

# WEEK 3: DOMAIN MODELING

# DATABASE DESIGN

## AKA DOMAIN MODELING

# IT'S YOUR WORLD

- The physical world takes scientists to understand, is very complex
- The software world – up to you
- From a data perspective – the end-result = *domain model*

# A DOMAIN MODEL...

- Is a real-world concept (aka domain) represented as software
- Contains only the data and rules involved in the domain
- Is described using the actual words (i.e. vocabulary) used by those working in the domain

# DOMAIN MODEL

- Specific Language
- Behavioral Model
- Data Model

HOW DO WE DECIDE WHAT TO  
INCLUDE/NOT INCLUDE IN OUR  
DOMAIN MODEL?

# MVP

## Minimum Viable Product

*(aka How Software Engineers Think About  
Building Businesses)*





FIND THE SHORTEST PATH TO LAUNCHING  
SOMETHING PEOPLE WILL ACTUALLY USE

# OUR AGILE PROCESS

- User Stories
- Wireframes
- Domain Modeling
- Code
- Repeat

# USER STORIES

- Sentence format, written in the language of the end user
- What does the user do/how does the user interact with your system
- Concise way of capturing requirements

# USER STORY TEMPLATE

*As a [some user role], I want to [some goal], so I can [some value]*

# THE (FICTIONAL) IDEA:

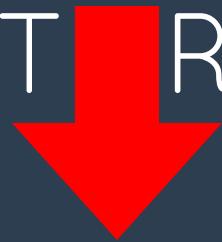
## A "SCHOOL" SYSTEM

- *This will be a system used to manage our school.*
- *A student in our school can use the system to browse the available courses and enroll in them, based on the dates/times that best fit their schedule.*
- *Students are added to the system by teachers. So are the courses they teach.*

Role



Goal



## FIRST USER STORY

*As a student, I want to browse available courses, seeing the course description and bio of the instructor, so I can decide if I want to enroll in it.*



Value

- As a **student**, I want to **browse available courses, seeing the course description and bio of the instructor**, so I can **decide if I want to enroll in it**.
- As a **student**, I want to **see the available sections (dates and times offered) and enroll in the section of my choosing**, so that I can **enroll in the course I want at the time that best works for my schedule**.
- As a **teacher**, I want to **be able to maintain (add, edit, and remove) a list of students at our school**, so that **we know who our students are, their contact information (email and phone number), and provide access to enroll in classes**.
- As a **teacher**, I want to **be able to maintain (add, edit, and remove) a list of teachers (including myself) at our school**, so that **we can manage teachers' bios and a list of classes they teach**.
- As a **teacher**, I want to **be able to maintain (add, edit, and remove) a list of courses and the sections of those courses**, so that **we can publish it for students to browse and enroll**.

# USER STORIES

- General vision -> Articulated more clearly
- Too much? Too little?
- Do users/customers get enough value to provide feedback?
- Not set in stone; writing user stories is an *iterative* process

# WIREFRAMES

- A visual representation of the user stories
- Formats include:
  - Paper
  - Notability
  - Balsamiq
  - Keynote/Powerpoint
  - Graphics Apps (Photoshop, Sketch, etc)
  - HTML/CSS

University of Code and Tacos

https://

# Browse Courses

## Introduction to Software Development

The course is focused on software development within the context of product entrepreneurship. The intent of this course is to give you an overview of the technical tools, technologies, and skills necessary to build a software-based product, and to help you gain perspectives on building software through the lens of a startup founder, product manager, or technical leader.

Date and Time	Instructor	Register
Tuesday 8:30-11:30am	Brian Eng <a href="#">Bio</a>	<a href="#">Enroll</a>
Wednesday 6-9pm	Ben Block <a href="#">Bio</a>	<a href="#">Enroll</a>

## Taco-Making 101

In this course, you'll learn how to build a proper taco. You'll learn to make all the traditional variations of tacos, such as al pastor, carne asada, tacos de camarones, tacos de lengua, fish tacos, and many more!

Date and Time	Instructor	Register
Wednesday 6-9pm	Brian Eng <a href="#">Bio</a>	<a href="#">Enroll</a>
Thursday 6-9pm	Ben Block <a href="#">Bio</a>	<a href="#">Enroll</a>

# MODELS



# MODELS

- User stories and wireframes are a way to think about and discover all the entities in your world, as well as the relationships between them
- Entities = *models*
- All the entities and relationships = domain model

# HOW TO: START MODELING

- Think about all the real-world things in your world
- Students and teachers
  - Not theoretical – real things
  - Have *attributes*
  - *Student* - first name, last name, email, and phone number
  - *Teacher* - first name, last name, bio

## students

<b>id</b>	<b>first_name</b>	<b>last_name</b>	<b>email</b>	<b>phone_number</b>
1	Jane	Doe	jane@example.com	555-1212
2	Jenny	Smith	jenny@gmail.com	867-5309
3	John	Johnson	john@acme.com	456-7890

## teachers

<b>id</b>	<b>first_name</b>	<b>last_name</b>	<b>bio</b>
1	Ben	Block	Often talks to a rubber ducky.
2	Brian	Eng	Loves tacos.

# DOMAIN MODELING, STEP 2

- Other things that have attributes – data we need to keep
- Courses
  - Course name
  - Course description

## courses

<b>id</b>	<b>name</b>	<b>description</b>
1	Intro to Software Development	This course is focused on software development...
2	Taco-Making 101	In this course, you'll learn how to build a proper taco...

# DOMAIN MODELING, STEP 3: RELATIONSHIPS

- Add more attributes to a model? Or create another model and a relationship?
- How to tell the difference between an entity and a relationship?
- Consider that a course has multiple times/instructors...

## courses

<b>id</b>	<b>name</b>	<b>description</b>	<b>time_1</b>	<b>teacher_id_1</b>	<b>time_2</b>	<b>teacher_id_2</b>
1	Intro to Software Development	This course is focused on software development...	Wednesday 6:30-9:30pm	1	Friday 1:30-4:30pm	2
2	Taco-Making 101	In this course, you'll learn how to build a proper taco...	Wednesday 6-9pm	2	Thursday 6-9pm	1



## courses

<b>id</b>	<b>name</b>	<b>description</b>	<b>time_1</b>	<b>teacher_id_1</b>	<b>time_2</b>	<b>teacher_id_2</b>	<b>time_3</b>	<b>teacher_id_3</b>
1	Intro to Software Development	This course is focused...	Wednesday 6:30-9:30pm	1	Friday 1:30-4:30pm	2		
2	Taco-Making 101	In this course, you'll learn...	Wednesday 6-9pm	2	Thursday 6-9pm	1	Monday 6-9pm	2



# POOR DESIGN

## Products + Reviews

Name	Price	Department	review1_rating	review1_body	review2_rating	review2_body
Camera	\$299	Electronics	4	This cam...	5	Photos...
Sofa	\$699	Furniture	5	Comfy!		
Dining Table	\$1299	Furniture				
Toaster	\$79	Housewares	3	Makes toast		

# RELATIONSHIPS, CONTINUED

- More times/instructors = table grows horizontally 😵👎
- Best practice to grow a database vertically, not horizontally
- Should be another model and a relationship
- *Sections* = course/time/instructor
  - We don't know how many sections of a course there could be
  - A section has its own attributes, like the time it's offered, and the teacher who teaches it.
    - This list of attributes could potentially change in the future, making it very difficult to manage if this data lived within the *Courses* model.

## courses

<b>id</b>	<b>name</b>	<b>description</b>
1	Intro to Software Development	This course is focused on software development...
2	Taco-Making 101	In this course, you'll learn how to build a proper taco...

## sections

<b>id</b>	<b>time</b>	<b>course_id</b>	<b>teacher_id</b>
1	Wednesday 6:30-9:30pm	1	1
2	Friday 1:30-4:30pm	1	2
3	Wednesday 6-9pm	2	2
4	Thursday 6-9pm	2	1

## courses

<b>id</b>	<b>name</b>	<b>description</b>
1	Intro to Software Development	This course is focused on software development...
2	Taco-Making 101	In this course, you'll learn how to build a proper taco...

## sections

<b>id</b>	<b>time</b>	<b>course_id</b>	<b>teacher_id</b>
1	Wednesday 6:30-9:30pm	1	1
2	Friday 1:30-4:30pm	1	2
3	Wednesday 6-9pm	2	2
4	Thursday 6-9pm	2	1
5	<b>Monday 6-9pm</b>	<b>2</b>	<b>2</b>

# ONE-TO-MANY RELATIONSHIP



# ONE-TO-MANY RELATIONSHIP



# MANY-TO-MANY RELATIONSHIP





# BUILDING SUCCESSFUL RELATIONSHIPS

- Grow tables vertically, not horizontally
- To create a one-to-many relationship in a domain model, we simply need to add a foreign key column on the "many" side of the equation
- One many-to-many relationship = two one-to-many relationships
- The model in the middle is known as the *join model - Section* in our example

# NAMING CONVENTIONS

- Not technical... best practices
- When talking about models like *Course* and *Section*, we write them in the singular form, and beginning with a capital letter
- Database table names like **courses** and **sections** are always plural, and in all lower-case
- Column names are always in lower-case, e.g. **name** or **description**
- If a table or column name is made up of more than one word, we separate the words by underscores, e.g. **first\_name** or **teacher\_id**

# LAB

[github.com/entr451-winter2026/domain-modeling](https://github.com/entr451-winter2026/domain-modeling)

- Modify the **school.sql** script to make the courses, teachers, and sections tables real (the statement that creates the students table is already there). Execute the script by running **.read school.sql** at the SQLite prompt, and execute the **.schema** command to ensure that everything went as expected.
- Design the model that allows students to sign up for classes – let's call it **Enrollment** – do it on paper, in Excel, or using another tool of your choice – whatever you prefer
- Make the **enrollments** table by writing a **CREATE TABLE** statement in the **school.sql** script, and execute the script.

students

<b>id</b>	<b>first_name</b>	<b>last_name</b>	<b>email</b>	<b>phone_number</b>
1	Jane	Doe	jane@example.com	555-1212
2	Jenny	Smith	jenny@gmail.com	867-5309
3	John	Johnson	john@acme.com	456-7890

teachers

<b>id</b>	<b>first_name</b>	<b>last_name</b>	<b>bio</b>
1	Ben	Block	A seasoned pro instructor.
2	Brian	Eng	Loves tacos.

courses

<b>id</b>	<b>name</b>	<b>description</b>
1	Intro to Software Development	This course is focused on software development...
2	Taco-Making 101	In this course, you'll learn how to build a proper taco...

sections

<b>id</b>	<b>time</b>	<b>course_id</b>	<b>teacher_id</b>
1	Tuesday 8:30-11:30	1	2
2	Wednesday 6-9pm	1	1
3	Wednesday 6-9pm	2	2
4	Thursday 6-9pm	2	1

# DOMAIN MODELING EXERCISES

# DOMAIN MODELING: THE RECIPE

- Start with the real-world entities, create models
- Add in more entities based on data you need to keep, create more models
- Add a splash of relationships, create join models if needed

# EXERCISES

<https://entr451.com/domain-modeling-case-study-i/>

<https://entr451.com/domain-modeling-case-study-ii/>

- Jot down a visual of the domain model on paper or using your tool of choice
- Finished product = write and test *CREATE TABLE* statements to physically create the SQLite database; include *DROP TABLE* statements at the beginning so every run of the script begins fresh
- "Solution" will be presented later – the names of your models/tables might be different, and that's OK

# NEXT WEEK

- Assignment #1 DUE (check Canvas > Assignments)
  - Submit link to your Github repo on Canvas (not Gitpod, **Github!**)
- Computer Programming 😎