

These are the slides for the SQL for Beginners: Learn SQL using MySQL and Database Design on Udemy. They are provided free of charge to all students.

More information about the course: <https://lpa.dev/u1sqlb>

If you have any questions or queries, please add your feedback in the Q&A section of the course on Udemy.

Best regards,

Tim Buchalka
Learn Programming Academy

SQL for Beginners Slides

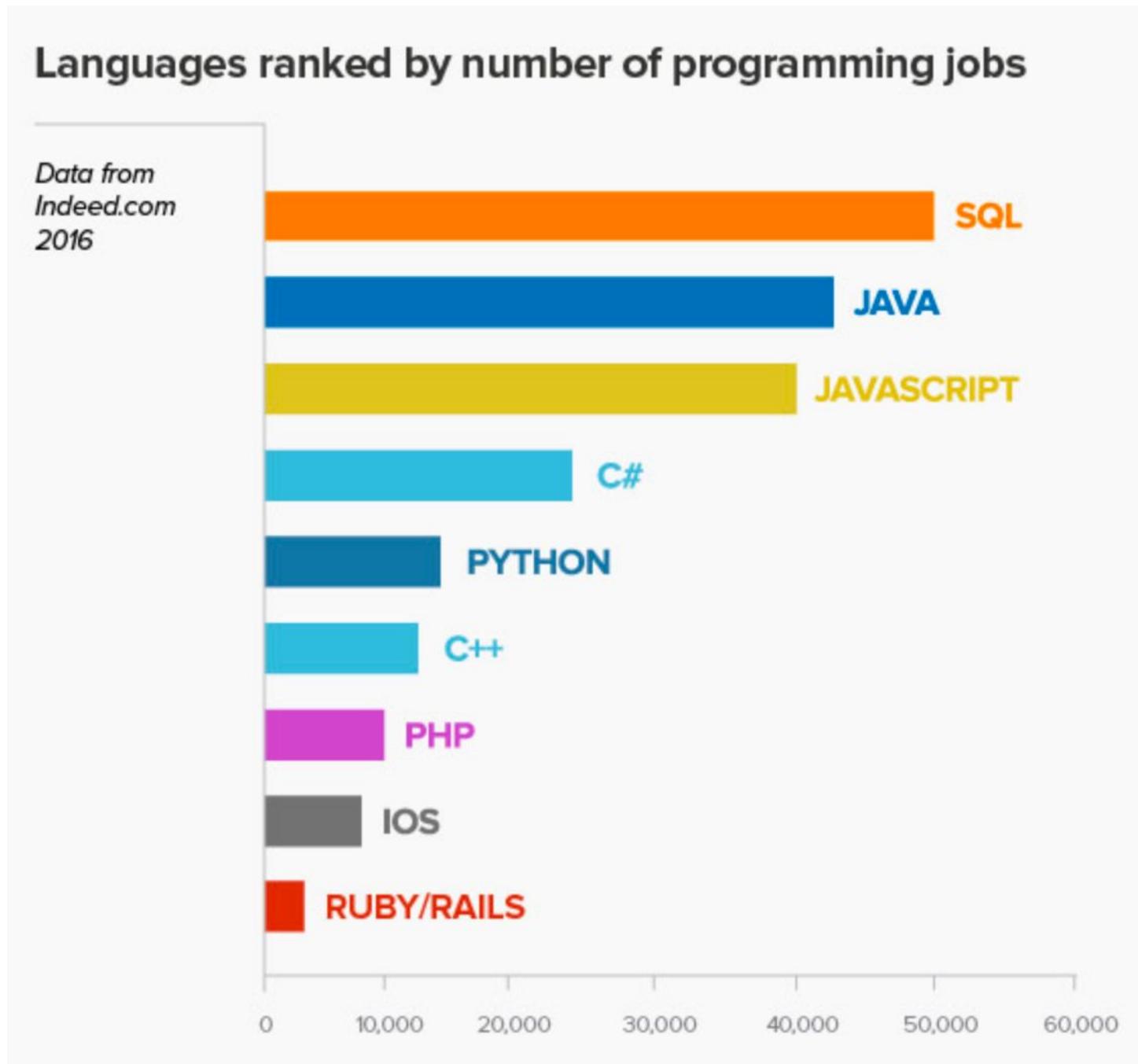
Main Course Slides.

SQL FOR BEGINNERS



IT Systems Engineer

COURSE INTRODUCTION



No Prior Knowledge

No Prior Knowledge

Beginner



**Exper
t**

In The Course

Database Design

Creating a Real World Database from Scratch

Writing Complex Queries To Retrieve Data

Challenges For You to Test Your Knowledge

This Course Is For

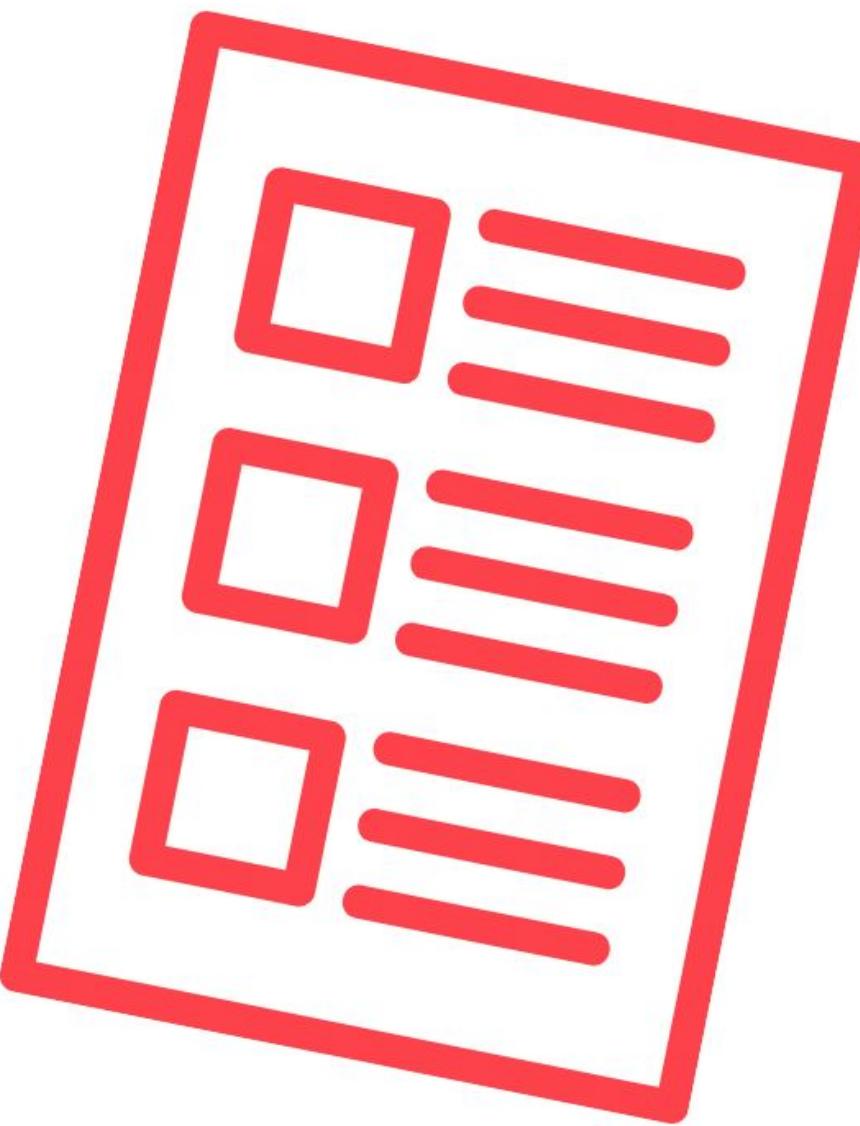
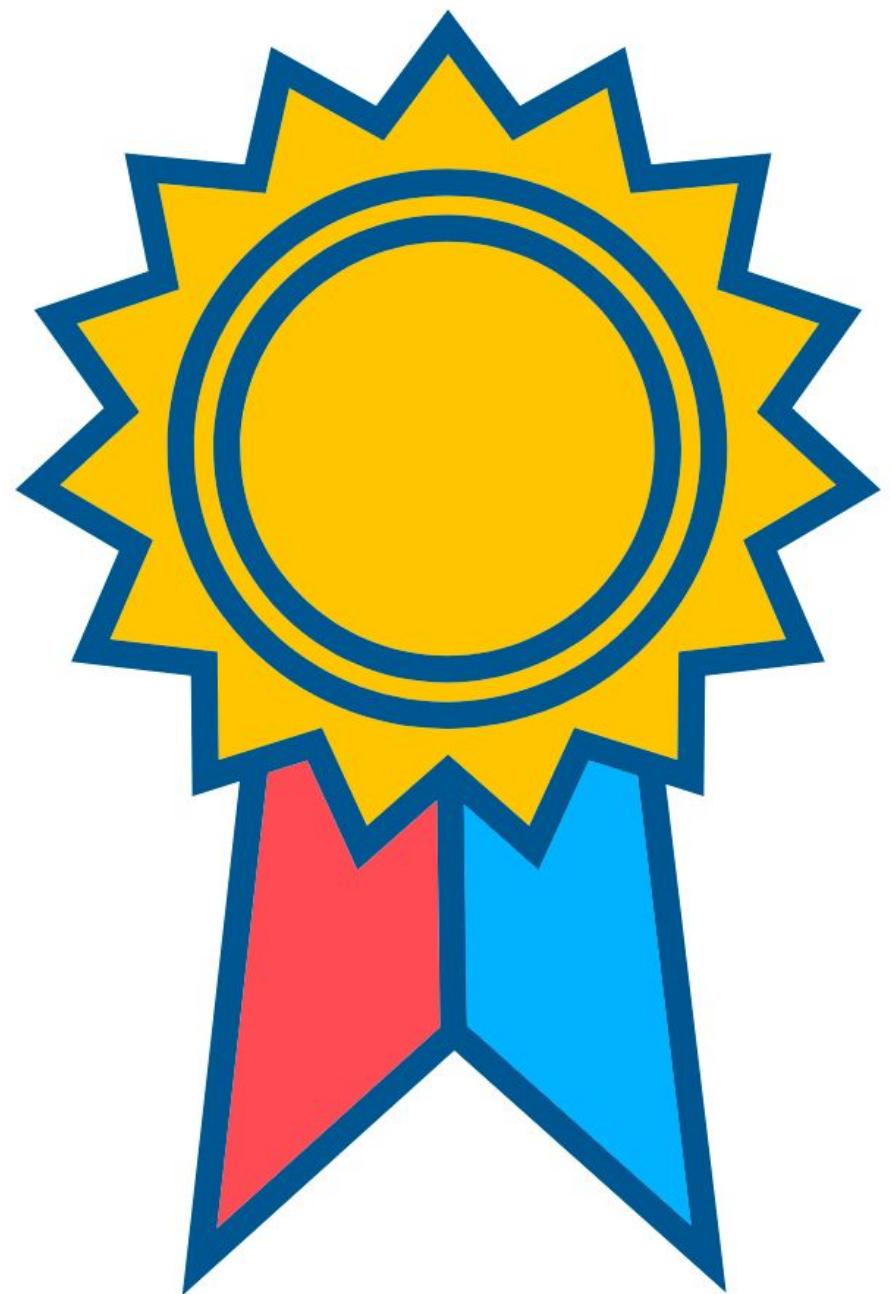
You

You are new to SQL and want to become an expert on SQL and databases

You are new to MySQL and want to master a second database

You know the basics of SQL and want to take your skills to the next level

COURSE INTRODUCTION



SYLLABUS OVERVIEW

Section 2

Learn about Databases, SQL and MySQL

Install and Setup MySQL and MySQL Workbench

Write Your First SQL queries.

Section 3

Primary and Foreign Keys

How to Create, Modifying and Delete Tables

Creating a Database for a Coffee Store

Section 4

How to Insert, Update and Delete Data

Insert Data into the Coffee Store Database

Section 5

How to Retrieve Data from a Table

Filter using Where Clauses

Ordering Your Data

Section 6

Retrieve Data from More Than One Table

How to Use Table Joins

Differences Between Joins

Section 7

Learn About Database Design

Normalization

Relationships

Constraints

Section 8

Create a Database for a Cinema Online Booking System

Insert Data into this Database

Section 9

Learn About Aggregate Functions

How to Group Data

Use the Having Clause

Section 10

Learn About Subqueries

Non-Correlated Subqueries

Correlated Subqueries

WHAT YOU WILL LEARN

What a database is.

What SQL and MySQL are and how they are related.

What a relational Database Management System is.

Installation and setup of MySQL and MySQL Workbench.

Writing your first SQL queries.

DATABASES, SQL AND MySQL

WHAT IS A DATABASE

An organised collection of information (data).

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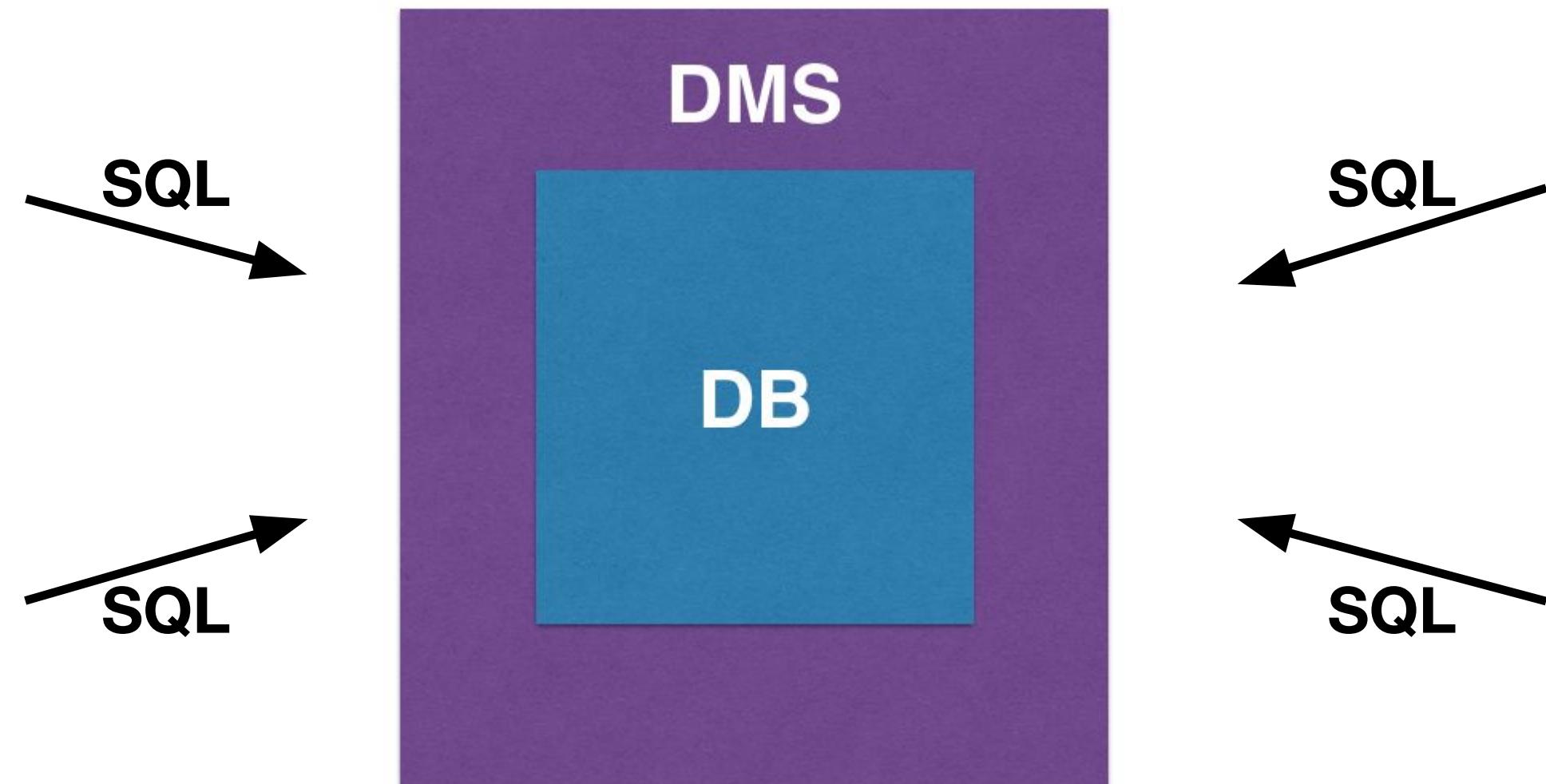
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WHAT IS A DATABASE

Allows us to access and interact with the data.



WHAT IS SQL

Structured Query Language.

It is a standard language used to communicate with databases.

SQL is used to perform tasks on a database.

```
SELECT * FROM  
customers;
```

WHAT IS MySQL

MySQL is a Relational Database Management System.

Provides a UI for us to access and interact with the database.

RDBMS

MySQL
PostgreSQL
SQL Server
Oracle

RELATIONAL DATABASE MANAGEMENT SYSTEM RDBMS

WHAT IS AN RDBMS

A relational database is a collection of data organised into tables.

Tables contain columns of data categories, and rows with particular instances of that data category.

id	first_name	last_name	gender
1	Chris	Martin	M
2	Emma	Law	F
3	Mark	Watkins	M
4	Daniel	Williams	M
5	Sarah	Taylor	F

WHAT IS AN RDBMS

Tables in a relational database can be linked together.

id	first_name	last_name	gender
1	Chris	Martin	M
2	Emma	Law	F
3	Mark	Watkins	M
4	Daniel	Williams	M
5	Sarah	Taylor	F

customer_id	order_time
2	2017-01-01 08:05:16
12	2017-01-01 08:44:34
4	2017-01-01 09:20:02
9	2017-01-01 11:51:56
22	2017-01-01 13:07:10

RDBMS is what we use to access and interact with the relational database.

SQL FOR BEGINNERS

Data Definition Language

Section Introduction

BY THE END OF THIS SECTION

DATA TYPES

PRIMARY AND FOREIGN KEYS

CREATING TABLES

MODIFYING TABLES

DELETING TABLES

DELETING ALL DATA FROM TABLES

CREATING YOUR FIRST DATABASE

CREATE A DATABASE FOR A COFFEE SHOP

PRODUCTS

CUSTOMERS

ORDERS

SQL FOR BEGINNERS

Data Types

NUMERIC DATA TYPES

INT : Whole numbers

FLOAT(M,D) : Decimal numbers (approximate)

DECIMAL(M,D) : Decimal numbers (precise)

NON-NUMERIC DATA TYPES

CHAR(N) : Fixed length character

VARCHAR(N) : Varying length character

ENUM('M','F') : Value from a defined list

BOOLEAN : True or False values

DATE AND TIME TYPES

DATE : Date (YYYY-MM-DD)

DATETIME : Date and the time (YYYY-MM-DD HH-MM-SS)

TIME : Time (HHH-MM-SS)

YEAR : Year (YYYY)

SQL FOR BEGINNERS

Primary and Foreign Keys

PRIMARY KEY

- A primary key is a column, or set of columns, which uniquely identifies a record within a table.
- A primary key must be unique.
- A primary key cannot be NULL.
- A table can only have one primary key.

When we create our tables we will learn how to define our primary keys.

PRIMARY KEY EXAMPLE

	<code>id integer</code>	<code>first_name character varying (20)</code>	<code>last_name character varying (20)</code>	<code>gender character (1)</code>	<code>telephone character varying (15)</code>
1	John	Smith		M	01903765032
2	John	Burrows		M	01903733211
3	John			M	
4	Susan	Andrews		F	01304333492
5	Emily	Simmonds		F	01708454567
6	George	Simmonds		M	01708454567
7	Emily	Warburton		F	01903909009
8	David	Smith		M	01503665382
9	Jennifer	Jang		F	01944225042

The ID column is the PRIMARY KEY in the customers table.

Can't be the first_name, last_name or even telephone number as they are not unique.

FOREIGN KEY

- A foreign key is used to link two tables together.
- A foreign key is a column whose values match the values of another table's primary key column.
- The table with the primary key is called the reference, or parent, table and the table with the foreign key is called the child table.
- A table can have multiple foreign keys.

FOREIGN KEY EXAMPLE

<input type="checkbox"/> id integer	<input type="checkbox"/> customer_id integer	<input type="checkbox"/> product_id integer	<input type="checkbox"/> quantity integer	<input type="checkbox"/> price numeric	<input type="checkbox"/> order_date date
1	5	1	2	49.50	2017-01-02
2	9	2	1	49.50	2017-01-03
3	22	13	1	75.00	2017-01-05
4	7	3	1	49.50	2017-01-09
5	9	10	4	25.00	2017-01-11
6	[null]	10	3	25.00	2017-01-11
7	1	11	2	20.00	2017-01-11
8	13	8	2	69.00	2017-01-14
9	5	4	1	60.00	2017-01-16
10	20	6	3	65.00	2017-01-16

Customer_id column and product_id column are FOREIGN KEYS in the orders table.

They are referencing PRIMARY KEY columns in the customers and products tables.

Creating the Coffee Store Database

CUSTOMERS				
ID	FIRST_NAME	LAST_NAME	GENDER	PHONE_NUMBER

MORE ON ALTER TABLE SECTION INTRODUCTION

BY THE END OF THIS SECTION

HOW TO ADD AND REMOVE PRIMARY KEYS

HOW TO ADD AND REMOVE FOREIGN KEYS

HOW TO ADD A UNIQUE CONSTRAINT

HOW TO CHANGE A COLUMNS NAME

HOW TO CHANGE A COLUMNS DATA TYPE

IN THIS SECTION WE WILL

CREATE A NEW DATABASE

MODIFY THE TABLES WITHIN THIS DATABASE

EXERCISES AND SOLUTIONS

Exercise 1

- Add a primary key to the id fields in the pets and people tables.
- Add a foreign key to the owner_id field in the pets table referencing the id field in the people table.
- Add a column named email to the people table.
- Add a unique constraint to the email column in the people table.
- Rename the name column in the pets table to 'first_name'.
- Change the postcode data type to CHAR(7) in the addresses table.

SQL FOR BEGINNERS

Data Manipulation Language

Section Introduction

BY THE END OF THIS SECTION

INSERT DATA INTO TABLES

UPDATE DATA IN A TABLE

DELETE DATA FROM A TABLE

Insert Into

PRODUCTS			
ID	NAME	PRICE	COFFEE_ORIGIN
1	ESPRESSO	2.50	BRAZIL
2	MACCHIATO	3.00	BRAZIL
3	CAPPUCCINO	3.50	COSTA RICA
4	LATTE	3.50	INDONESIA
5	AMERICANO	3.00	BRAZIL
6	FLAT WHITE	3.50	INDONESIA
7	FILTER	3.00	INDIA

SQL FOR BEGINNERS

Selecting from a Table

Section Introduction

BY THE END OF THIS SECTION

How to retrieve data from a table using the SELECT command.

Adding WHERE clauses to filter your query.

How to use the IN, BETWEEN and LIKE commands.

How to order your result set by column.

BY THE END OF THIS SECTION

How to limit the number of rows in your extraction.

How to remove duplicate values.

How to set a column name alias.

Exercises to practice your SQL skills.

Exercise 1

1. From the customers table, select the first name and phone number of all the females who have a last name of Bluth.
2. From the products table, select the name for all products that have a price greater than 3.00 or a coffee origin of Sri Lanka.
3. How many male customers don't have a phone number entered into the customers table?

Exercise 2

1. From the products table, select the name and price of all products with a coffee origin equal to Colombia or Indonesia. Ordered by name from A-Z.
2. From the orders table, select all the orders from February 2017 for customers with id's of 2, 4, 6 or 8.
3. From the customers table, select the first name and phone number of all customers who's last name contains the pattern 'ar'.

Exercise 3

1. From the customers table, select distinct last names and order alphabetically from A-Z.
2. From the orders table, select the first 3 orders placed by customer with id 1, in February 2017.
3. From the products table, select the name, price and coffee origin but rename the price to retail_price in the results set.

SQL FOR BEGINNERS

Selecting from Multiple Tables

Section Introduction

BY THE END OF THIS SECTION

Learn how to SELECT data from multiple tables by using different types of JOIN statements in SQL.

How to write an INNER JOIN query.

How to write LEFT and RIGHT JOINs queries and the differences between them.

How to SELECT data from more than two tables using multiple JOIN statements.

SQL FOR BEGINNERS

Joins

WHAT IS A JOIN

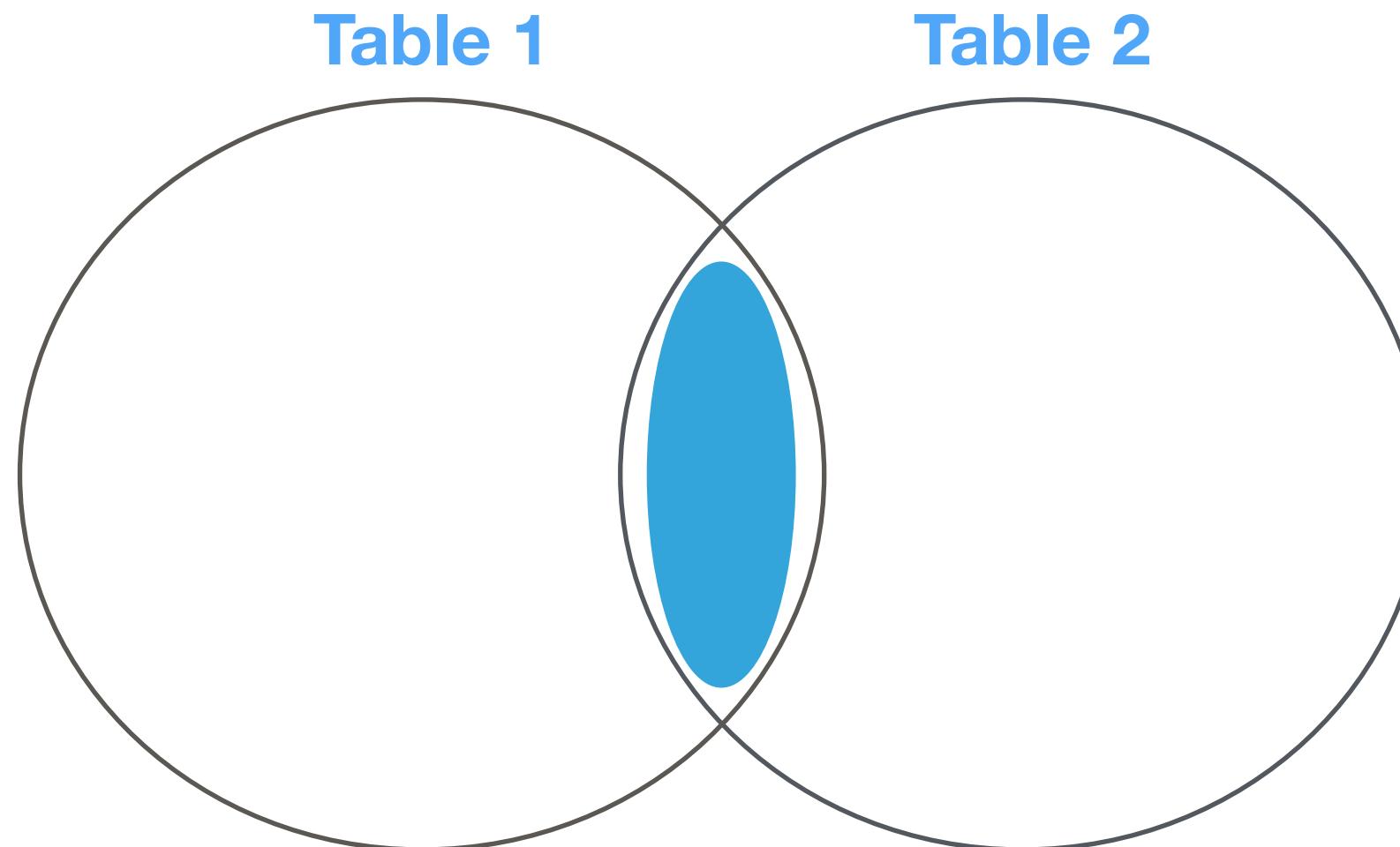
Joins allow you to retrieve data from multiple tables in a single select statement.

To join two tables there needs to be a related column between them.

There are many different kinds of Join.

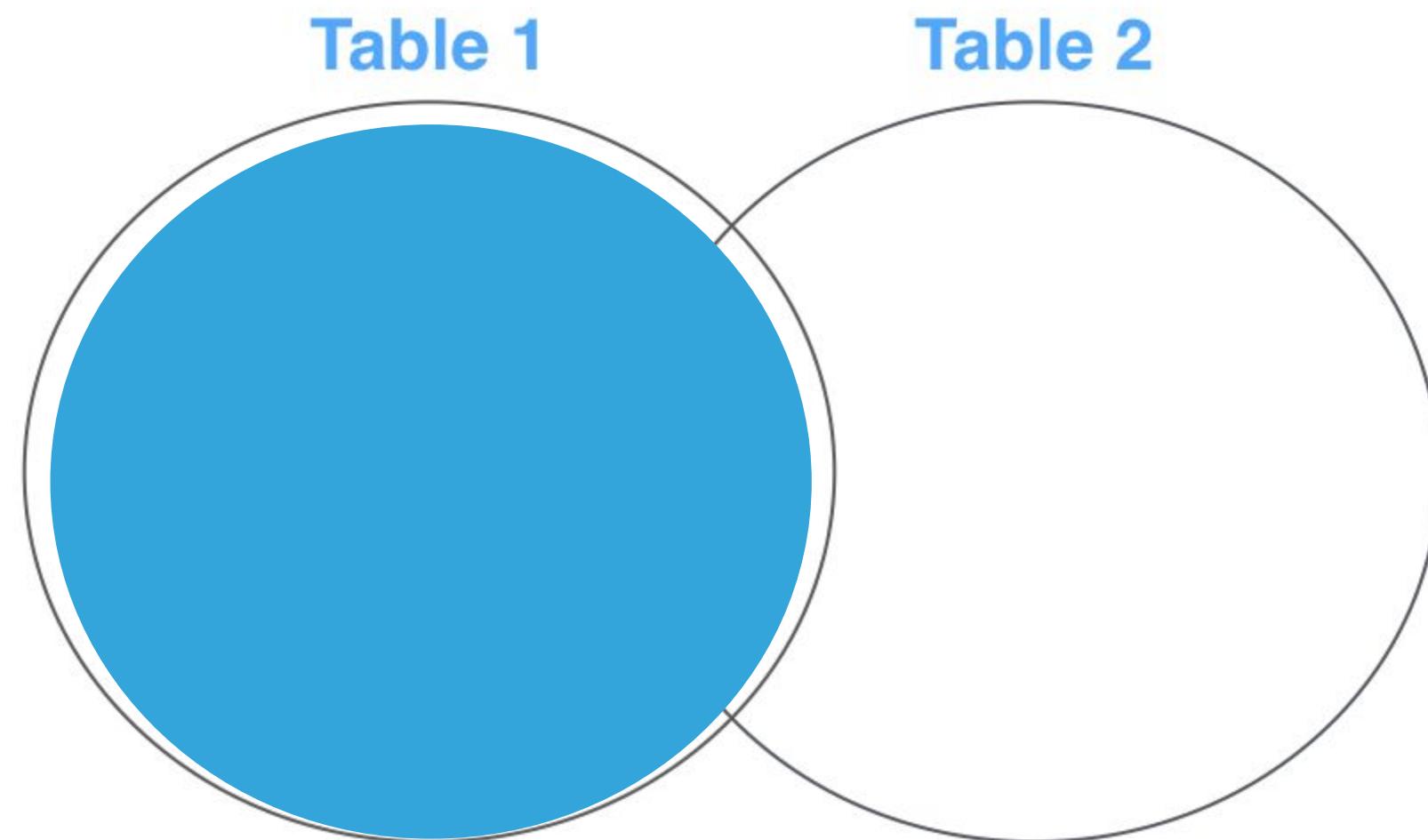
INNER JOIN

Will retrieve data only when there is matching values in both tables.



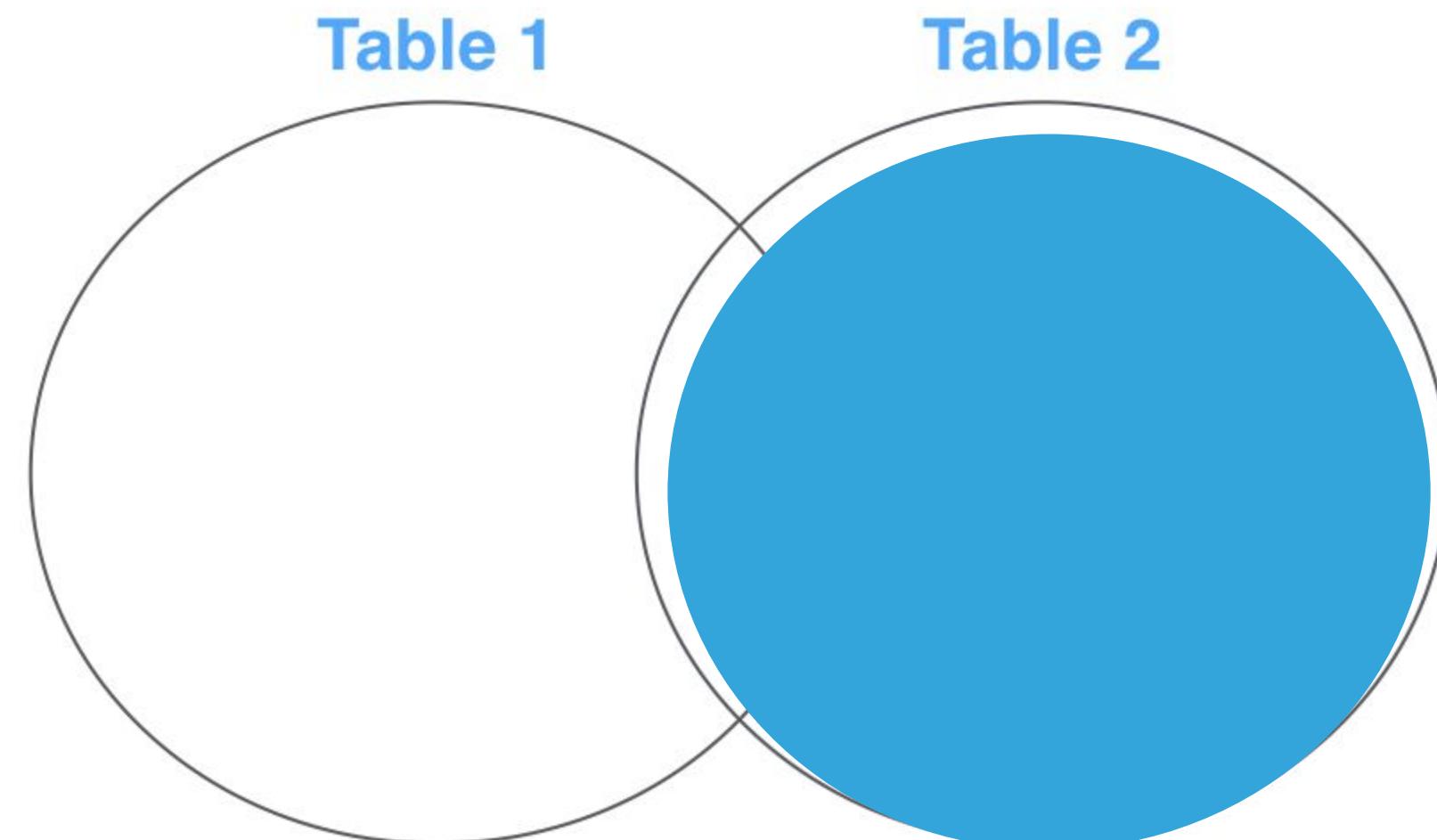
LEFT JOIN

Will retrieve all data from the left table (table 1) and matching rows from the right table (table 2).



RIGHT JOIN

Will retrieve all data from the right table (table 2) and matching rows from the left table (table 1).



Exercise 1

Select the order id and customers phone number for all orders of product id 4.

Select product name and order time for filter coffees sold between January 15th 2017 and February 14th 2017.

Select the product name and price and order time for all orders from females in January 2017.

Database Design

Section Introduction

Database Design NORMALIZATION

RELATIONSHIPS

CONSTRAINTS

NORMALIZATION

WHAT IS NORMALIZATION

Normalization is the process of efficiently organizing data in a database.

- Why?
- To eliminate redundant data.
- To only store related data in a table.

WHAT IS NORMALIZATION

Student	Year	Class	Teacher
John Smith	9	Geography	Mr. Green
Tom Buchanan	9	Geography	Mr. Green
Sarah Bennet	8	Physics	Mrs. Einstein
Charlie Brown	9	Geography	Mr. Green
April Barnes	10	Music	Mrs. Sharpe

WHAT IS NORMALIZATION

Benefits:

- Reduce storage space.
- Reduce insert, update and deletion anomalies.
- Improve query performance.

WHAT IS NORMALIZATION

Levels of normalization:

- 1st Normal Form (1NF).
- 2nd Normal Form (2NF).
- 3rd Normal Form (3NF).
- Boyce and Codd Normal Form (BCNF).

FIRST NORMAL FORM (1NF)

WHAT IS 1NF

Tables are in 1NF if:

- No repeated rows of data.
- Columns only contain a single value.
- The table has a primary key.

1NF EXAMPLE

STUDENT	YEAR	CLASS
Paul Dawson	11	Math
Peggy Mitchell	10	History
Paul Dawson	11	Math
Brian Cox	8	English, Chemistry
Linda Marsh	7	Math, History, Biology

1NF EXAMPLE

STUDENT	YEAR	CLASS
Paul Dawson	11	Math
Peggy Mitchell	10	History
Brian Cox	8	English
Brian Cox	8	Chemistry
Linda Marsh	7	Math
Linda Marsh	7	History
Linda Marsh	7	Biology

SECOND NORMAL FORM (2NF)

WHAT IS 2NF

Tables are in 2NF if:

- They conform to 1NF.
- Every column that is not a primary key of the table is dependent on the whole of the primary key.

2NF EXAMPLE

STUDENT	SUBJECT	GRADE	AGE
Natasha Williams	Maths	A	15
Natasha Williams	English	B	15
Daniel James	Maths	C	16
Simon Brown	Chemistry	A	14
Emma Thomas	Geography	B	14

2NF EXAMPLE

STUDENT	SUBJECT	GRADE
Natasha Williams	Maths	A
Natasha Williams	English	B
Daniel James	Maths	C
Simon Brown	Chemistry	A
Emma Thomas	Geography	B

2NF EXAMPLE

STUDENT	AGE
Natasha Williams	15
Daniel James	16
Simon Brown	14
Emma Thomas	14

THIRD NORMAL FORM (3NF)

WHAT IS 3NF

Tables are in 3NF if:

- They conform to 2NF.
- Every column that is not a primary key is only dependent on the whole of the primary key.

3NF EXAMPLE



SUBJECT	YEAR	STAR PUPIL	STAR PUPIL DATE OF BIRTH
Math	2015	Matthew Taylor	1999-03-21
Physics	2015	William Edwards	1999-09-15
Chemistry	2015	Georgina Simon	1998-11-04
Math	2016	Benjamin Long	2000-05-02
Physics	2016	William Edwards	1999-09-15

3NF EXAMPLE

SUBJECT	YEAR	STAR PUPIL
Math	2015	Matthew Taylor
Physics	2015	William Edwards
Chemistry	2015	Georgina Simon
Math	2016	Benjamin Long
Physics	2016	William Edwards

3NF EXAMPLE

STAR PUPIL	STAR PUPIL DATE OF BIRTH
Matthew Taylor	1999-03-21
William Edwards	1999-09-15
Georgina Simon	1998-11-04
Benjamin Long	2000-05-02

RELATIONSHIPS

WHAT ARE RELATIONSHIPS

Tables are related through primary and foreign keys.

One to One Relationship.

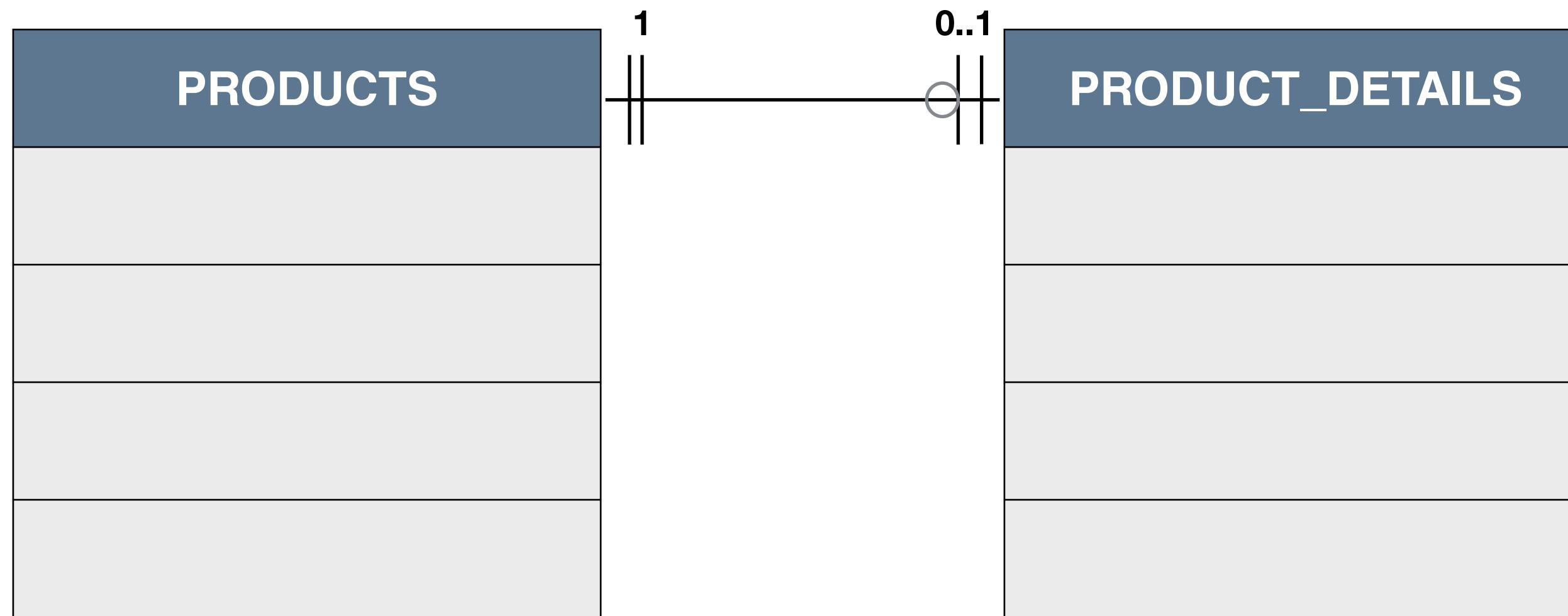
One to Many Relationship.

Many to Many Relationship.

ONE TO ONE RELATIONSHIP

WHAT IS ONE TO ONE

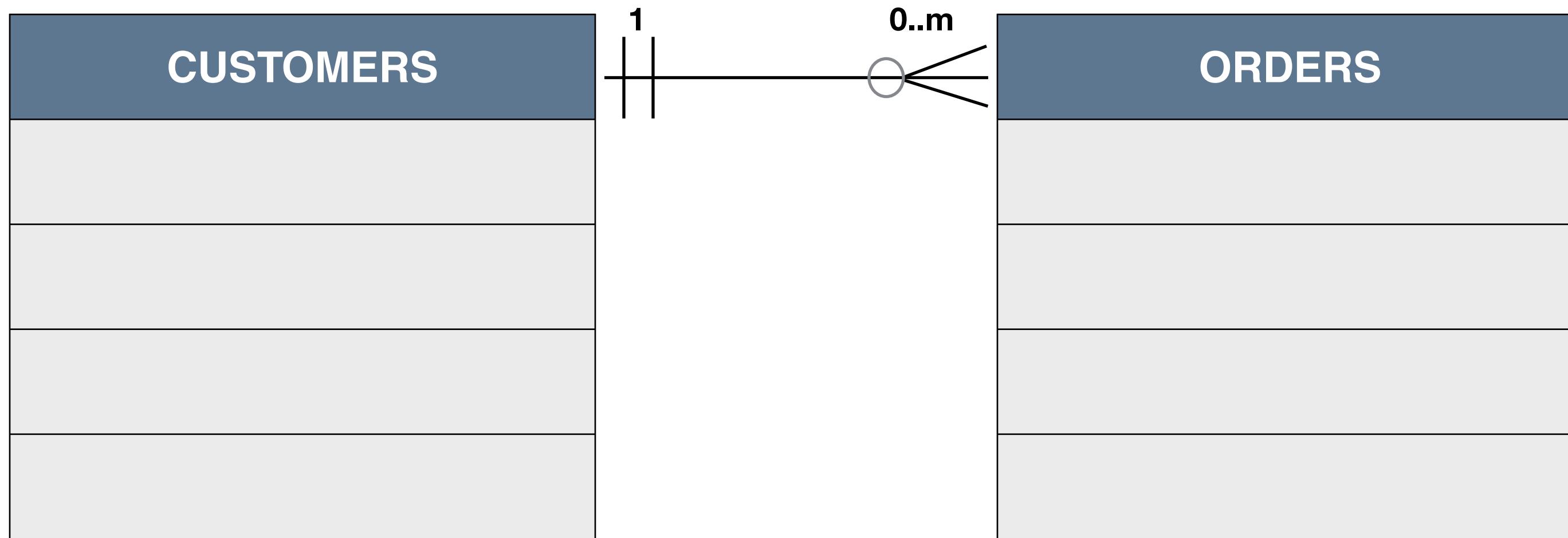
Where a key to one table appears no more than once as the key in another table and vice versa.



ONE TO MANY RELATIONSHIP

WHAT IS ONE TO MANY

Where a primary key of one table can be in multiple rows of a foreign key column of another table.



MANY TO MANY RELATIONSHIP

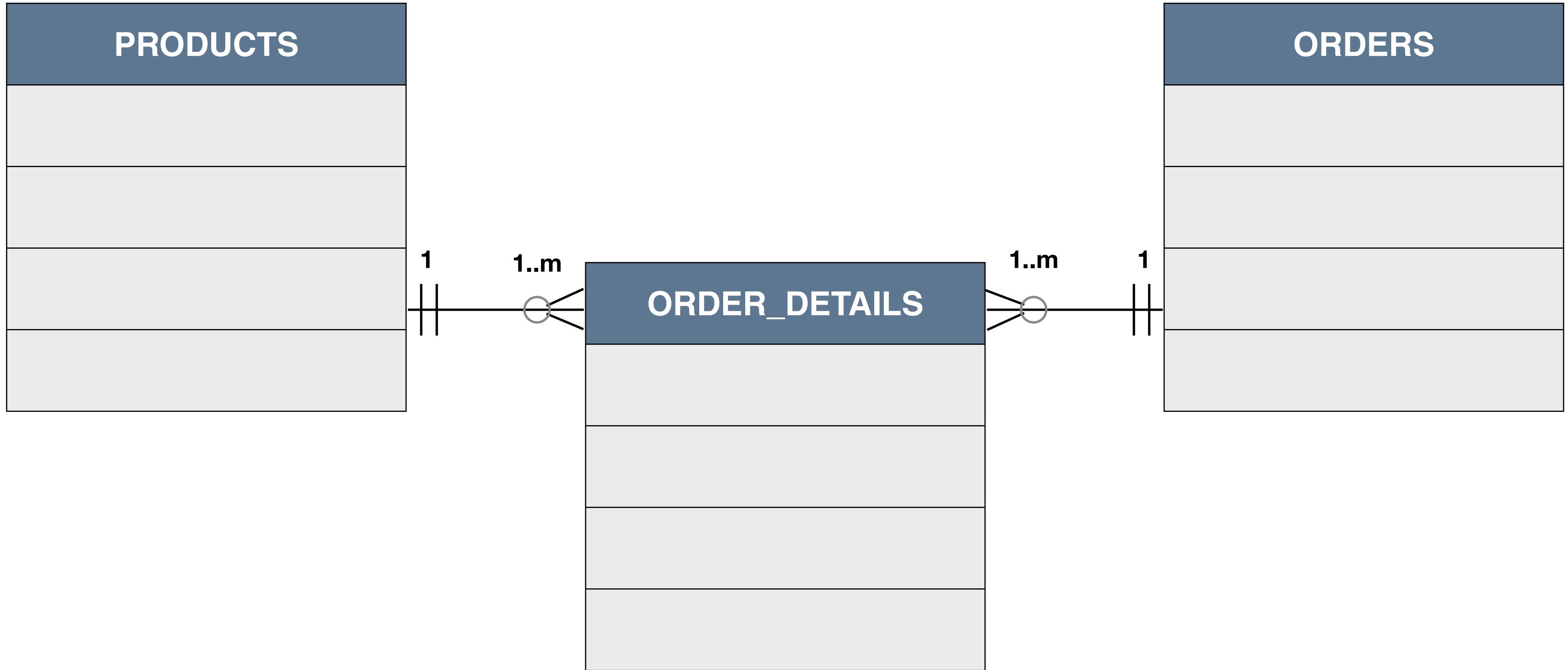
WHAT IS MANY TO MANY

Where two tables can have many instances of each other.

PRODUCTS

ORDERS

WHAT IS MANY TO MANY



CONSTRAINTS

CONSTRAINTS

NOT NULL - A column can't contain any null values.

UNIQUE - A column can't contain any duplicate values of data.

PRIMARY KEY - A column that uniquely identifies each row of data.

FOREIGN KEY - A column which is related to a primary key in another table.

CONSTRAINTS

CHECK - Controls the values that can be inserted into a column.

Example: **CHECK(ratings BETWEEN 0 AND 100)**

DEFAULT - If no values is inserted into a column, you can set a default value.

Example: **email DEFAULT ‘No Data’**

CINEMA BOOKING SYSTEM DB

SECTION INTRODUCTION

IN THIS SECTION

Create a database for a cinema online booking system.

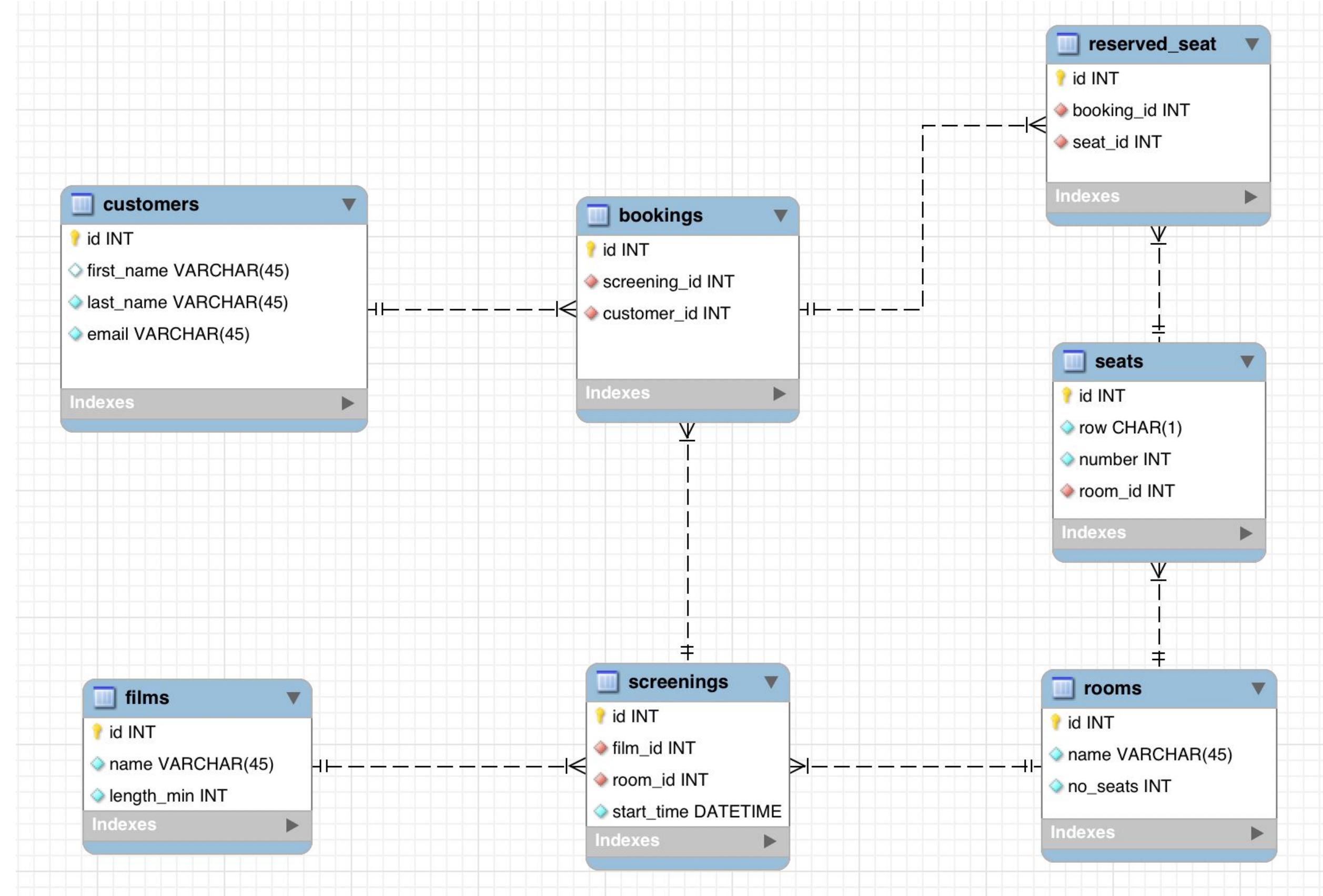
Consisting of 7 tables.

Explanation of the database schema.

Inserting data into our completed database.

CINEMA BOOKING SYSTEM DATABASE

DB SCHEMA



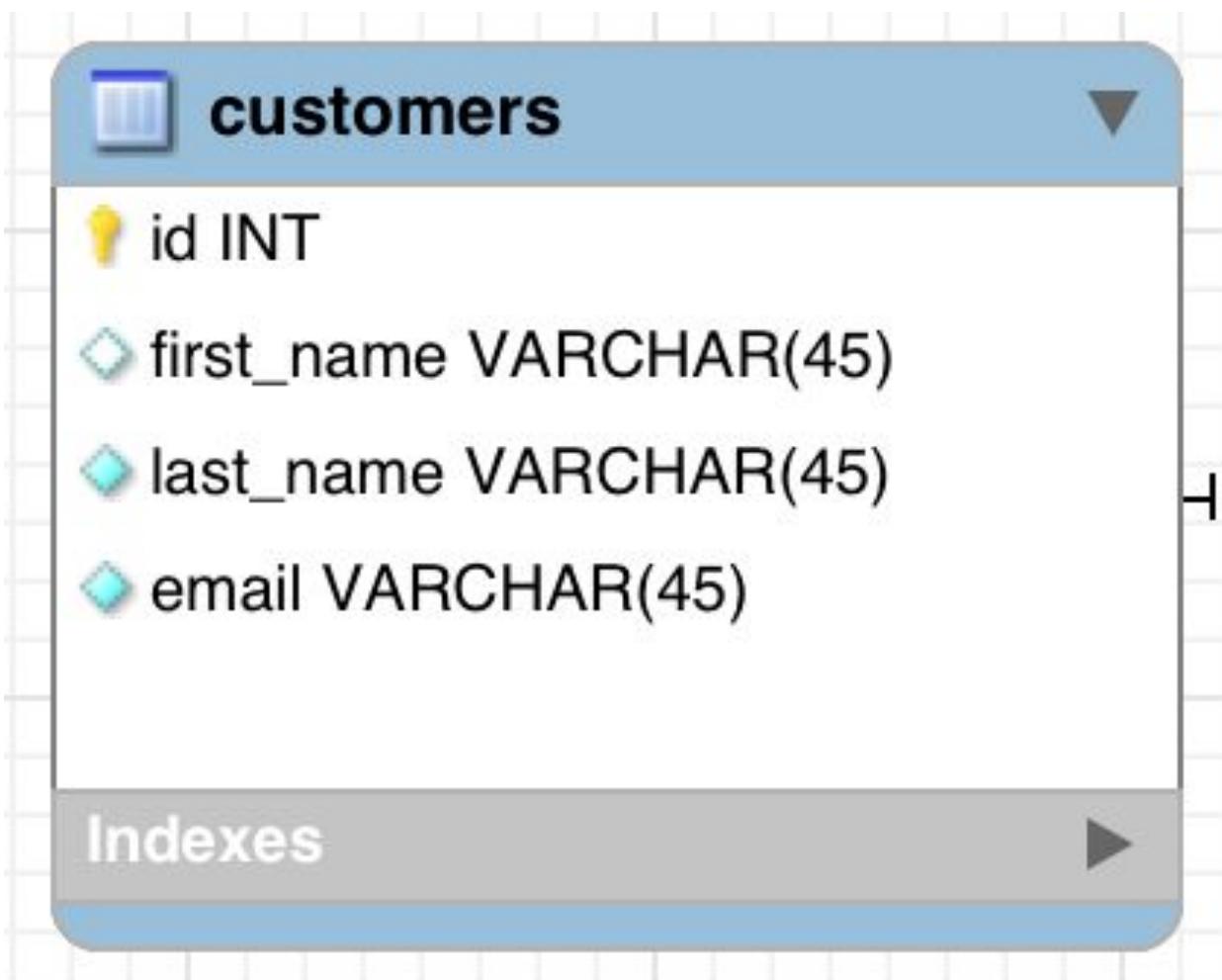
FILMS TABLE

Films Table



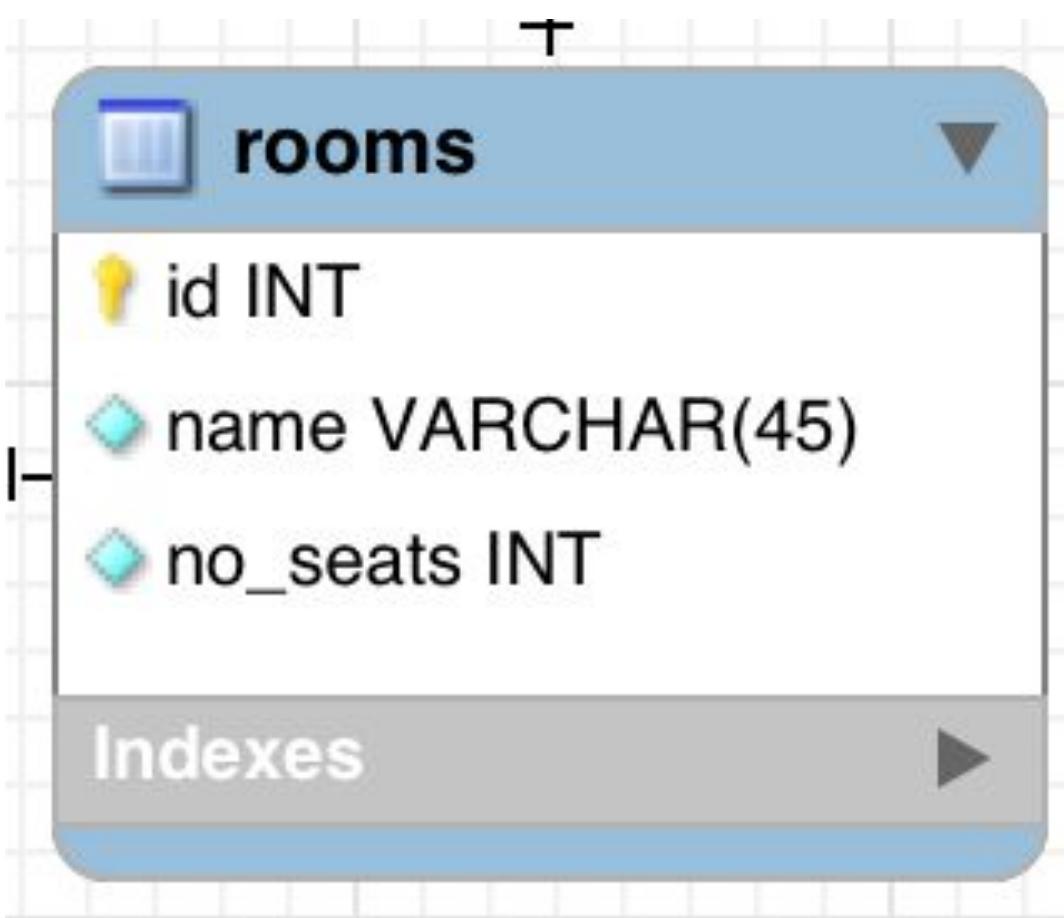
CUSTOMERS TABLE

CUSTOMERS TABLE



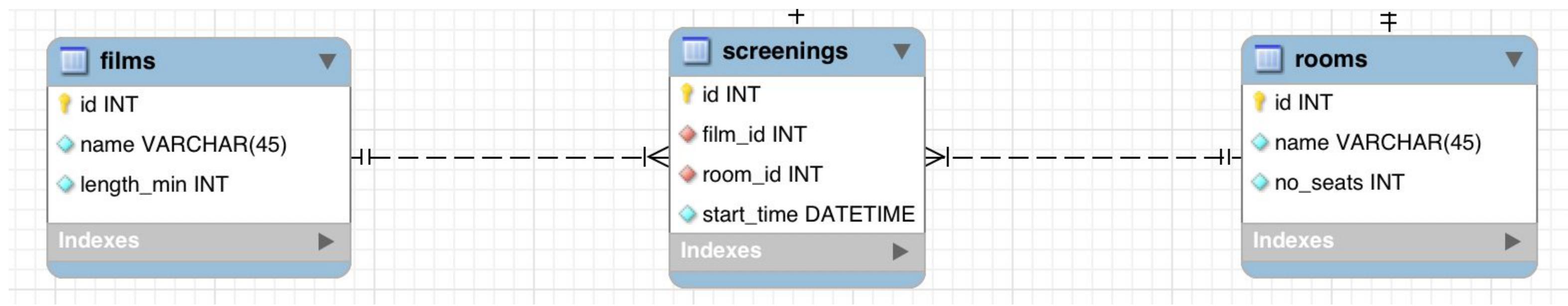
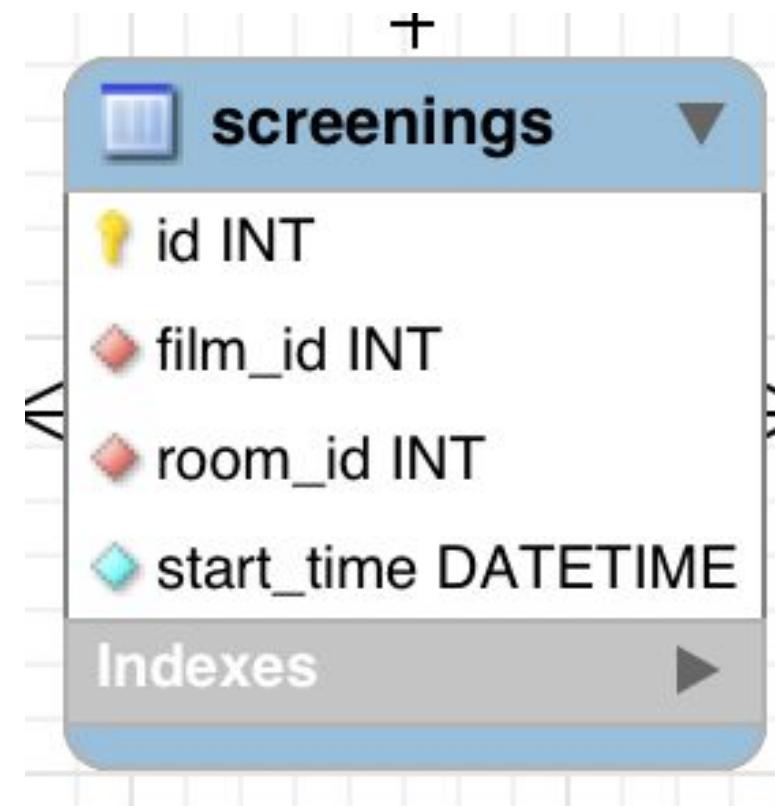
ROOMS TABLE

ROOMS TABLE



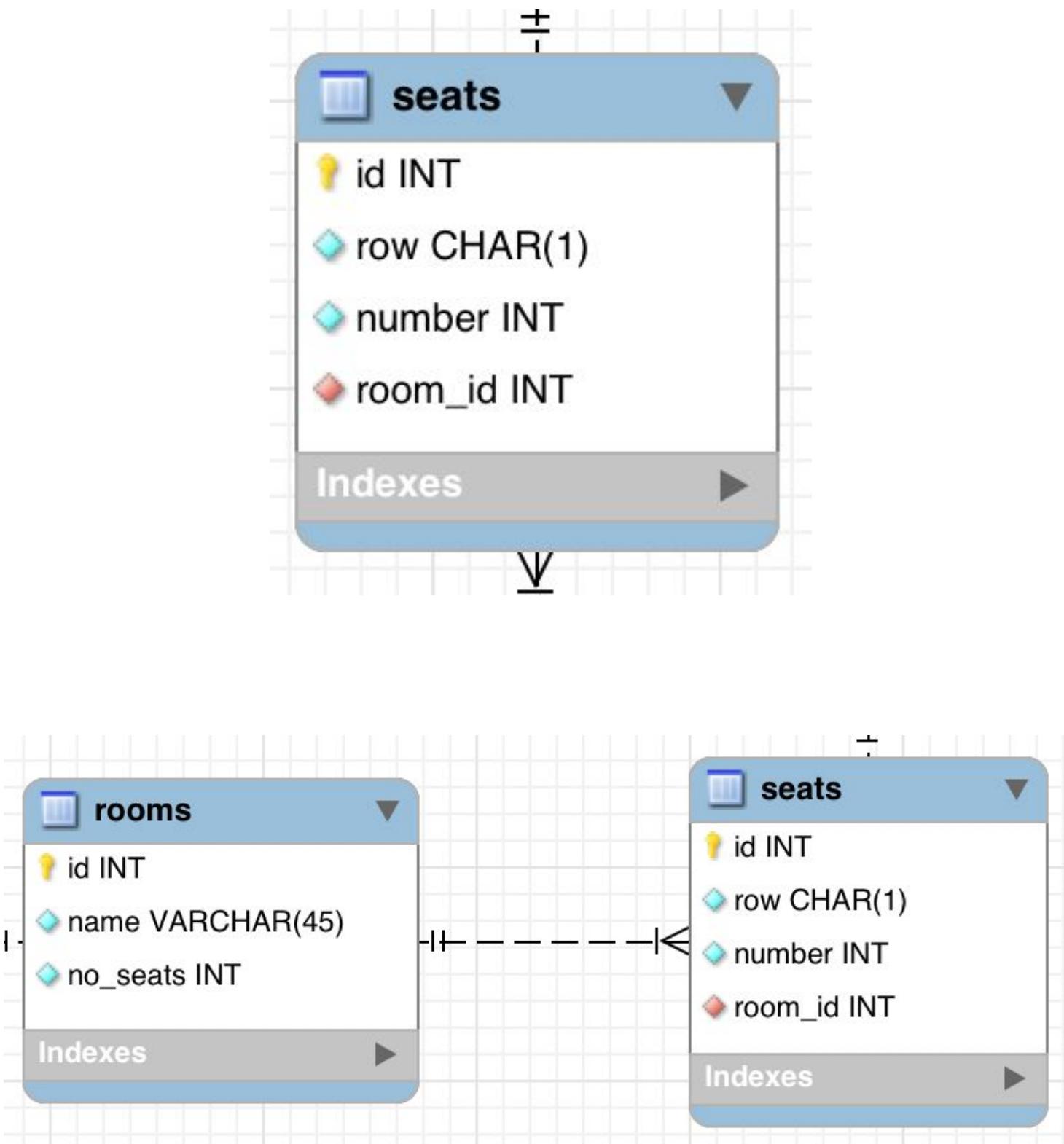
SCREENINGS TABLE

SCREENINGS TABLE



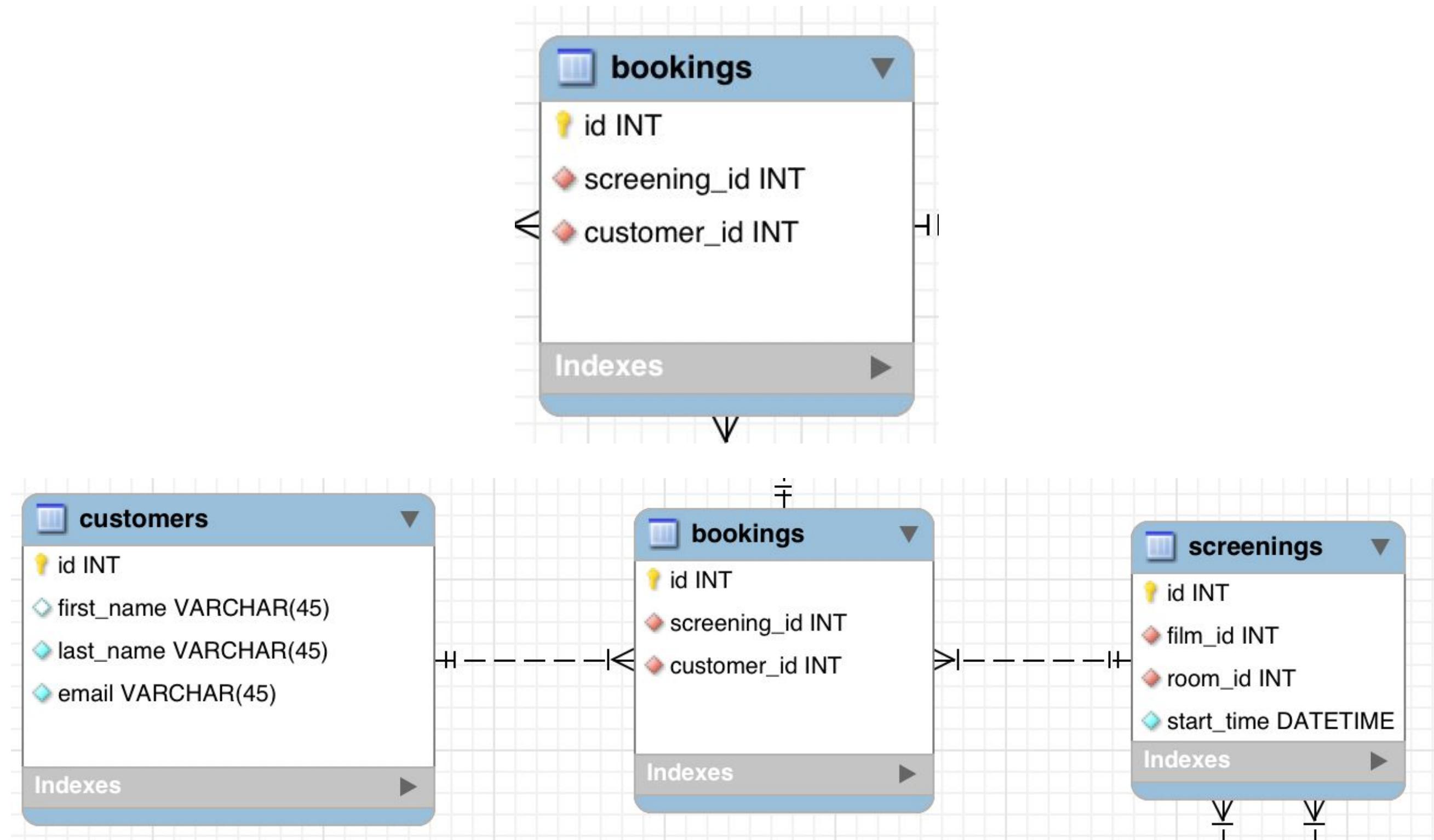
SEATS TABLE

SEATS TABLE



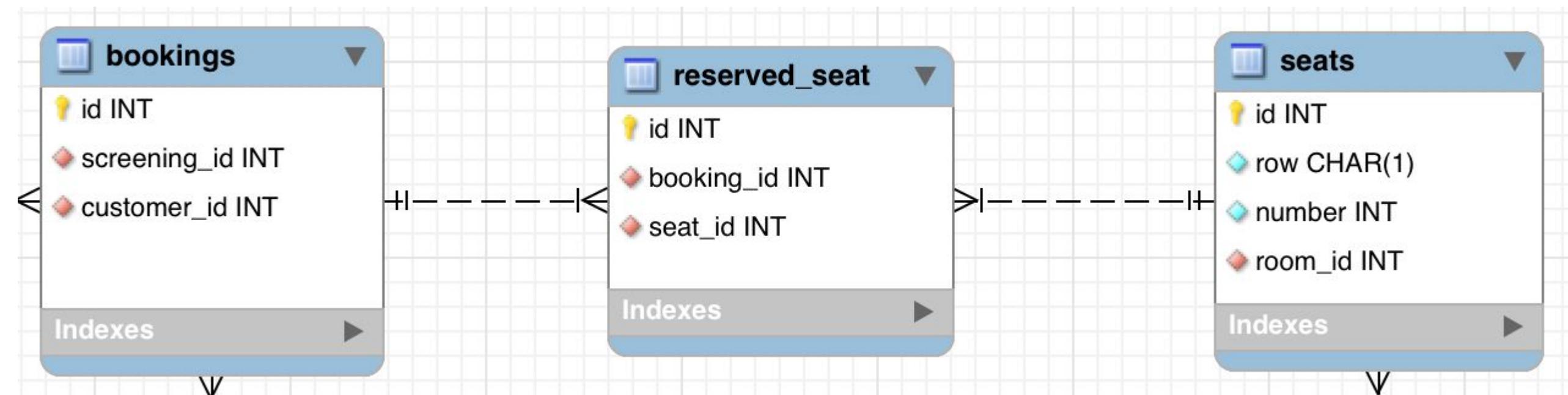
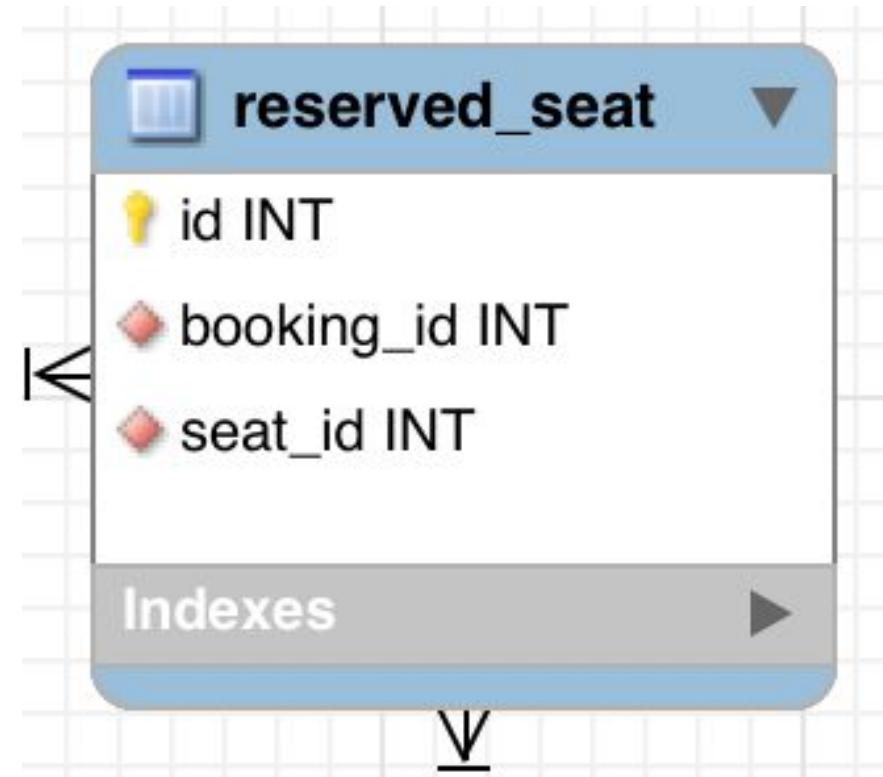
BOOKINGS TABLE

BOOKINGS TABLE



RESERVED_SEAT TABLE

RESERVED_SEAT TABLE



AGGREGATE FUNCTIONS

SECTION INTRODUCTION

WHAT YOU WILL LEARN

What aggregate functions are.

How to use COUNT, MIN, MAX, SUM and AVG functions.

How to group data using GROUP BY clauses.

What the HAVING clause is and how to use it.

Exercise and solutions to practice.

WHAT ARE AGGREGATE FUNCTIONS

WHAT ARE AGGREGATE FUNCTIONS

Perform a calculations on data within a column and returns one result row.

Can use GROUP BY clauses to group the results by one (or more) columns.

Can use a HAVING clause in a similar way to a WHERE clause in a SELECT statement to filter the results set.

David	May
Theresa	Davis
Jerry	Martin
John	Smith
Martin	Watkins
Emma	Watson
Javier	Pastore
Charlotte	Hare
Mark	Smith
Emily	Thorne
David	Paul
Cherry	Wang
Bort	Simpson
Emma	Connor

WHAT ARE AGGREGATE FUNCTIONS

COUNT

SUM

MIN

MAX

AVG

Exercise 1

1. How many bookings did customer id 10 make in October 2017.
2. Count the number of screenings for Blade Runner 2049 in October 2017.
3. Count the number of unique customers who made a booking for October 2017.

Exercise 2

1. Select the customer id and count the number of reserved seats grouped by customer for October 2017.
2. Select the film name and count the number of screenings for each film that is over 2 hours long.

SUBQUERIES

SECTION INTRODUCTION

WHAT YOU WILL LEARN

WHAT SUBQUERIES ARE AND THE DIFFERENT TYPES.

NON-CORRELATED SUBQUERIES

CORRELATED SUBQUERIES

EXERCISES AND SOLUTIONS

WHAT ARE SUBQUERIES

WHAT ARE SUBQUERIES

Subqueries are queries nested within other queries.

```
SELECT id, start_time FROM screenings
WHERE film_id IN
(SELECT id FROM films
WHERE length_min > 120)
;
```

WHAT ARE SUBQUERIES

Can be used in a SELECT, INSERT, UPDATE or DELETE query.

The nested query can be in the WHERE clause or the FROM.

Two types of subquery:

Non-correlated.

Correlated.

NON-CORRELATED SUBQUERY

The inner query can run independently of the outer query.

```
SELECT id, start_time FROM screenings
WHERE film_id IN
(SELECT id FROM films
WHERE length_min > 120)
;
```

Inner query runs first and produces a result set, which is then used by the outer query.

CORRELATED SUBQUERY

The inner query can't run independently of the outer query.

```
SELECT SCREENING_ID, CUSTOMER_ID,  
       (SELECT COUNT(SEAT_ID)  
        FROM RESERVED_SEAT WHERE BOOKING_ID =  
          B.ID)  
    FROM BOOKINGS B;
```

The inner query runs for every row in the outer query.

Exercise 1

1. Select the film name and length for all films with a length greater than the average film length.
2. Select the maximum number and the minimum number of screenings for a particular film.
3. Select each film name and the number of screenings for that film.

IN THIS SECTION

Learn what MySQL functions are.

Learn about the most important string functions.

Learn about the most important date functions.

STRING FUNCTIONS

Concatenate

Substring

Upper

Lower

DATE FUNCTIONS

Date

Month

Year

IN THIS SECTION

Multiple exercises with video solutions.

Ask any question in the Q&A section.

WHAT ARE MySQL FUNCTIONS?

WHAT ARE MySQL FUNCTIONS?

Functions are stored programs which can be passed parameters and return a value.

We have already seen some MySQL functions - aggregate functions.

For example: MAX(column);

STRING FUNCTIONS

Functions that take string parameters.

Name	Description
<code>ASCII()</code>	Return numeric value of left-most character
<code>BIN()</code>	Return a string containing binary representation of a number
<code>BIT_LENGTH()</code>	Return length of argument in bits
<code>CHAR()</code>	Return the character for each integer passed
<code>CHAR_LENGTH()</code>	Return number of characters in argument
<code>CHARACTER_LENGTH()</code>	Synonym for CHAR_LENGTH()
<code>CONCAT()</code>	Return concatenated string
<code>CONCAT_WS()</code>	Return concatenate with separator
<code>ELT()</code>	Return string at index number
<code>EXPORT_SET()</code>	Return a string such that for every bit set in the value bits, you get an on string and for every unset bit, you get an off string
<code>FIELD()</code>	Return the index (position) of the first argument in the subsequent arguments
<code>FIND_IN_SET()</code>	Return the index position of the first argument within the second argument
<code>FORMAT()</code>	Return a number formatted to specified number of decimal places
<code>FROM_BASE64()</code>	Decode to a base-64 string and return result
<code>HEX()</code>	Return a hexadecimal representation of a decimal or string value
<code>INSERT()</code>	Insert a substring at the specified position up to the specified number of characters
<code>INSTR()</code>	Return the index of the first occurrence of substring
<code>LCASE()</code>	Synonym for LOWER()
<code>LEFT()</code>	Return the leftmost number of characters as specified
<code>LENGTH()</code>	Return the length of a string in bytes
<code>LIKE</code>	Simple pattern matching
<code>LOAD_FILE()</code>	Load the named file
<code>LOCATE()</code>	Return the position of the first occurrence of substring
<code>LOWER()</code>	Return the argument in lowercase

DATE FUNCTIONS

Functions that take date, time or datetime parameters.

Name	Description
ADDDATE ()	Add time values (intervals) to a date value
ADDTIME ()	Add time
CONVERT TZ ()	Convert from one time zone to another
CURDATE ()	Return the current date
CURRENT DATE (), CURRENT DATE	Synonyms for CURDATE()
CURRENT TIME (), CURRENT TIME	Synonyms for CURTIME()
CURRENT TIMESTAMP (), CURRENT TIMESTAMP	Synonyms for NOW()
CURTIME ()	Return the current time
DATE ()	Extract the date part of a date or datetime expression
DATE ADD ()	Add time values (intervals) to a date value
DATE FORMAT ()	Format date as specified
DATE SUB ()	Subtract a time value (interval) from a date
DATEDIFF ()	Subtract two dates
DAY ()	Synonym for DAYOFMONTH()
DAYNAME ()	Return the name of the weekday
DAYOFMONTH ()	Return the day of the month (0-31)
DAYOFWEEK ()	Return the weekday index of the argument
DAYOFYEAR ()	Return the day of the year (1-366)
EXTRACT ()	Extract part of a date
FROM_DAYS ()	Convert a day number to a date
FROM_UNIXTIME ()	Format Unix timestamp as a date
GET_FORMAT ()	Return a date format string
HOUR ()	Extract the hour
LAST_DAY	Return the last day of the month for the argument

Exercise 1

Concatenate the film names and length from the films table.

Extract the customers email from the 5th character onwards.

Select the customers first name in lower case and their last name in upper case for each customer with a last name of 'Smith'.

Select the last 3 letters of each film name from the films table.

Concatenate the first three letters in the `first_name` and `last_name` columns together from the customers table.

Exercise 2

Select the film id and start time from the screenings table for the date of 20th of October 2017.

Select all the data from the screenings table for the start time between the 6th and 13th of October 2017.

Select all the data from the screenings table for October 2017.

Challenge Slides.

CHALLENGES!

CHALLENGE ONE

Which films are over 2 hours long?

CHALLENGE TWO

Which film had the most screenings in October 2017

CHALLENGE THREE

How many bookings did the film ‘Jigsaw’ have in October 2017

CHALLENGE FOUR

Which 5 customers made the most bookings in October 2017

CHALLENGE FIVE

Which film was shown in the Chaplin room most often in October 2017

CHALLENGE SIX

How many of the customers made a booking in October 2017