Welcome to the CoGrammar

Q&A: Relational Databases and Python

The session will start shortly...

Questions? Drop them in the chat.

Software Engineering Session Housekeeping

- The use of disrespectful language is prohibited in the questions, this is a supportive, learning environment for all - please engage accordingly. **(Fundamental British Values: Mutual Respect and Tolerance)**
- No question is daft or silly - **ask them!**
- There are **Q&A sessions** throughout this session, should you wish to ask any follow-up questions.
- If you have any questions outside of this lecture, or that are not answered during this lecture, please do submit these for upcoming Academic Sessions. You can submit these questions here: Questions

Software Engineering Session Housekeeping cont.

- For all **non-academic questions**, please submit a query: www.hyperiondev.com/support
- Report a **safeguarding** incident: www.hyperiondev.com/safeguardreporting
- We would love your **feedback** on lectures: Feedback on Lectures

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- Ideal for individuals in noisy or quiet environments or for those with **hearing impairments**.

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2. **Browser Settings:**
   - Google Chrome: Go to *Settings > Accessibility > Live Captions* and toggle ON.
   - Edge: Enable captions in *Settings > Accessibility*.

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Simone Botes

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Polls

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Polls

- *Refer to the polls section to vote for you option.*

1. **Which of the following statements best describes a relational database?**

   A. Stores data in a single table

   B. Organises data into structured tables related by common fields

   C. Stores data in a hierarchical structure

   D. Stores data in unstructured format

Polls

- *Refer to the polls section to vote for you option.*

2. What is the primary function of a primary key in a table?

   A. To store foreign key references

   B. To uniquely identify each record in a table

   C. To create relationships between tables

   D. To allow NULL values

Polls

- *Refer to the polls section to vote for you option.*

3. What is the purpose of a foreign key in a relational database?

   A. To speed up database queries

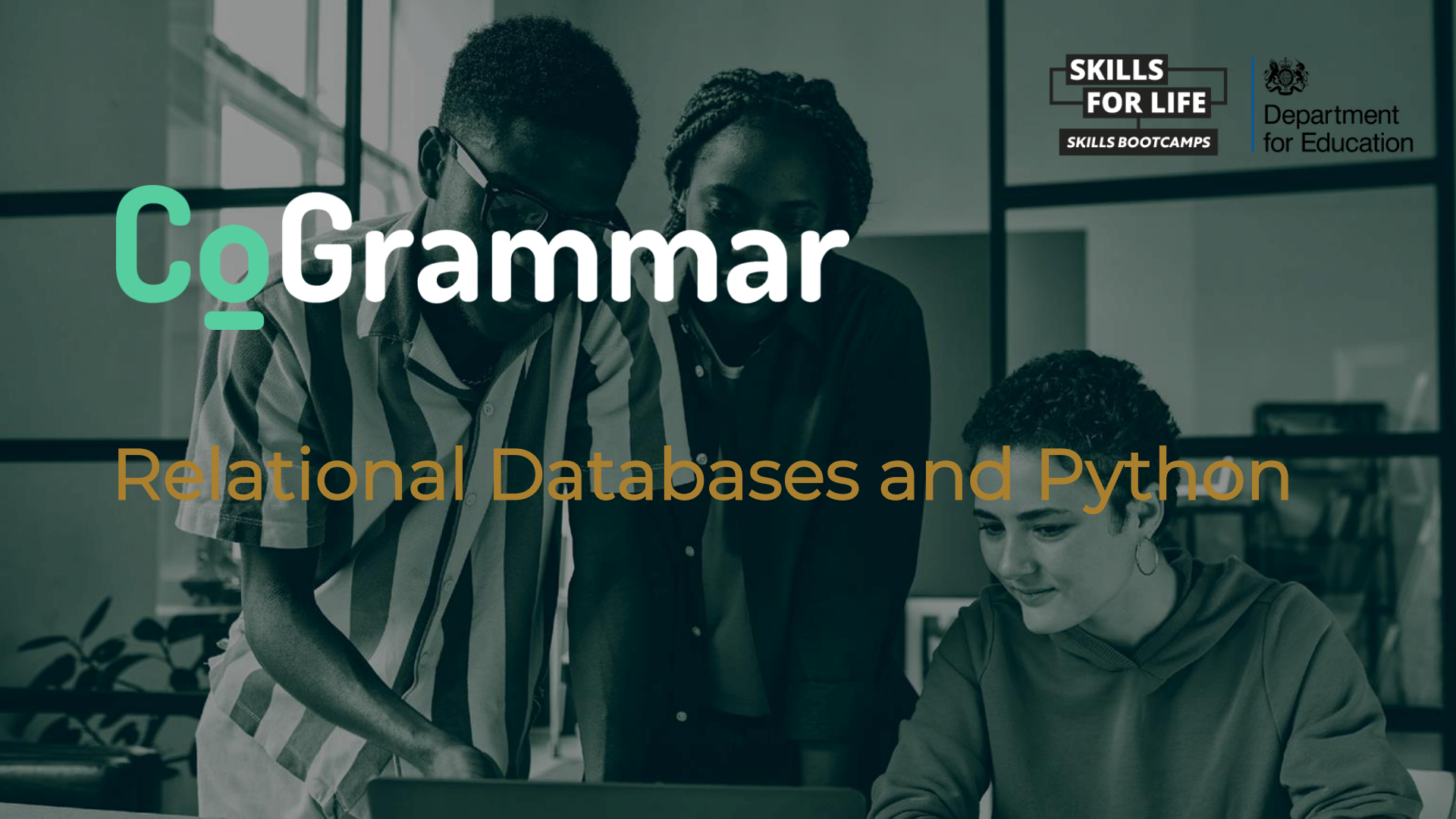
   B. To allow duplicate values in different tables

   C. To ensure data consistency by linking tables

   D. To create indexes automatically

Learning Outcomes

- Define Normalisation
- Normalise a table to 1NF, 2NF and 3NF
- Connect your SQLite database to a Python program.
- Create tables with their relationships using SQLite.
- Run SQL queries to apply CRUD operations.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Relational Databases and Python

Relational Databases

- A relational database is a database based on the relational model of data.
- Relational Model
  - A relational model organises data into one or more tables (or "relations") of columns and rows, with a unique key identifying each row.

Relational Databases

- Rows are also called records.
- Columns are also called attributes.
- Generally, each table/relation represents one "entity type" (such as customer or product).

Keys

- Each row in a table has its own unique key.
- Rows in a table can be linked to rows in other tables by adding a column for the unique key of the linked row.
- Allows us to select or modify one and only one row in a table.
- There is a unique primary key (PK) for each row in a table.
- Primary and Foreign keys

Relationships

- Relationships are a logical connection between different tables (entities), established based on interaction among these tables.

Designing a Relational Database

1. Identify entities and their attributes.
2. Identify relationships between entities. An example would be customers place orders.
3. Database design should be built using normalisation form.

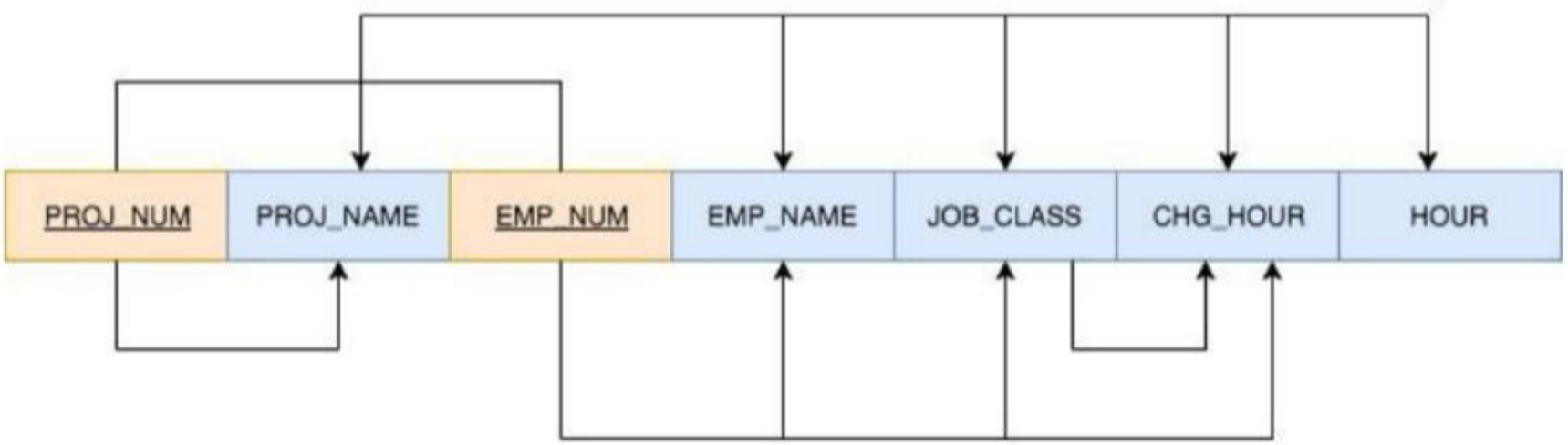
Normalisation

- Process of organising data in a database
- Creating tables and establishing relationships between those tables.
- Eliminate redundancy and inconsistent dependency

Normalisation

PROJ_NUM	PROJ_NAME	EMP_NUM	EMP_NAME	JOB_CLASS	CHG_HOUR	HOURS
15	Evergreen	103	June Arbaugh	Elect. Engineer	$67.55	23
15	Evergreen	101	John News	Database Designer	$82.00	19
15	Evergreen	105	Alice Johnson	Database Designer	$82.00	35
15	Evergreen	106	William Smithfield	Programmer	$26.66	12
15	Evergreen	102	David Senior	System Analyst	$76.43	12
18	Amberwave	114	Ann Jones	Applications Designer	$38.00	24
18	Amberwave	118	James Frommer	General Support	$14.50	45
18	Amberwave	104	Anne Remoras	System Analyst	$76.43	32
18	Amberwave	112	Darlene Smithson	DSS Analyst	$36.30	44

1NF



(Coronel & Morris, 2014, pg. 198)

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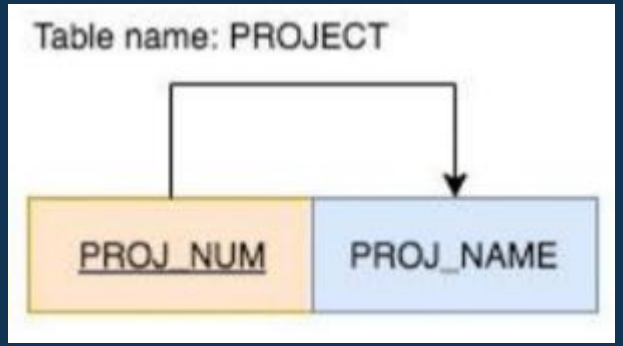
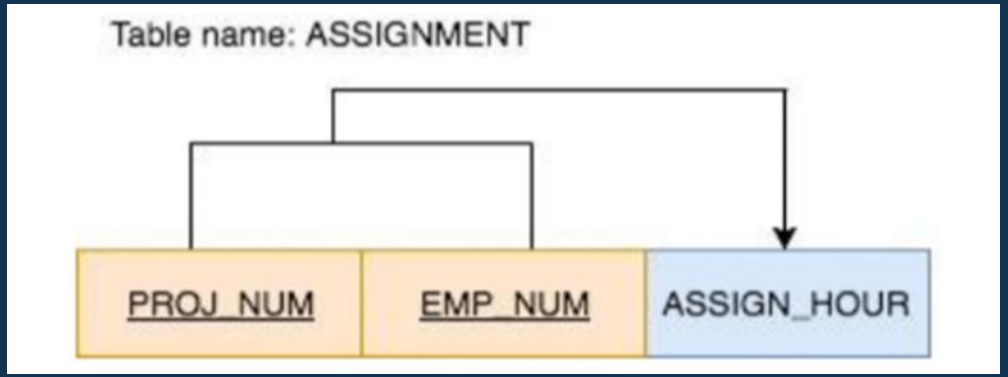
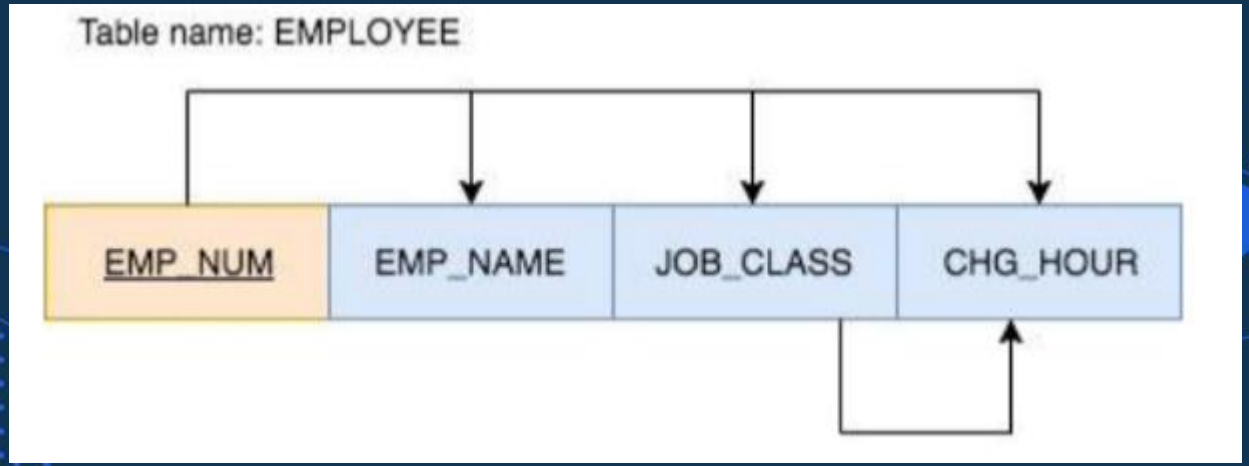
2NF







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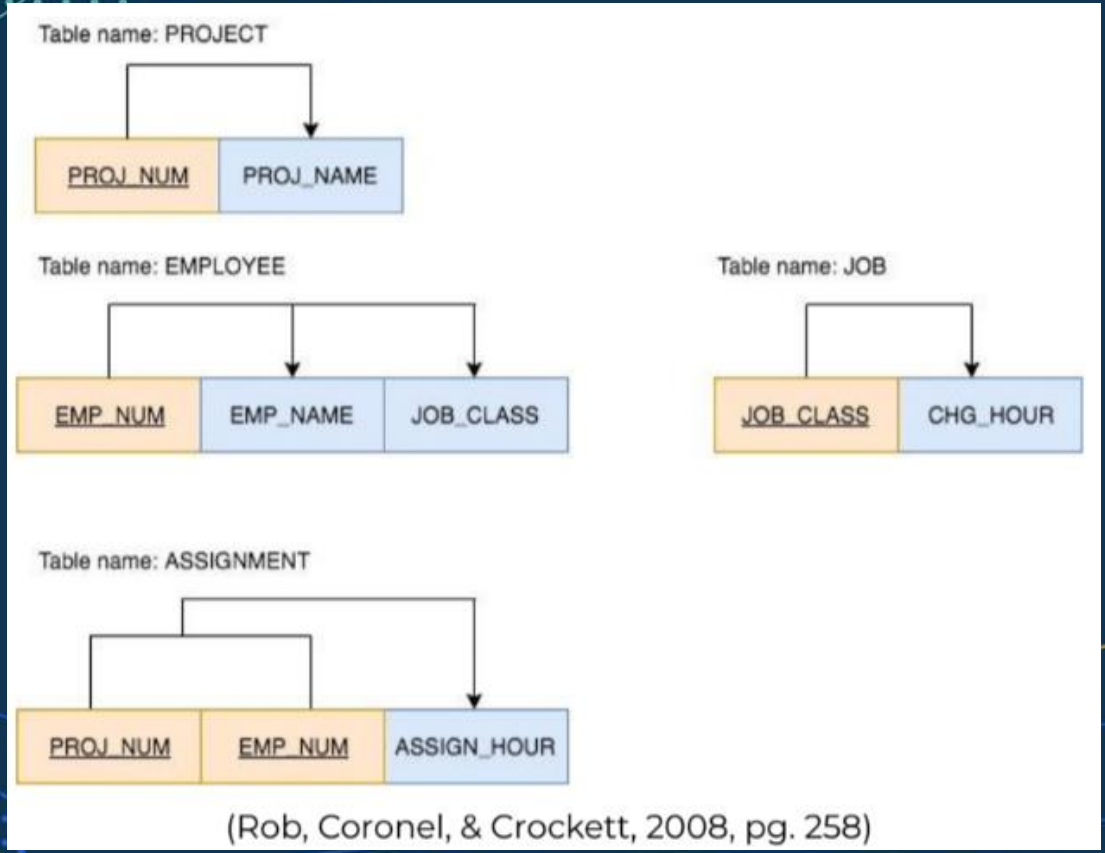
3NF



(Rob, Coronel, & Crockett, 2008, pg. 258)

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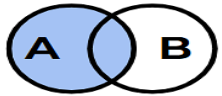
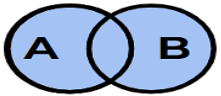
SQL: Accessing Multiple Tables

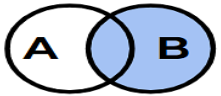
- INNER JOIN - Records match in both tables
- LEFT JOIN - All values in A, and matching values in B
- FULL OUTER JOIN - All values in both tables



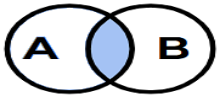

```
SELECT *
FROM A
LEFT JOIN B
ON A.id = B.id
```



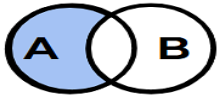

```
SELECT *
FROM A
FULL OUTER JOIN B
ON A.id = B.id
```



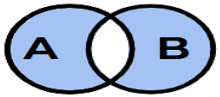

```
SELECT *
FROM A
RIGHT JOIN B
ON A.id = B.id
```



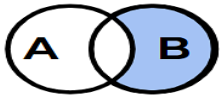

```
SELECT *
FROM A
INNER JOIN B
ON A.id = B.id
```




```
SELECT *
FROM A
LEFT JOIN B
ON A.id = B.id
WHERE B.id IS NULL
```




```
SELECT *
FROM A
FULL OUTER JOIN B
ON A.id = B.id
WHERE A.id IS NULL
OR B.id IS NULL
```




```
SELECT *
FROM A
RIGHT JOIN B
ON A.id = B.id
WHERE A.id IS NULL
```

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DBMS

- Database management system (DBMS)
  - Collection of programs that manages the database structure and access to the data.
  - Acts as intermediary between user and database
  - Hides internal complexity from the user

DBMS Advantages

- Better data sharing
- Improved data integration
- Minimised data inconsistency
- Improved data access
- Improved decision making
- Increased end-user productivity

Connecting SQL to Python

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SQLite Syntax

```
import sqlite3

db = sqlite3.connect('data/student_db')
cursor = db.cursor()

cursor.execute('''
    CREATE TABLE student(id INTEGER PRIMARY KEY, name TEXT,
                grade INTEGER)
''')

db.commit()
```

Basic SQLite Syntax

```
cursor.execute('''INSERT INTO student(name, grade)
                  VALUES(?,?)''', (name1,grade1))
db.commit()

students_ = [(name1,grade1),(name2,grade2),(name3,grade3)]
cursor.executemany(''' INSERT INTO student(name, grade) VALUES(?,?)''',
students_)
db.commit()
```

Let’s take a short break

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Let’s get coding!

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Polls

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Polls

- *Refer to the polls section to vote for you option.*

1. What will happen if you try to insert a record with a foreign key value that does not exist in the referenced table?

   A. The insert succeeds

   B. The foreign key column is set to NULL

   C. The database throws an error

   D. The record is inserted with a default value

Polls

- *Refer to the polls section to vote for you option.*

2. What happens if a referenced record in a foreign key constraint is deleted and CASCADE is enforced?

   A. The deletion is blocked

   B. All related records in the referencing table are also deleted

   C. A warning is shown, but deletion proceeds

   D. The foreign key column in the referencing table is set to NULL

Polls

- *Refer to the polls section to vote for you option.*

3. What is the purpose of the PRAGMA foreign_keys = ON; statement in SQLite?

   A. It creates a new foreign key

   B. It removes all foreign key constraints

   C. It enables support for enforcing foreign key constraints

   D. It checks for duplicate foreign keys

Lesson Conclusion

- Relational Databases: Based on the relational model of data that organises data into one or more tables (or "relations") of columns and rows, with a unique key identifying each row.
- Normalisation: Process of organising data in a database.
- DBMS: Collection of programs that manages the database structure and access to the data
- SQLite: Lightweight, self-contained SQL database engine.

Questions and Answers

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Thank you for attending

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