

# Databases

INTRODUCTION TO SQL

A dark blue circular badge with the word "SQL" written in white capital letters.

SQL

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# Course goals

1. Understand databases and their structure → Chapter 1
2. Extract information from databases using SQL → Chapter 2

# Structured Query Language (SQL)

- SQL communicates with databases



# Introducing databases

## patrons

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

## books

id	title	author	genre	pub_year
638	Being Mortal	Atul Gawande	Non-Fiction	2015
912	Educated	Tara Westover	Non-Fiction	2018
322	Night	Elie Wiesel	Non-Fiction	1956
156	Where the Wild Things Are	Maurice Sendak	Childrens	1963

## checkouts

id	start_date	due_date	card_num	book_id
567	2022-05-13	2022-05-27	54378	638
568	2022-06-10	2022-06-24	54378	322
569	2022-06-27	2022-07-11	45783	156
570	2022-08-14	2022-08-28	90123	912

# A closer look at tables

## patrons

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

# Rows and columns

The diagram illustrates the concepts of rows and columns in a table. On the left, a table titled "patrons" is shown with four columns: card\_num, name, member\_year, and total\_fine. A red arrow labeled "Row" points to the second row, which contains the data for Maham. On the right, the same table is shown again, but the "total\_fine" column is highlighted with a green border, and a green arrow labeled "Column" points to it.

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

- Individual data
- Specific part of data

# Relational databases

- Define relationships between tables of data inside the database

**checkouts**

<b>id</b>	<b>start_date</b>	<b>due_date</b>	<b>card_num</b>	<b>book_id</b>
23359	2024-05-11	2024-05-25	<b>54378</b>	<b>547</b>
23360	2024-05-12	2024-05-26	<b>94722</b>	<b>156</b>
23361	2024-05-12	2024-05-26	<b>45783</b>	<b>912</b>
23362	2024-05-13	2024-05-27	<b>90123</b>	<b>838</b>

**patrons**

<b>card_num</b>	<b>name</b>	<b>member_year</b>	<b>total_fine</b>
<b>54378</b>	Izzy	2012	9.86
<b>94722</b>	Maham	2020	0
<b>45783</b>	Jasmin	2022	2.05
<b>90123</b>	James	1989	0

**books**

<b>id</b>	<b>title</b>	<b>author</b>	<b>genre</b>	<b>pub_year</b>
<b>838</b>	Being Mortal	Atul Gawande	Non-Fiction	2015
<b>912</b>	Educated	Tara Westover	Non-Fiction	2018
<b>547</b>	Segment of One	Michael Grigsby	Fiction	2022
<b>156</b>	Where the Wild Things Are	Maurice Sendak	Childrens	1963

# Database advantages



# Let's practice!

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# Tables

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# Table naming

Table names:

- Clear
- Refer the data it contains(plural)
- Lowercase
- Use underscores—no spaces



patrons	card_num	name	member_year	total_fine
	54378	Izzy	2012	9.86
	94722	Maham	2020	0
	45783	Jasmin	2022	2.05
	90123	James	1989	0

# Records and fields

- Table rows are *records*
- Table columns are *fields*

The diagram illustrates the concepts of records and fields using a table titled "patrons". A red arrow points from the left towards the table, labeled "Record (row)". Another red arrow points downwards from the top of the table, labeled "Field (column)".

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

# Records

- A specific data observation

patrons



card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

# Fields

Field  
↓

patrons

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

- One piece of a record

# Field naming

Field names:

- Lowercase
- Use underscores—no spaces
- Singular
- Different from the table name

# Unique identifiers

- Keys identify unique records

Unique  
Identifier  
(key)

patrons

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

# Multiple tables

patrons

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

checkouts

id	start_date	due_date	card_num	book_id
567	2022-05-13	2022-05-27	54378	638
568	2022-06-10	2022-06-24	54378	322
569	2022-06-27	2022-07-11	45783	156
570	2022-08-14	2022-08-28	90123	912

card_num	name	member_year	total_fine	checkout_id	start_date	due_date	book_id
54378	Izzy	2012	9.86	23359	2024-05-11	2024-05-25	547
54378	Izzy	2012	9.86	23360	2024-05-11	2024-05-26	156
94722	Maham	2020	0				
45783	Jasmin	2022	2.05	23361	2024-05-12	2024-05-26	912
90123	James	1989	0	23362	2024-05-13	2024-05-27	838

# Let's practice!

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# Data types

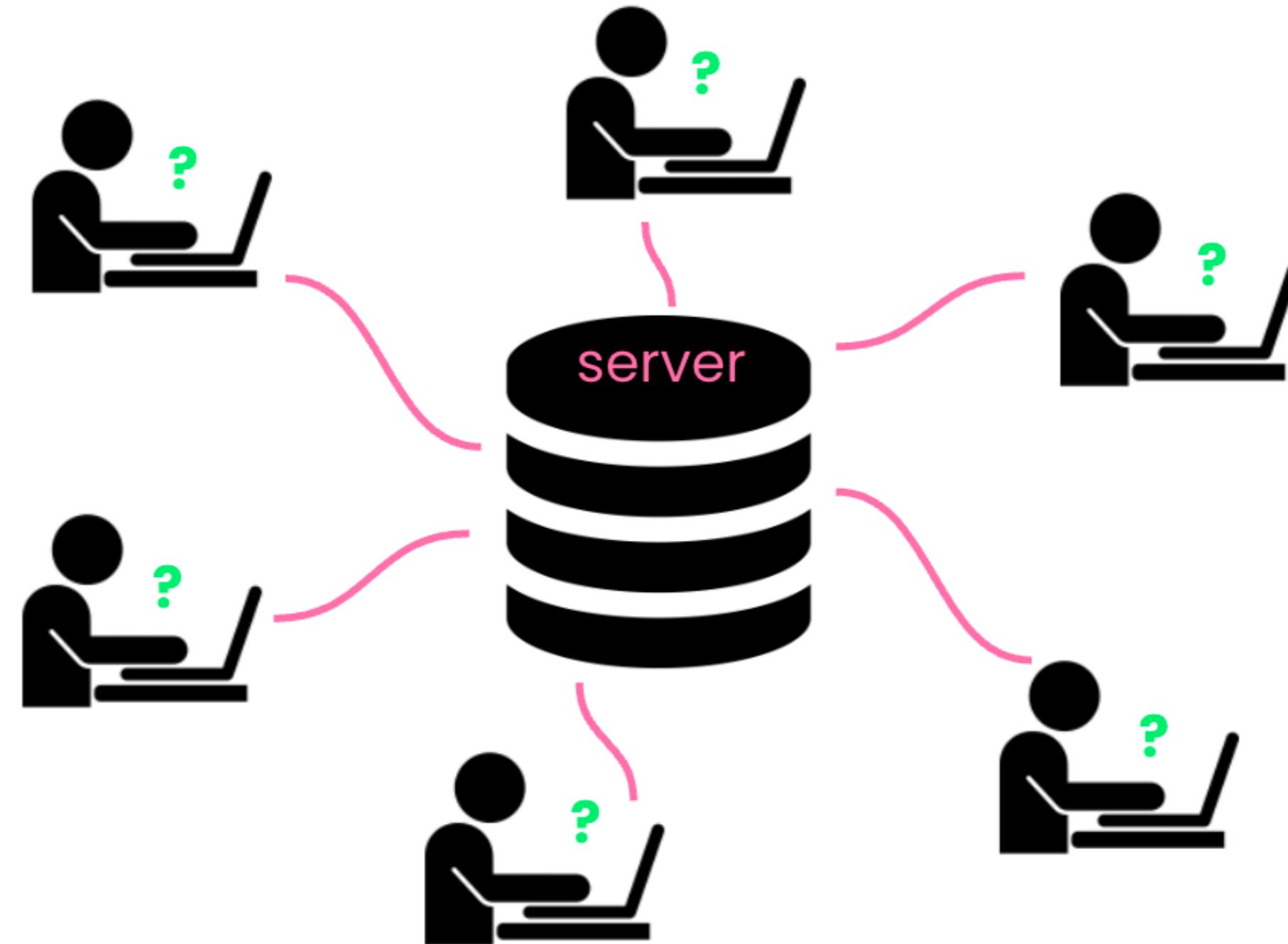
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# Database storage



# SQL data types

all one data type			
all one data type			
card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

- Different types of data are stored differently and take up different space
- Some operations only apply to certain data types

# Strings

a string field

patrons

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

- A string is a sequence of characters such as letters or punctuation
- `VARCHAR` is a flexible and popular string data type in SQL

# Integers

an integer field

patrons

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

- Integers store whole numbers
- `INT` is a flexible and popular integer data type in SQL

# Floats

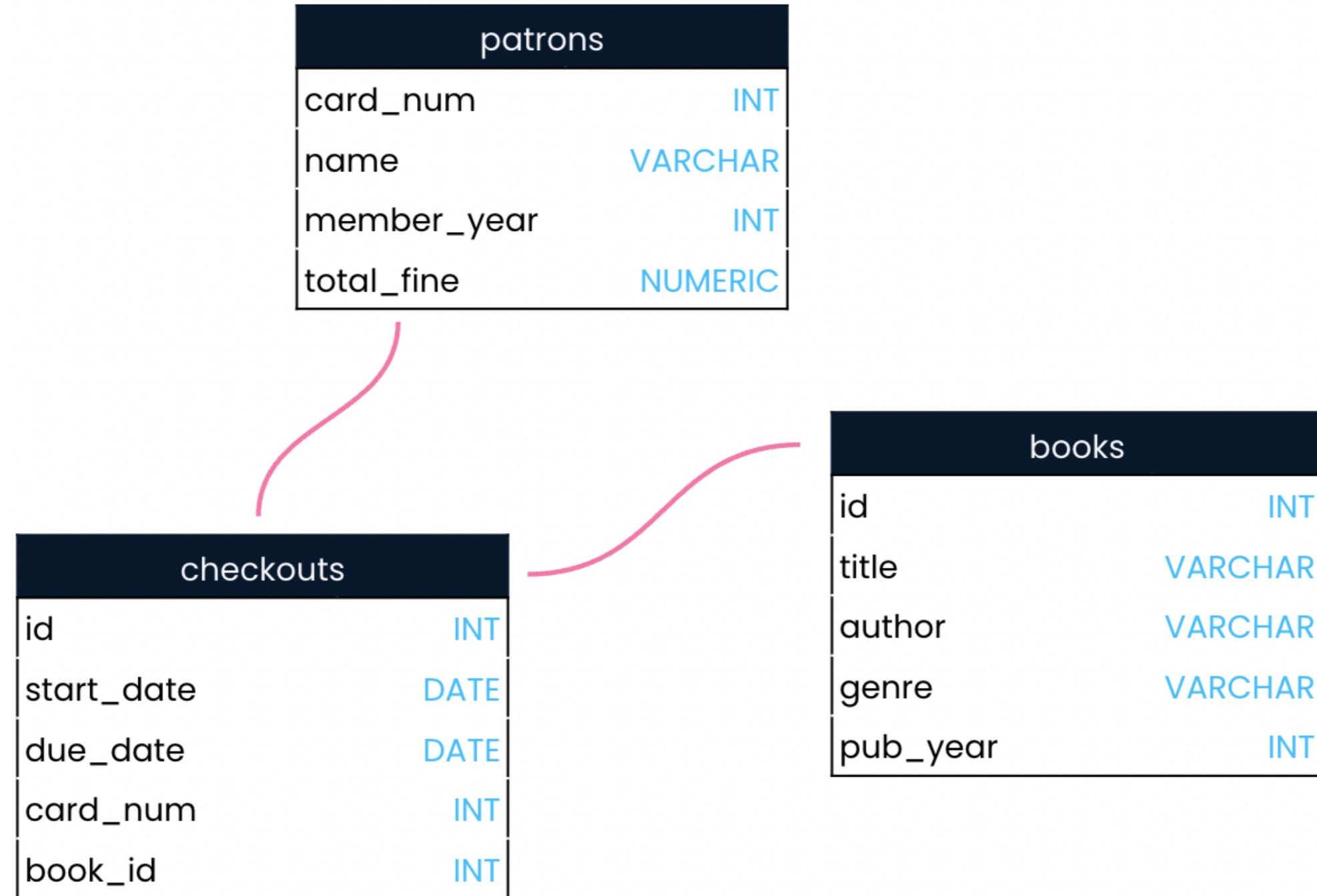
patrons

card_num	name	member_year	total_fine
54378	Izzy	2012	9.86
94722	Maham	2020	0
45783	Jasmin	2022	2.05
90123	James	1989	0

a float field

- Floats store numbers that include a fractional part
- **NUMERIC** is a flexible and popular float data type in SQL

# Schemas



# Let's practice!

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