happen in the order they're written:
how the query is written
how you should think about it
SELECT ...
FROM + JOIN
WHERE ...
GROUP BY ...
HAVING ...
ORDER BY ...
LIMIT ...
FROM + JOIN
WHERE
GROUP BY
HAVING
SELECT
ORDER BY
LIMIT
(In reality query execution is much more complicated than this. There are a lot of optimizations.)

HAVING

`HAVING` is used to filter the results of a `GROUP BY` clause.

```
SELECT Continent, AVG(Population) FROM Country GROUP BY Continent HAVING
AVG(Population) > 500000;
```

Notes before Midterm

Subqueries can only return **one** field. Field selected in subquery needs to be the same as the field in the `WHERE` statement.

Aggregate function can not be used inside an aggregate function.

Empty string `''` is **not** the same as `NULL`.

- Use `IS NULL` or `IS NOT NULL` to check for `NULL` values.

How to check answers?

- Add a field in the SELECT clause
- Check for typos, missing part of the query or magic quotes
- Read error messages