Week 2 Review

Overview

CREATE TABLE	ORDER BY
INSERT INTO	Aggregate Functions
ALTER TABLE	GROUP BY
UPDATE	HAVING
DELETE and ON DELETE	JOIN
DROP and TRUNCATE	Set operations
SELECT	WITH
Conditional Expressions	Subqueries

Review: CREATE TABLE

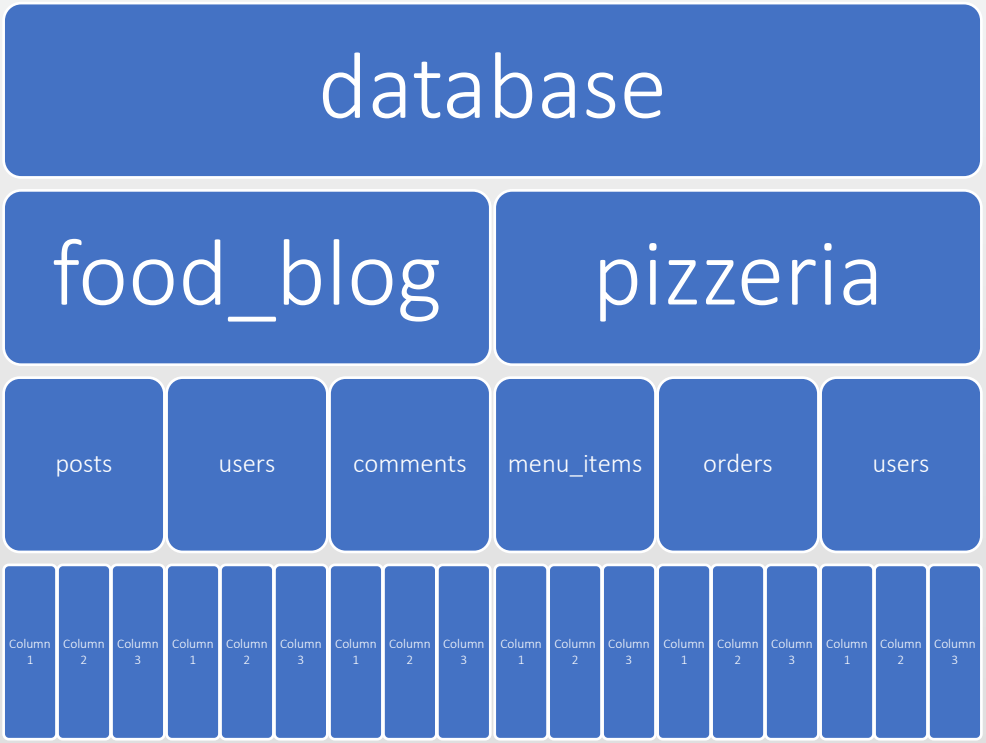
Syntax:

```
CREATE TABLE table_name (
  column1 datatype column_constraints,
  column2 datatype column_constraints,
  column3 datatype column_constraints
);
```

Example:

```
CREATE TABLE cars (
  id SERIAL PRIMARY KEY,
  year INT,
  make TEXT NOT NULL,
  model TEXT NOT NULL
);
```

Review: Tables



We can think of each cell of data as living at an address specified by a unique (database, schema, table, column, row) tuple.

Review: INSERT INTO

Syntax:

```
INSERT INTO table_name (column1_name, column2_name, column3_name)
VALUES (value1, value2, value3);
```

Example:

```
INSERT INTO cars (year, make, model)
VALUES (2020, 'Toyota', 'Prius');
```

Review: ALTER TABLE

Examples:

```
ALTER TABLE cars
ADD wheel_count INT NOT NULL DEFAULT 4;
```

```
ALTER TABLE accounts
ADD CONSTRAINT fk_accounts_customers
FOREIGN KEY (customer_id)
REFERENCES customers;
```

Review: UPDATE

Syntax:

```
UPDATE table_name
SET column1 = value1, column2 = value2, ...
WHERE some_column = some_value;
```

Example:

```
UPDATE cars
SET make = 'The Ford Motor Company'
WHERE make = 'Ford';
```

Review: DELETE

Syntax:

```
DELETE FROM table_name
WHERE some_column = some_value;
```

Example:

```
DELETE FROM cars
WHERE year IS NULL;
```

When comparing a value against **NULL** anywhere in SQL, use the operators **IS** and **IS NOT** instead of **=** and **!=**

Review: ON DELETE

```
CREATE TABLE orders(
    id SERIAL PRIMARY KEY,
    amount_spent NUMERIC NOT NULL,
    CONSTRAINT fk_customer
        FOREIGN KEY(customer_id)
        REFERENCES customers(id)
        ON DELETE CASCADE
);
```

```
CREATE TABLE orders(
    id SERIAL PRIMARY KEY,
    amount_spent NUMERIC NOT NULL,
    CONSTRAINT fk_customer
        FOREIGN KEY(customer_id)
        REFERENCES customers(id)
        ON DELETE SET NULL
);
```

```
CREATE TABLE orders(
    id SERIAL PRIMARY KEY,
    amount_spent NUMERIC NOT NULL,
    CONSTRAINT fk_customer
        FOREIGN KEY(customer_id)
        REFERENCES customers(id)
        ON DELETE SET DEFAULT 1
);
```

Review: DROP and TRUNCATE

```
DROP TABLE cars;
```

Deletes a table and all its records

```
DROP DATABASE week2;
```

Deletes a database and all its tables and records

```
TRUNCATE TABLE cars;
```

Deletes all records of a table but not the table itself

Review: SELECT

Syntax:

```
SELECT column_name1, column_name2, FROM table_name;
```

Example:

```
SELECT title, author FROM books;
```

books table

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

result set

	title text	author text
1	Frankenstein	Mary Shelley
2	The Great Gatsby	F. Scott Fitzgerald
3	Big Fish	Daniel Wallace
4	Don Quixote	Miguel de Cervantes

Review: SELECT ... as ...

Change column names in result set if needed
by using the **as** keyword to create aliases

Example:

```
SELECT author as book_author, title as book_title FROM books;
```

books table

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

result set

	book_author text	book_title text
1	Mary Shelley	Frankenstein
2	F. Scott Fitzgerald	The Great Gatsby
3	Daniel Wallace	Big Fish
4	Miguel de Cervantes	Don Quixote

Review: SELECT ... as ...

Using the * **wildcard character** instead of column names will result in all columns being selected, i.e. the entire table
Generally not recommended

Example:

```
SELECT * from books;
```

books table

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

result set

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

Review: Conditional expressions

Comparison and logical operators used in conditional expressions

Operator	Description
=	Equal
>	Greater than
<	Less than
>=	Greater than or equal
<=	Less than or equal
<> or !=	Not equal
AND	Logical operator AND
OR	Logical operator OR
IN	Return true if a value matches any value in a list
BETWEEN	Return true if a value is between a range of values
LIKE	Return true if a value matches a pattern
IS NULL	Return true if a value is NULL
NOT	Negate the result of other operators

Review: Conditional expressions

WHERE

Use to filter SELECT query results based on condition

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

```
SELECT title, author FROM books WHERE genre = 'Novel';
```

	title text	author text
1	Frankenstein	Mary Shelley
2	The Great Gatsby	F. Scott Fitzgerald
3	Don Quixote	Miguel de Cervantes

```
SELECT title, author, year
FROM books
WHERE genre = 'Novel' AND year < 1900;
```

	title text	author text	year integer
1	Frankenstein	Mary Shelley	1818
2	Don Quixote	Miguel de Cervantes	1605

Review: Conditional Expressions

DISTINCT

Eliminates duplicate rows from result set

Example:

```
SELECT DISTINCT genre FROM books;
```

books table

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

result set

	genre text
1	Novel
2	Magical Realism

Review: Conditional Expressions

LIMIT

Cap number of records in result set

Example:

```
SELECT DISTINCT genre
FROM books LIMIT 1;
```

books table

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

result set

	genre text
1	Novel

Review: Conditional Expressions

BETWEEN

Selects records where specified column value falls within a range, inclusive

Example:

```
SELECT b.title as twentieth_century_books
FROM books b
WHERE b.year BETWEEN 1900 AND 2000;
```

books table

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

result set

	twentieth_century_books text
1	The Great Gatsby
2	Big Fish

Review: Conditional Expressions

LIKE & ILIKE: performs pattern matching based on wildcards

% matches any sequence of 0 or more characters

_ matches any single character

LIKE is case-sensitive, ILIKE is not

Examples:

"Book titles that begin with T"

```
SELECT b.title FROM books b
WHERE b.title LIKE 'T%';
```

	title text
1	The Great Gatsby

"Book titles that contain T"

```
SELECT b.title FROM books b
WHERE b.title LIKE '%T%';
```

	title text
1	The Great Gatsby

"Book titles that contain T or t"

```
SELECT b.title FROM books b
WHERE b.title ILIKE '%T%';
```

	title text
1	Frankenstein
2	The Great Gatsby
3	Don Quixote

Review: Conditional Expressions

IN

Evaluates as TRUE if list of options contains specified value

Example:

```
SELECT b.title, b.year FROM books b
WHERE b.year IN (1990, 1986, 1996, 1998);
```

books table

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

result set

	title text	year integer
1	Big Fish	1998

Review: ORDER BY

Syntax:

```
SELECT
    select_list
FROM
    table_name
ORDER BY
    sort_expression1 [ASC | DESC],
            ...
    sort_expressionN [ASC | DESC];
```

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

Example:

```
SELECT * FROM books
ORDER BY year;
```

	id [PK] integer	title text	author text	genre text	year integer
1	4	Don Quixote	Miguel de Cervantes	Novel	1605
2	1	Frankenstein	Mary Shelley	Novel	1818
3	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
4	3	Big Fish	Daniel Wallace	Magical Realism	1998

Review: Aggregate Functions

Function	Description
COUNT	Count of the column specified (includes NULL values if * is used)
MAX	Maximum value in the column (excludes NULL values)
MIN	Minimum value in the column (excludes NULL values)
AVG	Average value in the column (excludes NULL values, only works on numeric data types)
SUM	Sum of values in the column (excludes NULL values, only works on numeric data types)

Review: Aggregate Functions

Examples:

"Count of all books"

```
SELECT COUNT(*)
AS book_count
FROM books;
```

	book_count bigint
1	4

"Year of the oldest book"

```
SELECT MIN(b.year)
AS year_of_oldest_book
FROM books b;
```

	year_of_oldest_book integer
1	1605

Review: GROUP BY

Syntax:

```
SELECT
   column_1,
   column_2,
   ...,
   aggregate_function(column_3)
FROM
   table_name
GROUP BY
   column_1,
   column_2,
   ...;
```

Example:

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

```
SELECT genre, COUNT(*) AS book_count
FROM books GROUP BY genre;
```

	genre text	book_count bigint
1	Novel	3
2	Magical Realism	1

Count number of books per genre
Return a single row for each group

Review: HAVING

Syntax:

```
SELECT
   column_1,
   column_2,
   ...,
   aggregate_function(column_3)
FROM
   table_name
GROUP BY
   column_1,
   column_2,
   ...
HAVING
   conditional_expression;
```

Example:

	id [PK] integer	title text	author text	genre text	year integer
1	1	Frankenstein	Mary Shelley	Novel	1818
2	2	The Great Gatsby	F. Scott Fitzgerald	Novel	1925
3	3	Big Fish	Daniel Wallace	Magical Realism	1998
4	4	Don Quixote	Miguel de Cervantes	Novel	1605

```
SELECT genre, COUNT(*) AS book_count
FROM books
GROUP BY genre
HAVING(COUNT(*)) > 1;
```

	genre text	book_count bigint
1	Novel	3

Count books per genre such that the count is greater than 1

Review: Set operations

Allow us to query from more than 1 table at a time

- **UNION**: Combines result set from 2 SELECT queries, removes duplicates, returns combined result set
- **UNION ALL**: Same as UNION, but does not remove duplicates
- **INTERSECT**: Combines result set from 2 SELECT queries and eliminates *unique* rows
- **EXCEPT**: Takes 2 result sets from SELECT queries, returns first result set after eliminating any rows matching those of second result set

Review: JOIN

Query from multiple tables based on values of common columns between related tables

Syntax:

```
SELECT select_list
FROM left_table
[INNER | LEFT | RIGHT | FULL] JOIN right_table
ON left_column = right_column;
```

Default type is INNER JOIN:

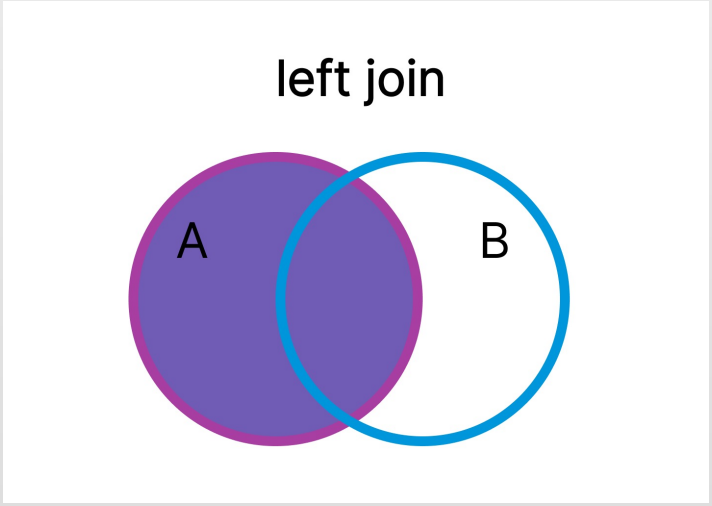
1. Selects rows from left_table
2. Compares left_column to right_column
3. If equal, adds selected columns to result set
4. Otherwise, skips

Review: LEFT JOIN

Result guaranteed to contain every row from left_table

1. Selects rows from left_table
2. Compares left_column to right_column
3. If equal, adds selected columns to result set
4. Otherwise, adds selected columns from left_table with NULL placeholders for columns in right_table

```
SELECT select_list
FROM left_table
[INNER | LEFT | RIGHT | FULL] JOIN right_table
ON left_column = right_column;
```

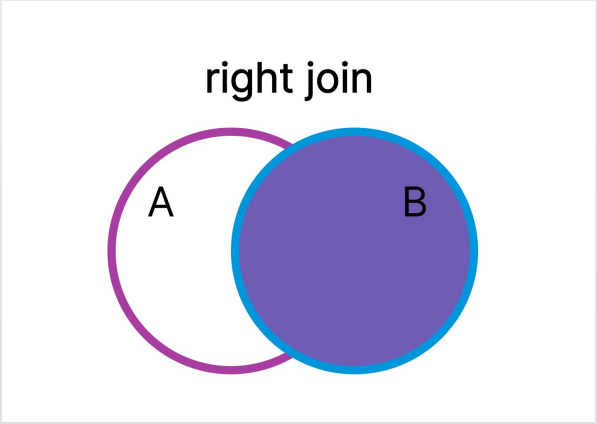


Review: RIGHT JOIN

Result guaranteed to contain every row from right_table

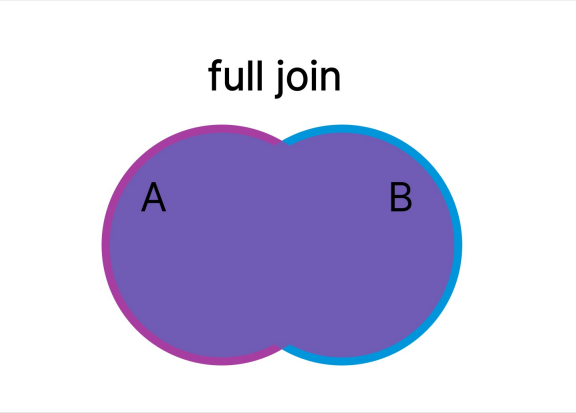
1. Selects rows from right_table
2. Compares left_column to right_column
3. If equal, adds selected columns to result set
4. Otherwise, adds selected columns from right_table with NULL placeholders for columns in left_table

```
SELECT select_list
FROM left_table
[INNER | LEFT | RIGHT | FULL] JOIN right_table
ON left_column = right_column;
```



Review: FULL JOIN

- Selects all rows from both left_table and right_table
- Selects columns from corresponding joined table if match found, else adds NULL placeholder values




```
SELECT select_list
FROM left_table
[INNER | LEFT | RIGHT | FULL] JOIN right_table
ON left_column = right_column;
```

Review: Subqueries

- Subqueries are nested queries
- Can use SQL logical operators: **EXISTS, ANY, ALL, IN, NOT IN**

EXISTS: Returns True if subquery returns at least 1 row

IN: Returns True if some value is in subquery's result set

NOT IN: Returns True if some value is NOT in subquery's result set

ANY: Used with a comparison operator, checks against values in subquery result set, returns True if **any** comparison evaluates as true.

ALL: Used with a comparison operator, checks against values in subquery result set, returns True if **all** comparisons evaluate as True.

Review: WITH (CTE)

- WITH keyword is used to create temporary tables called Common Table Expressions, discarded at end of query
- Break down complex queries into smaller, more manageable parts

"For the top sales regions (top 10% in total sales), find the total units sold and the total sales for each product"

```sql
WITH regional_sales AS (
        SELECT region, SUM(amount) AS total_sales
        FROM orders
        GROUP BY region
    ), top_regions AS (
        SELECT region
        FROM regional_sales
        WHERE total_sales > (SELECT SUM(total_sales)/10 FROM regional_sales)
    )
SELECT region,
       product,
       SUM(quantity) AS product_units,
       SUM(amount) AS product_sales
FROM orders
WHERE region IN (SELECT region FROM top_regions)
GROUP BY region, product;
```