DATA SCIENCE AND MACHINE LEARNING BOOTCAMP

SQL

SQL

SQL is the single most requested language for positions of Data Analyst and Data Scientist. Ahead of Python, ahead of R, ahead of Excel.

Why do you think that is?

SQL

Structured Query Language is a standard database language used to create, manage and query data from relational databases.

We need to clarify some of these words today

- Database
- Relational
- Query

DATABASES

Organized collection of data structured in ways that impose some rules on the data according to needs, e.g.

- Size
- Accuracy
- Security
- Redundancy
- Accessibility

- Governance
  - Access
  - Centralization
  - Timeliness

ANATOMY OF A DATABASE

ALL THE COMPONENTS WE WILL TALK ABOUT

- Tables
- Columns
- Rows

- Keys
- Relationships
- Views

TABLES, COLUMNS, ROWS

TABLES

Tables are the main structures in the database.

Each table always represents a single, specific subject. The order of rows and columns within a table is of absolutely no importance. Every table should contain at least one column—known as a primary key—that uniquely identifies each of its rows.

The subject that a given table represents is usually either an object or an event. When the subject is an object, the table represents something that is tangible, such as a person, place, or thing. (i.e.: Pilots, products, machines, students, buildings, and equipment) When the subject is an event, the table represents something that occurs at a given point in time and has characteristics you wish to record. (i.e.: judicial hearings, distributions of funds, lab test results, and geological surveys)

SAMPLE - SAKILA DATABASE

THE FILMS TABLE

film_id	title	description	release_year	language_id	original_language_id	rental_duration	rental_rate	length	replacement_cost	rating	special_features	last_update
1	ACADEMY DINOSAUR	A Epic Drama of a Feminist And a Mad Scientist ...	2006	1	NULL	6	0.99	86	20.99	PG	Deleted Scenes,Behind the Scenes	2006-02-15 05:03:42
2	ACE GOLDFINGER	A Astounding Epistle of a Database Administrat...	2006	1	NULL	3	4.99	48	12.99	G	Trailers,Deleted Scenes	2006-02-15 05:03:42
3	ADAPTATION HOLES	A Astounding Reflection of a Lumberjack And a ...	2006	1	NULL	7	2.99	50	18.99	NC-17	Trailers,Deleted Scenes	2006-02-15 05:03:42
4	AFFAIR PREJUDICE	A Fanciful Documentary of a Frisbee And a Lum...	2006	1	NULL	5	2.99	117	26.99	G	Commentaries,Behind the Scenes	2006-02-15 05:03:42
5	AFRICAN EGG	A Fast-Paced Documentary of a Pastry Chef An...	2006	1	NULL	6	2.99	130	22.99	G	Deleted Scenes	2006-02-15 05:03:42
6	AGENT TRUMAN	A Intrepid Panorama of a Robot And a Boy who...	2006	1	NULL	3	2.99	169	17.99	PG	Deleted Scenes	2006-02-15 05:03:42
7	AIRPLANE SIERRA	A Touching Saga of a Hunter And a Butler who ...	2006	1	NULL	6	4.99	62	28.99	PG-13	Trailers,Deleted Scenes	2006-02-15 05:03:42
8	AIRPORT POLLOCK	A Epic Tale of a Moose And a Girl who must Con...	2006	1	NULL	6	4.99	54	15.99	R	Trailers	2006-02-15 05:03:42
9	ALABAMA DEVIL	A Thoughtful Panorama of a Database Administ...	2006	1	NULL	3	2.99	114	21.99	PG-13	Trailers,Deleted Scenes	2006-02-15 05:03:42
10	ALADDIN CALENDAR	A Action-Packed Tale of a Man And a Lumberjac...	2006	1	NULL	6	4.99	63	24.99	NC-17	Trailers,Deleted Scenes	2006-02-15 05:03:42
11	ALAMO VIDEOTAPE	A Boring Epistle of a Butler And a Cat who must ...	2006	1	NULL	6	0.99	126	16.99	G	Commentaries,Behind the Scenes	2006-02-15 05:03:42
12	ALASKA PHANTOM	A Fanciful Saga of a Hunter And a Pastry Chef ...	2006	1	NULL	6	0.99	136	22.99	PG	Commentaries,Deleted Scenes	2006-02-15 05:03:42
13	ALI FOREVER	A Action-Packed Drama of a Dentist And a Croc...	2006	1	NULL	4	4.99	150	21.99	PG	Deleted Scenes,Behind the Scenes	2006-02-15 05:03:42
14	ALICE FANTASIA	A Emotional Drama of a A Shark And a Databas...	2006	1	NULL	6	0.99	94	23.99	NC-17	Trailers,Deleted Scenes,Behind th...	2006-02-15 05:03:42
15	ALIEN CENTER	A Brilliant Drama of a Cat And a Mad Scientist w...	2006	1	NULL	5	2.99	46	10.99	NC-17	Trailers,Commentaries,Behind the...	2006-02-15 05:03:42

COLUMNS - ATTRIBUTES OF THE OBJECT

Columns represent a characteristic of the subject of the table to which it belongs.

Columns are the structures that store data. You can retrieve the data in these columns and then present it as information in almost any configuration imaginable.

ROWS - ENTRIES OF THE OBJECT

A row represents a unique instance of the subject of a table. It is composed of the entire set of columns in a table, regardless of whether or not the columns contain any values.

DATA TYPES

WHAT TYPES CAN THE SINGLE PIECE OF DATA BE?

- Integers (smallint, int, bigint)
- Char
- Varchar (variable length char)
- Text (unlimited length)
- Serial (autoincrementing: smallserial, serial, bigserial)
- Fixed/floating point (numeric real double precision)
-Date (timestamp, date, time, interval)

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TYPES OF DATABASES OPERATIONAL VS ANALYTICAL

Operational databases are the backbone of many companies, organizations, and institutions throughout the world today. This type of database is primarily used to collect, modify, and maintain data on a day-to-day basis. The type of data stored is dynamic, meaning that it changes constantly and always reflects up-to-the-minute information.

Analytical databases store and track historical and time-dependent data. They are valuable assets for tracking trends, viewing statistical data over a long period, or making tactical or strategic business projections. The type of data stored is static, meaning that the data is never (or very rarely) modified, although new data might often be added.

WHAT IS A RELATIONAL DATABASE

A relational database is a database structured to recognise relations between stored items of information.

- Relational databases are built of tables, which establish the relation between tuples (records or rows) and attributes (fields or columns).

- Each table can be related to each other using the concepts of keys

RDBMS

A relational database management system (RDBMS) is a software application program you use to create, maintain, modify, and manipulate a relational database.

SQL is the de facto universal language to work with data from relational databases so naturally, most RDBMS support SQL. SQL is more than just a means for extracting knowledge from data. It's also a language for defining the structures that hold data so we can organize relationships in the data.

MySQL is one of many RDBMS that support the use of SQL. We will use a graphical user interface to work with MySQL called MySQL workbench.

SHOW CASE SAKILLA

DATABASE ORGANIZATION

We are used to seeing denormalized tables. Easier to read but a lot of data replicated

What if we transformed it into a link between two tables?

N	O	P	Q
Product ID	Category	Sub-Category	Product Name
FUR-BO-10000112	Furniture	Bookcases	Bush Birmingham Collection Bookcase, Da
FUR-BO-10000330	Furniture	Bookcases	Sauder Camden County Barrister Bookcase,
FUR-BO-10000330	Furniture	Bookcases	Sauder Camden County Barrister Bookcase,
FUR-BO-10000330	Furniture	Bookcases	Sauder Camden County Barrister Bookcase,
FUR-BO-10000362	Furniture	Bookcases	Sauder Inglewood Library Bookcases
FUR-BO-10000362	Furniture	Bookcases	Sauder Inglewood Library Bookcases
FUR-BO-10000362	Furniture	Bookcases	Sauder Inglewood Library Bookcases
FUR-BO-10000362	Furniture	Bookcases	Sauder Inglewood Library Bookcases
FUR-BO-10000362	Furniture	Bookcases	Sauder Inglewood Library Bookcases
FUR-BO-10000468	Furniture	Bookcases	O'Sullivan 2-Shelf Heavy-Duty Bookcases
FUR-BO-10000468	Furniture	Bookcases	O'Sullivan 2-Shelf Heavy-Duty Bookcases
FUR-BO-10000468	Furniture	Bookcases	O'Sullivan 2-Shelf Heavy-Duty Bookcases
FUR-BO-10000468	Furniture	Bookcases	O'Sullivan 2-Shelf Heavy-Duty Bookcases
FUR-BO-10000468	Furniture	Bookcases	O'Sullivan 2-Shelf Heavy-Duty Bookcases
FUR-BO-10000468	Furniture	Bookcases	O'Sullivan 2-Shelf Heavy-Duty Bookcases
FUR-BO-10000711	Furniture	Bookcases	Hon Metal Bookcases, Gray
FUR-BO-10000711	Furniture	Bookcases	Hon Metal Bookcases, Gray
FUR-BO-10000780	Furniture	Bookcases	O'Sullivan Plantations 2-Door Library in La
FUR-BO-10000780	Furniture	Bookcases	O'Sullivan Plantations 2-Door Library in La
FUR-BO-10000780	Furniture	Bookcases	O'Sullivan Plantations 2-Door Library in La
FUR-BO-10000780	Furniture	Bookcases	O'Sullivan Plantations 2-Door Library in La
FUR-BO-10000780	Furniture	Bookcases	O'Sullivan Plantations 2-Door Library in La
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
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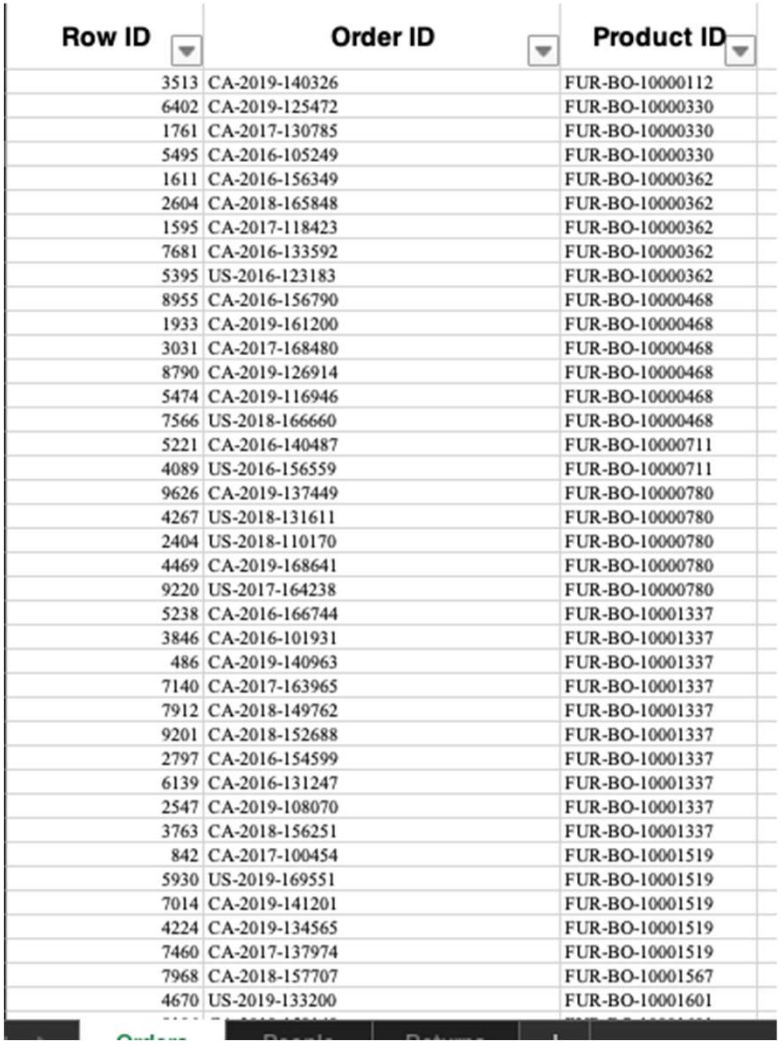
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
FUR-BO-10001337	Furniture	Bookcases	O'Sullivan Living Dimensions 2-Shelf Book
FUR-BO-10001519	Furniture	Bookcases	O'Sullivan 3-Shelf Heavy-Duty Bookcases
FUR-BO-10001519	Furniture	Bookcases	O'Sullivan 3-Shelf Heavy-Duty Bookcases
FUR-BO-10001519	Furniture	Bookcases	O'Sullivan 3-Shelf Heavy-Duty Bookcases
FUR-BO-10001519	Furniture	Bookcases	O'Sullivan 3-Shelf Heavy-Duty Bookcases

DATABASE ORGANIZATION

In one, you would see the products in each order



Row ID	Order ID	Product ID
3513	CA-2019-140326	FUR-BO-10000112
6402	CA-2019-125472	FUR-BO-10000330
1761	CA-2017-130785	FUR-BO-10000330
5495	CA-2016-105249	FUR-BO-10000330
1611	CA-2016-156349	FUR-BO-10000362
2604	CA-2018-165848	FUR-BO-10000362
1595	CA-2017-118423	FUR-BO-10000362
7681	CA-2016-133592	FUR-BO-10000362
5395	US-2016-123183	FUR-BO-10000362
8955	CA-2016-156790	FUR-BO-10000468
1933	CA-2019-161200	FUR-BO-10000468
3031	CA-2017-168480	FUR-BO-10000468
8790	CA-2019-126914	FUR-BO-10000468
5474	CA-2019-116946	FUR-BO-10000468
7566	US-2018-166660	FUR-BO-10000468
5221	CA-2016-140487	FUR-BO-10000711
4089	US-2016-156559	FUR-BO-10000711
9626	CA-2019-137449	FUR-BO-10000780
4267	US-2018-131611	FUR-BO-10000780
2404	US-2018-110170	FUR-BO-10000780
4469	CA-2019-168641	FUR-BO-10000780
9220	US-2017-164238	FUR-BO-10000780
5238	CA-2016-166744	FUR-BO-10001337
3846	CA-2016-101931	FUR-BO-10001337
486	CA-2019-140963	FUR-BO-10001337
7140	CA-2017-163965	FUR-BO-10001337
7912	CA-2018-149762	FUR-BO-10001337
9201	CA-2018-152688	FUR-BO-10001337
2797	CA-2016-154599	FUR-BO-10001337
6139	CA-2016-131247	FUR-BO-10001337
2547	CA-2019-108070	FUR-BO-10001337
3763	CA-2018-156251	FUR-BO-10001337
842	CA-2017-100454	FUR-BO-10001519
5930	US-2019-169551	FUR-BO-10001519
7014	CA-2019-141201	FUR-BO-10001519
4224	CA-2019-134565	FUR-BO-10001519
7460	CA-2017-137974	FUR-BO-10001519
7968	CA-2018-157707	FUR-BO-10001567
4670	US-2019-133200	FUR-BO-10001601

DATABASE ORGANIZATION

In the other, each line is a product, and there is no product repetition

Product ID	Category	Product Name
FUR-BO-10000112	Furniture	Bush Birmingham Collection Bookcase, Dark Cherry
FUR-BO-10000330	Furniture	Sauder Camden County Barrister Bookcase, Planked Cherry Finish
FUR-BO-10000362	Furniture	Sauder Inglewood Library Bookcases
FUR-BO-10000468	Furniture	O'Sullivan 2-Shelf Heavy-Duty Bookcases
FUR-BO-10000711	Furniture	Hon Metal Bookcases, Gray
FUR-BO-10000780	Furniture	O'Sullivan Plantations 2-Door Library in Landvery Oak
FUR-BO-10001337	Furniture	O'Sullivan Living Dimensions 2-Shelf Bookcases
FUR-BO-10001519	Furniture	O'Sullivan 3-Shelf Heavy-Duty Bookcases
FUR-BO-10001567	Furniture	Bush Westfield Collection Bookcases, Dark Cherry Finish, Fully Assembled
FUR-BO-10001601	Furniture	Sauder Mission Library with Doors, Fruitwood Finish
FUR-BO-10001608	Furniture	Hon Metal Bookcases, Black
FUR-BO-10001619	Furniture	O'Sullivan Cherrywood Estates Traditional Bookcase
FUR-BO-10001798	Furniture	Bush Somerset Collection Bookcase
FUR-BO-10001811	Furniture	Atlantic Metals Mobile 5-Shelf Bookcases, Custom Colors
FUR-BO-10001918	Furniture	Sauder Forest Hills Library with Doors, Woodland Oak Finish
FUR-BO-10001972	Furniture	O'Sullivan 4-Shelf Bookcase in Odessa Pine
FUR-BO-10002202	Furniture	Atlantic Metals Mobile 2-Shelf Bookcases, Custom Colors
FUR-BO-10002206	Furniture	Bush Saratoga Collection 5-Shelf Bookcase, Hanover Cherry, *Special Order
FUR-BO-10002213	Furniture	DMI Eclipse Executive Suite Bookcases

DATABASE ORGANIZATION

Now, do you want to know the Name of the product based on the order ID?

Row ID	Order ID	Product ID
3513	CA-2019-140326	FUR-BO-10000112
6402	CA-2019-125472	FUR-BO-10000330
1761	CA-2017-130785	FUR-BO-10000330
5495	CA-2016-105249	FUR-BO-10000330
1611	CA-2016-156349	FUR-BO-10000362
2604	CA-2018-165848	FUR-BO-10000362
1595	CA-2017-118423	FUR-BO-10000362
7681	CA-2016-133592	FUR-BO-10000362
5395	US-2016-123183	FUR-BO-10000362
8955	CA-2016-156790	FUR-BO-10000468
1933	CA-2019-161200	FUR-BO-10000468
3031	CA-2017-168480	FUR-BO-10000468
8790	CA-2019-126914	FUR-BO-10000468
5474	CA-2019-116946	FUR-BO-10000468
7566	US-2018-166660	FUR-BO-10000468
5221	CA-2016-140487	FUR-BO-10000711
4089	US-2016-156559	FUR-BO-10000711
9626	CA-2019-137449	FUR-BO-10000780
4267	US-2018-131611	FUR-BO-10000780
2404	US-2018-110170	FUR-BO-10000780
4469	CA-2019-168641	FUR-BO-10000780
9220	US-2017-164238	FUR-BO-10000780
5238	CA-2016-166744	FUR-BO-10001337
3846	CA-2016-101931	FUR-BO-10001337
486	CA-2019-140963	FUR-BO-10001337
7140	CA-2017-163965	FUR-BO-10001337
7912	CA-2018-149762	FUR-BO-10001337
9201	CA-2018-152688	FUR-BO-10001337
2797	CA-2016-154599	FUR-BO-10001337
6139	CA-2016-131247	FUR-BO-10001337
2547	CA-2019-108070	FUR-BO-10001337
3763	CA-2018-156251	FUR-BO-10001337
842	CA-2017-100454	FUR-BO-10001519
5930	US-2019-169551	FUR-BO-10001519
7014	CA-2019-141201	FUR-BO-10001519
4224	CA-2019-134565	FUR-BO-10001519
7460	CA-2017-137974	FUR-BO-10001519
7968	CA-2018-157707	FUR-BO-10001567
4670	US-2019-133200	FUR-BO-10001601

JOIN

DATABASE ORGANIZATION

These are called Normalized tables and can be "blend" together to obtains the data via de join operation

Product ID	Category	Product Name
FUR-BO-10000112	Furniture	Bush Birmingham Collection Bookcase,
FUR-BO-10000330	Furniture	Sauder Camden County Barrister Bookc
FUR-BO-10000362	Furniture	Sauder Inglewood Library Bookcases
FUR-BO-10000468	Furniture	O'Sullivan 2-Shelf Heavy-Duty Bookcas
FUR-BO-10000711	Furniture	Hon Metal Bookcases, Gray
FUR-BO-10000780	Furniture	O'Sullivan Plantations 2-Door Library in
FUR-BO-10001337	Furniture	O'Sullivan Living Dimensions 2-Shelf B
FUR-BO-10001519	Furniture	O'Sullivan 3-Shelf Heavy-Duty Bookcas
FUR-BO-10001567	Furniture	Bush Westfield Collection Bookcases, D
FUR-BO-10001601	Furniture	Sauder Mission Library with Doors, Frui
FUR-BO-10001608	Furniture	Hon Metal Bookcases, Black
FUR-BO-10001619	Furniture	O'Sullivan Cherrywood Estates Traditior
FUR-BO-10001798	Furniture	Bush Somerset Collection Bookcase
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FUR-BO-10001918	Furniture	Sauder Forest Hills Library with Doors,
FUR-BO-10001972	Furniture	O'Sullivan 4-Shelf Bookcase in Odessa I
FUR-BO-10002202	Furniture	Atlantic Metals Mobile 2-Shelf Bookcas
FUR-BO-10002206	Furniture	Bush Saratoga Collection 5-Shelf Bookc
FUR-BO-10002213	Furniture	DMI Eclipse Executive Suite Bookcases

RELATIONSHIPS

RELATIONSHIPS BETWEEN OBJECTS\TABLES

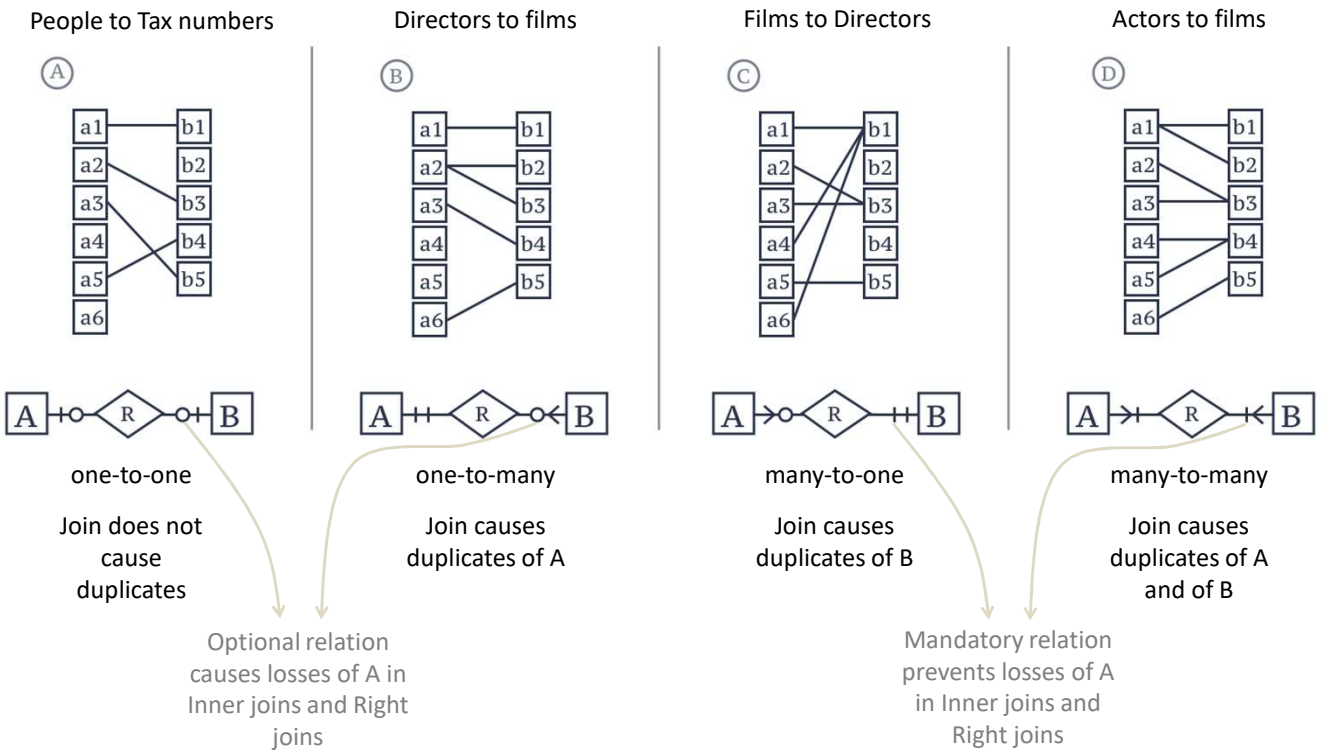
If rows in a given table can be associated in some way with rows in another table, the tables are said to have a relationship between them.

There are three types of relationships:

- 1to 1
- 1to many
- many to many

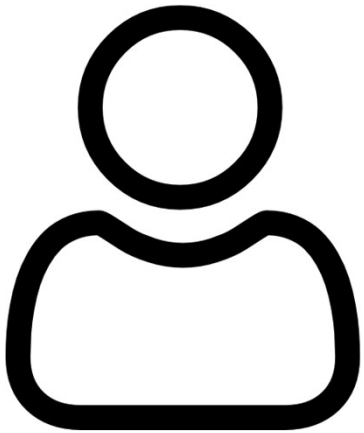
Keys are a special table construct designed to denote relationships between tables

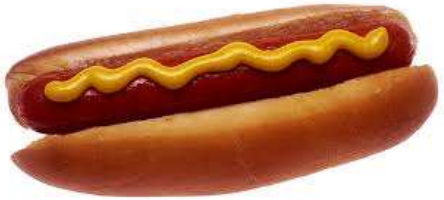
POSSIBLE RELATIONSHIPS BETWEEN TABLES

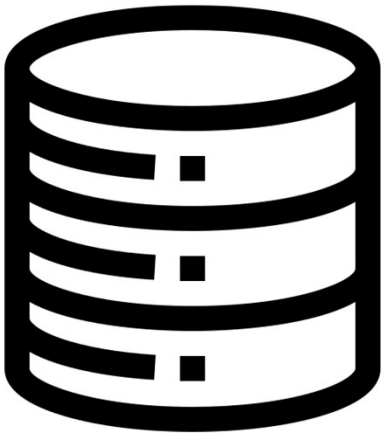


QUERIES – Scripting vs QUERYING

- Lets say we want to build a HotDog







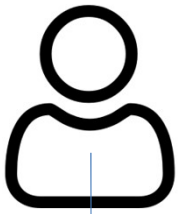
QUERIES – Scripting vs QUERYING

- SCRIPTING

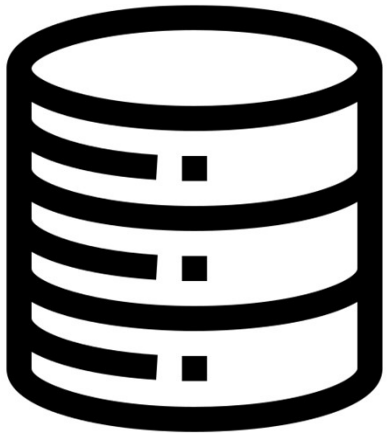
QUERIES – Scripting vs QUERYING

- SCRIPTING

pd.read_csv()



pd.groupby()
pd.filtering
etc



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2	ACE GOLDFINGER	A Astounding Epistle of a Database Administrat...	2006	1	NULL	3	4.99	48	12.99	G	Trailers,Deleted Scenes	2006-02-15 05:03:42
3	ADAPTATION HOLES	A Astounding Reflection of a Lumberjack And a ...	2006	1	NULL	7	2.99	50	18.99	NC-17	Trailers,Deleted Scenes	2006-02-15 05:03:42
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6	AGENT TRUMAN	A Intrepid Panorama of a Robot And a Boy who...	2006	1	NULL	3	2.99	169	17.99	PG	Deleted Scenes	2006-02-15 05:03:42
7	AIRPLANE SIERRA	A Touching Saga of a Hunter And a Butler who ...	2006	1	NULL	6	4.99	62	28.99	PG-13	Trailers,Deleted Scenes	2006-02-15 05:03:42
8	AIRPORT POLLOCK	A Epic Tale of a Moose And a Girl who must Con...	2006	1	NULL	6	4.99	54	15.99	R	Trailers	2006-02-15 05:03:42
9	ALABAMA DEVIL	A Thoughtful Panorama of a Database Administ...	2006	1	NULL	3	2.99	114	21.99	PG-13	Trailers,Deleted Scenes	2006-02-15 05:03:42
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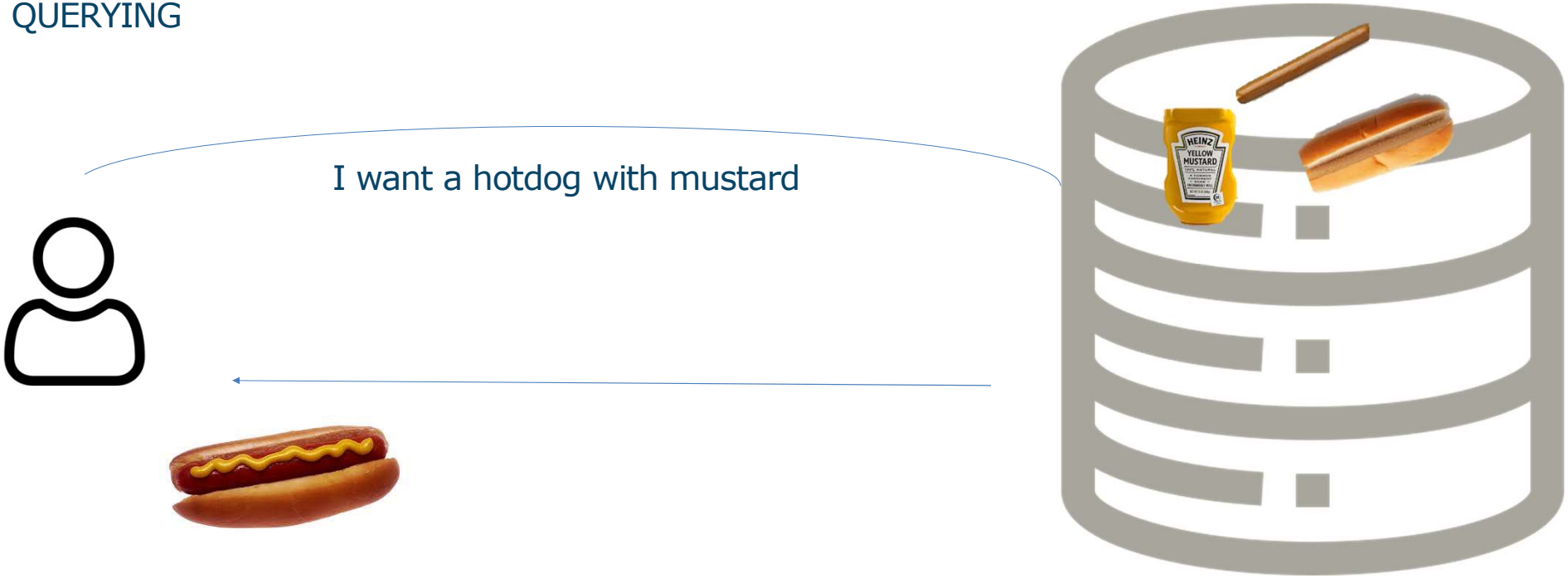
QUERIES – Scripting vs QUERYING

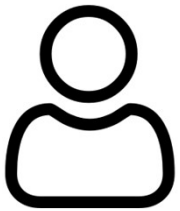
- QUERYING

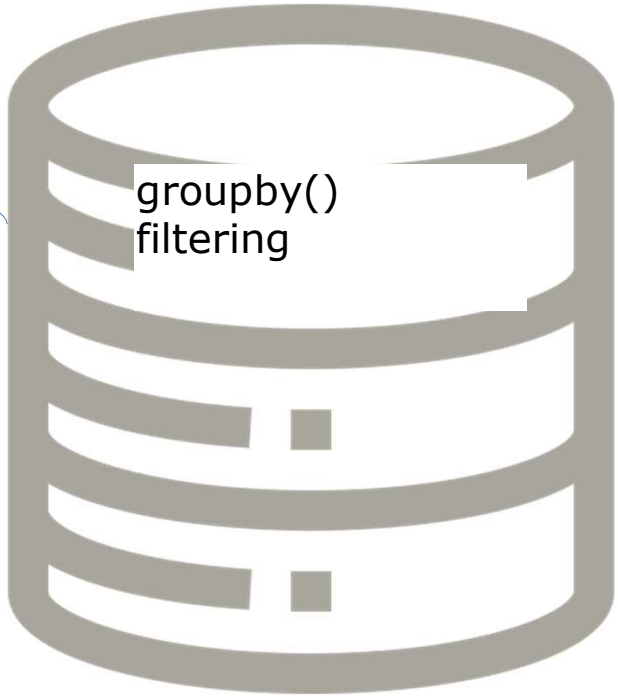


QUERIES – Scripting vs QUERYING

- QUERYING

I want data in a specific way





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QUERIES I

- Retrieving information from the database
- You have to specify which table(s) you want information for
- What is the criteria for the rows to be returned? any filters?
- How to manipulate the resulting fields?

SELECT STATEMENT

```
SELECT *FROM sakila.film;

SELECT title, description, rating FROM sakila.film;

SELECT DISTINCT rental_duration
FROM sakila.film;

SELECT DISTINCT rental_duration, language_id
FROM sakila.film;
```

ORDER BY

```
SELECT title, rental_rate, length
FROM sakila.film
ORDER BY length DESC;
```

```
SELECT title, rental_rate, length
FROM sakila.film
ORDER BY length DESC, rental_rate DESC;
```

ALIASING and COMPUTATIONS

```
SELECT title, rental_rate AS cost, length
FROM sakila.film;

SELECT title, rental_rate/length AS price_per_min
FROM sakila.film
ORDER BY price_per_min ASC

SELECT CONCAT(title,', rating:',rating) AS descriptor
FROM sakila.film;
```

https://www.w3schools.com/sql/sql_ref_sqlserver.asp

WHERE - HOW TO RETRIEVE DATA FROM SPECIFIC ROWS

```
SELECT *
FROM sakila.film
WHERE rental_duration =6;
```

Operator	Function	Example
=	Equal to	WHERE rental_duration = 6;
<>	Not equal to	WHERE rating <> 'R';
>	Greater than	WHERE rental_duration > 4;
<	Less than	WHERE rental_rate < 2.99;
>=	Greater than or equal to	WHERE rental_duration >= 4;
<=	Less than or equal to	WHERE rental_rate <= 2.99;
BETWEEN	Within a range	WHERE length BETWEEN 90 AND 120
IN	Match one in a set	WHERE rating in ('PG','PG-13','PG-17')
LIKE	Match pattern	WHERE rating LIKE 'PG%'
NOT	Negates a condition	WHERE rating NOT LIKE 'PG%'

AGGREGATIONS AND GROUP BY

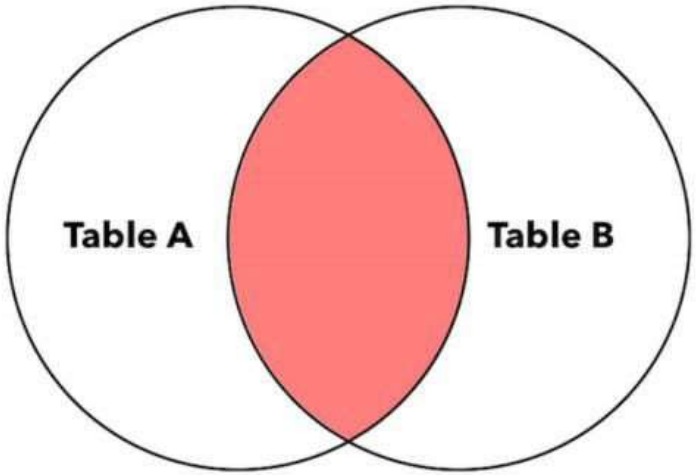
```
SELECT COUNT(*),MAX(rental_duration),AVG(replacement_cost),AVG(rental_duration)
FROM sakila.film
```

```
SELECT rating, COUNT(rating), AVG(rental_rate)
FROM sakila.film
GROUP BY rating;
```

```
SELECT rating, rental_duration, COUNT(rating), AVG(rental_rate)
FROM sakila.film
GROUP BY rating, rental_duration;
```

INNER JOIN

RETURNS ROWS FROM BOTH TABLES WHERE MATCHING VALUES ARE FOUND IN THE JOINED COLUMNS OF BOTH TABLES.




```
SELECT *
FROM Table_A
INNER JOIN Table_B
ON Table_A.Key =Table_B.Key
```

```
SELECT world.country.Name AS Country_Name,
world.city.Name AS City_Name,
world.country.GNP/world.city.Population AS GNP_per_capita
FROM world.country
INNER JOIN world.city
ON world.country.Code =world.city.CountryCode;
```

KEYS

PRIMARY VS FOREIGN

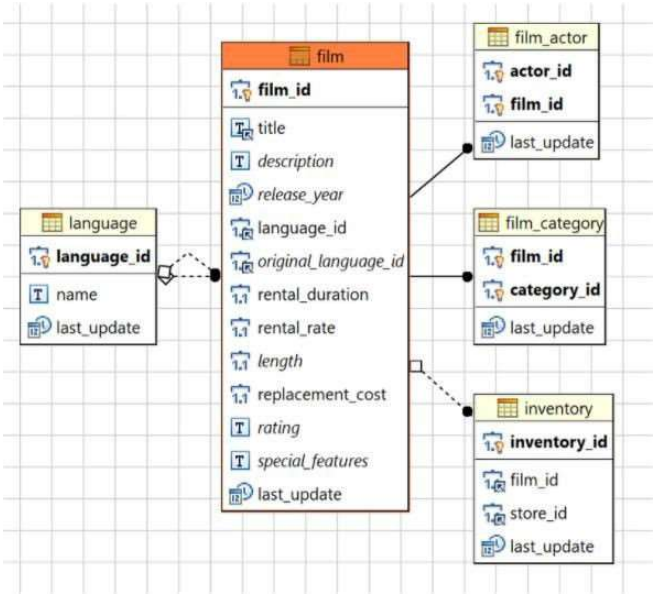
Every table in your database should have a primary key. A primary key consists of one column that uniquely identifies each row within a table.

The primary key:
- identifies a specific row throughout the entire database,
- its column identifies a given table throughout the entire database.
- enforce table-level integrity and help establish relationships with other tables.

When you determine that a pair of tables has a relationship to each other, you typically establish the relationship by taking a copy of the primary key from the first table and inserting it into the second table, where it becomes a foreign key.

RELATIONAL DATABASE SCHEMAS

- Entity Relational Diagram (ERD)
- Shows content of each table and connections between tables within a database schema
- Primary Key and Foreign Key visual here



ONE-TO-ONE RELATIONSHIP

A SINGLE ROW IN THE FIRST TABLE IS RELATED TO ONLY ONE ROW IN THE SECOND TABLE

A pair of tables has a one-to-one relationship when a single row in the first table is related to only one row in the second table, and a single row in the second table is related to only one row in the first table.

In this type of relationship, one table is referred to as the primary table, and the other is referred to as the secondary table. You establish this relationship by taking the primary key of the primary table and inserting it into the secondary table, where it becomes a foreign key. This is a special type of relationship because in nearly all cases the foreign key also acts as the primary key of the secondary table.

(e.g. citizen id and passport nr. Notice not all citizens have a passport)

ONE-TO-MANY RELATIONSHIP

ONE ROW IN ONE TABLE HAS A RELATIONSHIP WITH MULTIPLE ROWS IN ANOTHER TABLE

When a pair of tables has a one-to-many relationship, a single row in the first table can be related to many rows in the second table, but a single row in the second table can be related to only one row in the first table.

This relationship is established by taking the primary key of the table on the "one" side and inserting it into the table on the "many" side, where it becomes a foreign key. In this case the second table has also its own primary key.

(e.g. city and country - world database)

MANY-TO-MANY RELATIONSHIP

MANY ROWS IN ONE TABLE HAVE A RELATIONSHIP WITH MULTIPLE ROWS IN ANOTHER TABLE

A pair of tables is in a many-to-many relationship when a single row in the first table can be related to many rows in the second table, and a single row in the second table can be related to many rows in the first table.

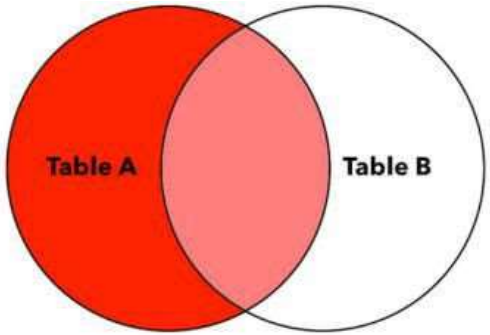
To establish this relationship properly, you typically create what is known as a linking table. This table provides an easy way to associate rows from one table with those of the other and will help to ensure that you have no problems adding, deleting, or modifying any related data. You define a linking table by taking a copy of the primary key of each table in the relationship and using them to form the structure of the new table. These columns actually serve two distinct roles: Together they form the composite primary key of the linking table, and separately they each serve as a foreign key.
(e.g. actor and film - sakila)

LEFT JOIN

RETURNS EVERY ROW FROM THE LEFT TABLE PLUS ROWS THAT MATCH VALUES IN THE JOINED COLUMN FROM THE RIGHT TABLE.

```
SELECT *
FROM Table_A
LEFT JOIN Table_B
ON Table_A.Key =Table_B.Key
```

If there's no match for a value in the left table, the query result contains NULL values for the right table columns.

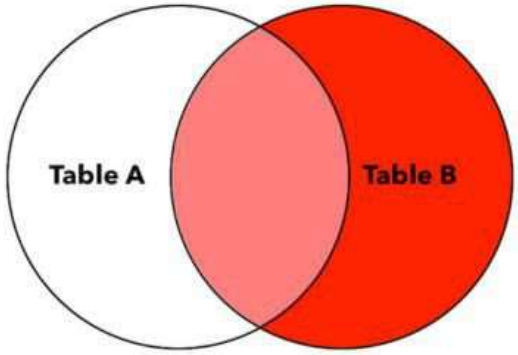


RIGHT JOIN

RETURNS EVERY ROW FROM THE RIGHT TABLE PLUS ROWS THAT MATCH THE KEY VALUES IN THE KEY COLUMN FROM THE LEFT TABLE

table columns.

```
SELECT *
FROM Table_A
RIGHT JOIN Table_B
ON Table_A.Key =Table_B.Key
```



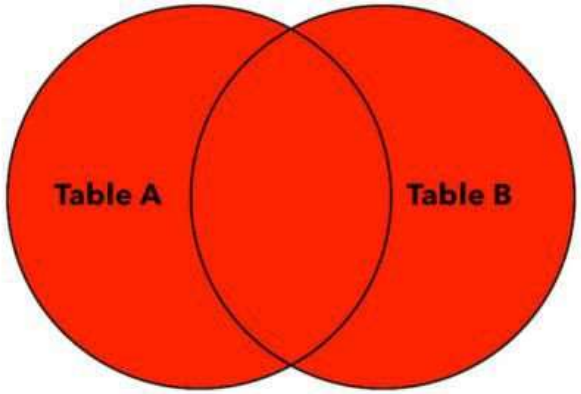
If there's no match for a value in the right table, the query result contains NULL values for the left

FULL OUTER JOIN

RETURNS EVERY ROW FROM BOTH TABLES AND MATCHES ROWS; THEN JOINS THE ROWS WHERE VALUES IN THE JOINED COLUMNS MATCH.

```
SELECT *
FROM Table_A
OUTER JOIN Table_B
ON Table_A.Key =Table_B.Key
```

If there's no match for a value in either the left or right table, the query result contains an empty row for the other table.



END OF DAY 1

DATA SCIENCE AND MACHINE LEARNING BOOTCAMP

SQL – Day 2

SUBQUERIES

As the name implies, subqueries are queries nested inside another query.

You can use a subquery in the place of any table of the main query, since SELECT statements themselves return "tables"

This is often a solution used for quick analysis since subqueries can easily become very complex

SUBQUERIES

Example: find the names of the actors which starred in movies with lengths higher or equal to the average length of all the movies

SUBQUERIES

Example: find the names of the actors which starred in movies with lengths higher or equal to the average length of all the movies

```
SELECT AVG(length) AS average FROM films
```

SUBQUERIES

Example: find the names of the actors which starred in movies with lengths higher or equal to the average length of all the movies

```
SELECT *
FROM sakila.film
WHERE length >(SELECT AVG(length) AS average FROM film)
```

SUBQUERIES

Example: find the names of the actors which starred in movies with lengths higher or equal to the average length of all the movies

```
SELECT film_id
FROM sakila.film
WHERE length >(SELECT AVG(length) AS average FROM film)
```

SUBQUERIES

Example: find the names of the actors which starred in movies with lengths higher or equal to the average length of all the movies

```
SELECT DISTINCT actor_id
FROM sakila.film_actor
INNER JOIN

    (SELECT film_id
    FROM sakila.film
    WHERE length >(SELECT AVG(length) AS average FROM film)) AS selected_films_id

ON sakila.film_actor.film_id =selected_films_id.film_id
```

SUBQUERIES

Example: find the names of the actors which starred in movies with lengths higher or equal to the average length of all the movies

```
SELECT first_name, last_name
FROM sakila.actor
INNER JOIN (
SELECT DISTINCT actor_id
FROM sakila.film_actor
INNER JOIN (SELECT film_id FROM sakila.film WHERE length >(SELECT AVG(length) AS average FROM film)) AS selected_films_id
ON sakila.film_actor.film_id =selected_films_id.film_id) AS selected_actors
ON sakila.actor.actor_id =selected_actors.actor_id
```

TEMPORARY

TABLES COMPLEXITY

BREEDS ERROR

Subqueries can easily become very complex and therefore hard to debug and get wrong

Temporary Tables can be reused and stored for a whole session

They are destroyed after the session, no actual database space is used

VIEWS

What if we would like to save a query?

```
DROP VIEW IF EXISTS actor_categories;

-- Create a new view
CREATE VIEW actor_categories AS
SELECT
actor_id,
first_name,
last_name,
COUNT(film_id) AS total_films,
CASE
WHEN COUNT(film_id) >= 30 THEN 'Star Actor'
WHEN COUNT(film_id) >= 15 THEN 'Frequent Actor'
ELSE 'Occasional Actor'
END AS actor_category
FROM
actor
JOIN
film_actor ON actor.actor_id = film_actor.actor_id
GROUP BY
actor_id
ORDER BY
total_films DESC;
```

```
SELECT `actor_categories`.`actor_id`,
`actor_categories`.`first_name`,
`actor_categories`.`last_name`,
`actor_categories`.`total_films`,
`actor_categories`.`actor_category`
FROM `sakila`.`actor_categories`;
```

ADVANCED TOPICS

ACTIONS QUERIES

Action queries are queries that alter the database

CREATE DATABASE

CREATE TABLE

DROP TABLE

DROP DATABASE

ALTER TABLE

INSERT INTO

UPDATE