



# Data Modeling

Data Boot Camp  
Lesson 9.3



# Class Objectives

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By the end of today's class, you will:



Apply data modeling techniques to database design.



Normalize data.

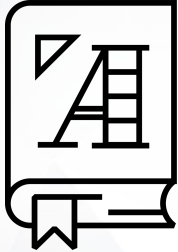


Identify data relationships.



Create visual representations of a database through entity relationship diagrams.

# Data Normalization



**Data normalization** is the process of restructuring data to a set of defined "normal forms."



The process of data normalization **eliminates data redundancy and inconsistencies.**

# Data Normalization

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Process of restructure data to a set of “normal forms.”



Reduce and eliminate data redundancy and inconsistencies



Three most common forms:



First normal form (1NF)



Second normal form (2NF)



Third normal form (3NF)



There are even more levels!

# First Normal Form (1NF)



Each field in a table row should contain a single value



Each row is unique

- Rows can have a fields that repeat
- But whole rows do not fully match

## Raw Data

family	children
Smiths	Chris, Abby, Susy
Jones	Steve, Mary, Dillion

## Normalization



## First Normal Form

family	children
Smiths	Abby
Smiths	Chris
Smiths	Susy
Jones	Dillon
Jones	Mary
Jones	Steve

# Second Normal Form (2NF)



Be in First Normal Form



Single Column Primary Key

- Primary Key
- Identifies the table and row uniquely



Generally there could be a need to create a new table

## Data in 1NF

family	children
Smiths	Abby
Smiths	Susy
Jones	Mary
Smiths	Chris
Jones	Dillion
Jones	Mary

## 2NF Normalization



## Family Table

family_id	family
1	Smiths
2	Jones

## Child Table

child_id	family_id	children
11	1	Chris
22	1	Abby
33	1	Susy
44	2	Steve
55	2	Mary
66	2	Dillion





**Transitive Dependence** is the reliance of a column's value on another column through a third column.

# Transitive Dependence

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## Transitive

- If  $X > Y$  and  $Y > Z$  then  $X > Z$ .



## Dependence

- One value relies on another.
- City relies on ZIP code; age depends on birthday.



## For example:

- Say you have three columns: StoreName, OwnerAddress, OwnerName.
- OwnerName and OwnerAddress rely on the the StoreName
- OwnerAddress also relies on the OwnerName.
- So OwnerAddress relies on the StoreName via the OwnerName

# Third Normal Form (3NF)



Must be in Second Normal Form



Contain non-transitively dependent columns

owner_id	owner_name	owner_address	store_name
11	Marshall	123, Fake St.	Soups and Stuff
22	Susan	44, New Drive	Sink Emporium
33	Molly	99, Old Lane	Tasty Burgers

## 3NF Normalization



owner_id	owner_name	owner_address
11	Marshall	123, Fake St.
22	Susan	44, New Drive
33	Molly	99, Old Lane

store_id	store_name	Owner_id (fk)
1	Soups and Stuff	11
2	Sink Emporium	22
3	Tasty Burgers	33



## **Activity:** Pet Normalizer

In this activity, you will practice data normalization skills using the provided data.

(Instructions sent via Slack)

**Suggested Time:**  
15 Minutes





**Time's Up!** Let's Review.

# Foreign Keys

# Foreign Keys

Foreign Keys reference the primary key of another table.




Can have a different name



Do not need to be unique


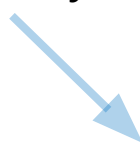
Primary Key



family_id	family
1	Smiths
2	Jones

Primary Key

Foreign Key



child_id	family_id	children
11	1	Chris
22	1	Abby
33	1	Susy
44	2	Steve
55	2	Mary
66	2	Dillion



## **Activity:** Foreign Keys

In this activity, you will create tables with foreign keys.

(Instructions sent via Slack)

**Suggested Time:**  
15 Minutes







**Time's Up!** Let's Review.

# Data Relationships

# Data Relationships

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01

**One-to-One**

02

**One-to-Many**

03

**Many-to-Many**

# One-to-One Relationship

ID	Name	Social Security
1	Homer	111111111
2	Marge	222222222
3	Lisa	333333333
4	Bart	444444444
5	Maggie	555555555



Each item in one column is linked to only one other item from the other column.



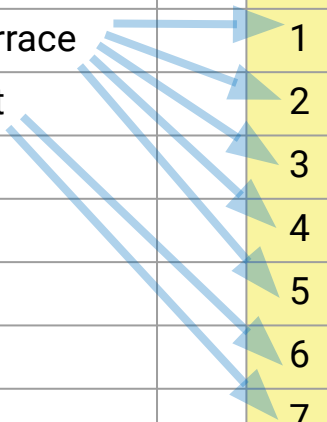
Here, each person in the Simpsons family can have only one social security number.



Each social security number can be assigned only to one person.

# One-to-Many Relationship

ID	Address		ID	Name	Social Security	AddressID
11	742 Evergreen Terrace		1	Homer	111111111	11
12	221B Baker Street		2	Marge	222222222	11
			3	Lisa	333333333	11
			4	Bart	444444444	11
			5	Maggie	555555555	11
			6	Sherlock	112233445	12
			7	Watson	223344556	12



The two tables, joined, would look like this.



Each person has an address.



Each address can be associated with multiple people.

# Many-to-Many Relationship

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ID	Child		ID	Parent
1	Bart		11	Homer
2	Lisa		12	Marge
3	Maggie			



Each child can have more than one parent.



Each parent can have more than one child.

# Many-to-Many Relationship

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ChildID	Child	ParentID	Parent
1	Bart	11	Homer
1	Bart	12	Marge
2	Lisa	11	Homer
2	Lisa	12	Marge
3	Maggie	11	Homer
3	Maggie	12	Marge



Each child can have more than one parent.

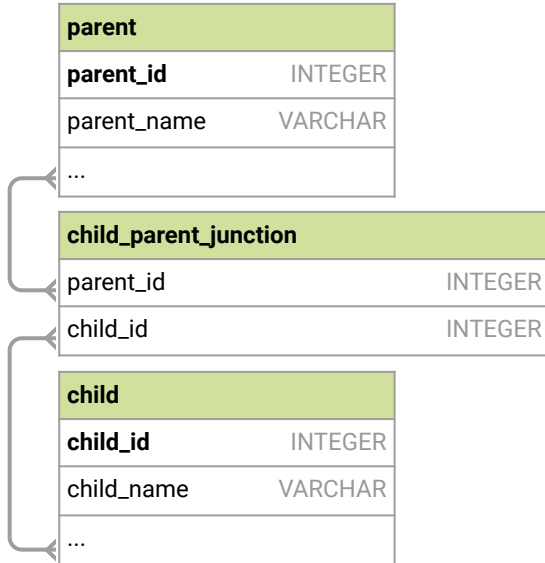


Each parent can have more than one child.



The two tables are joined in a junction table.

# Junction Table



The Junction table contains many parent\_ids and many child\_ids

	parent_id integer	child_id integer
1	11	1
2	11	2
3	11	3
4	12	1
5	12	2
6	12	3



Join child and parent table to junction table

	parent_name character varying (255)	child_name character varying (255)
1	Homer	Bart
2	Homer	Lisa
3	Homer	Maggie
4	Marge	Bart
5	Marge	Lisa
6	Marge	Maggie





## **Activity:** Data Relationships

In this activity, you will create table schemata for students and available courses, and then create a junction table to display all courses taken by students.

(Instructions sent via Slack)

**Suggested Time:**  
15 Minutes





**Time's Up!** Let's Review.

# Take a Break!

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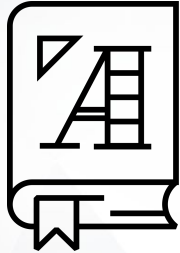
A small circular icon with a stylized orange and yellow flame or drop shape inside.

Countdown timer

**40:00**

(with alarm)

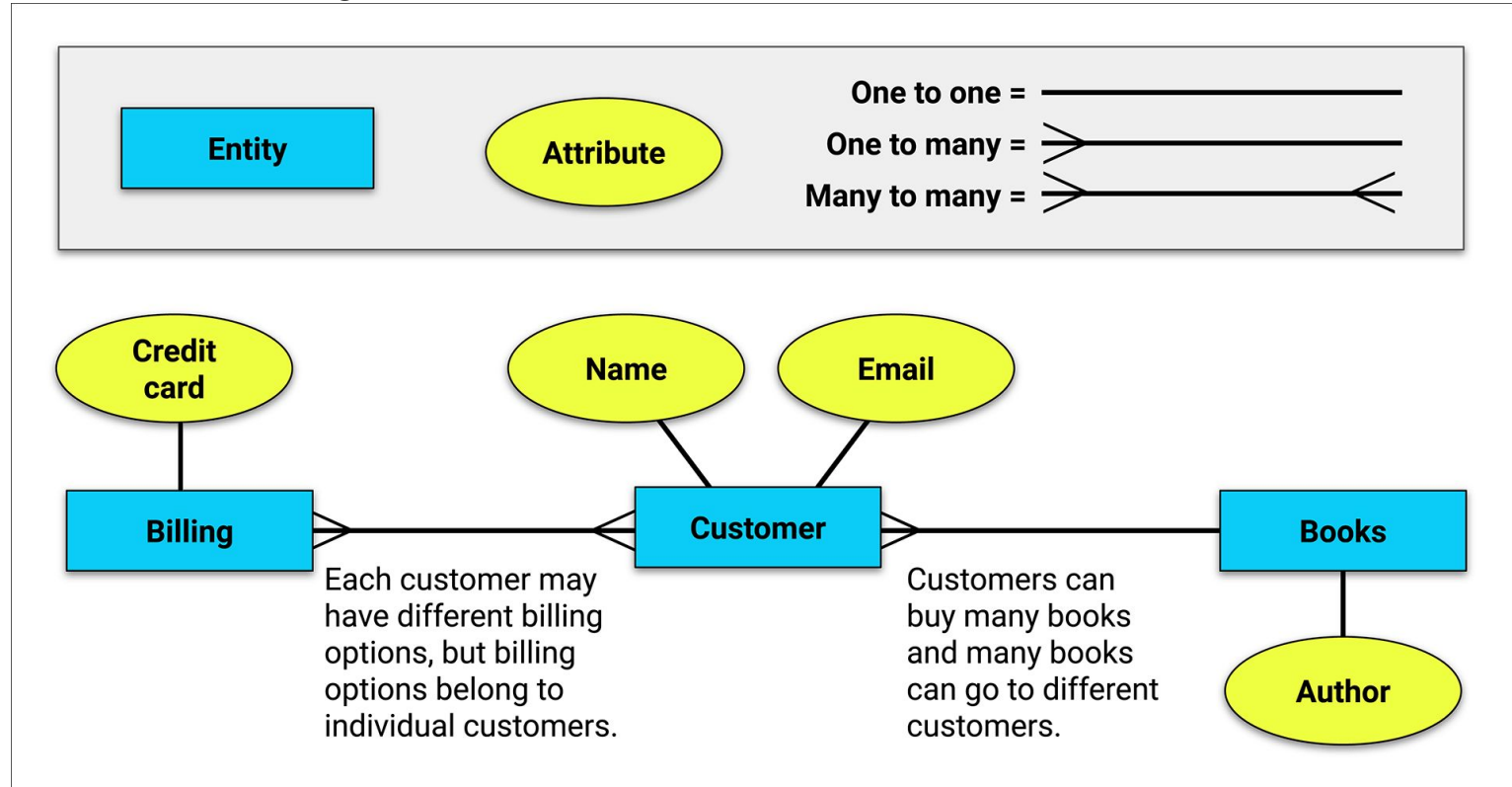
# Entity Relationship Diagrams



An **entity relationship diagram**, or **ERD**, is a visual representation of entity relationships within a database.

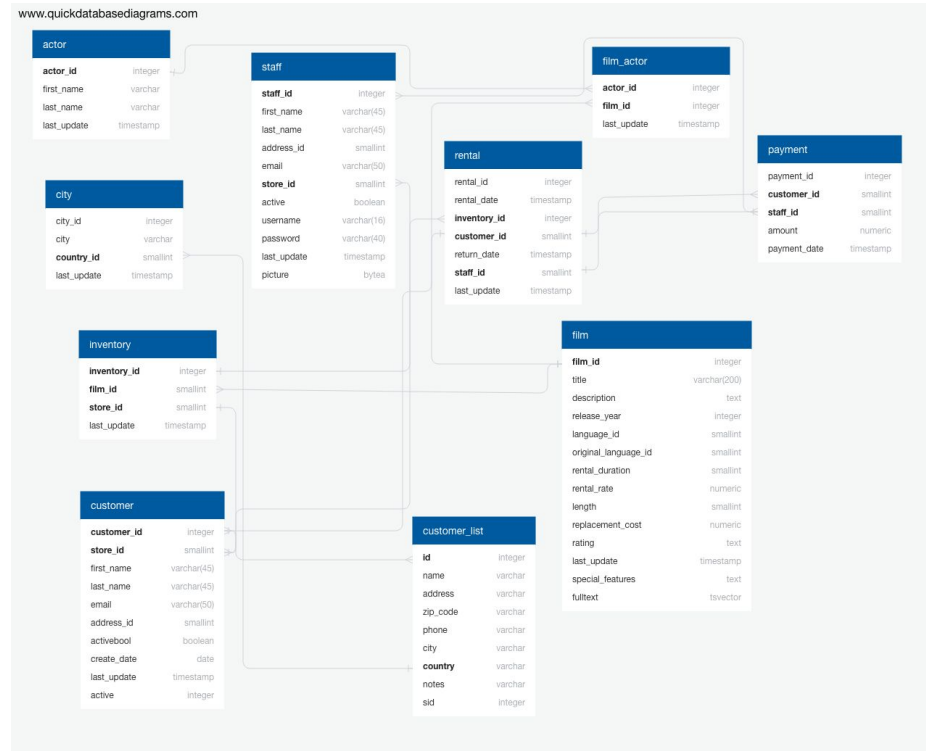
# ERDs

ERD use the following notation to create the models.



# ERDs

Entities, their data types, and relationships are all illustrated in the diagram.



# ERDs

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There are three models used when creating diagrams:



**Conceptual:** basic information containing table and column names.

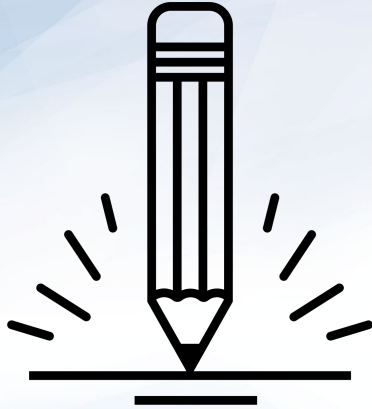


**Logical:** slightly more complex than conceptual models with IDs and data types defined.



**Physical:** the blueprint of the database, reflecting physical relationships between entities.





## **Activity:** Designing an ERD, Part II

In this activity, you will further improve on the ERD by creating a physical ERD.

(Instructions sent via Slack)

**Suggested Time:**  
15 Minutes





**Time's Up!** Let's Review.



## **Activity:** Unions

In this activity, you will have more practice with unions, by combining data from multiple tables without the use of joins.

(Instructions sent via Slack)

**Suggested Time:**  
10 Minutes





**Time's Up!** Let's Review.