Lab 4: Database Design

GW CS 2541: Database Systems and Team Projects - 2022

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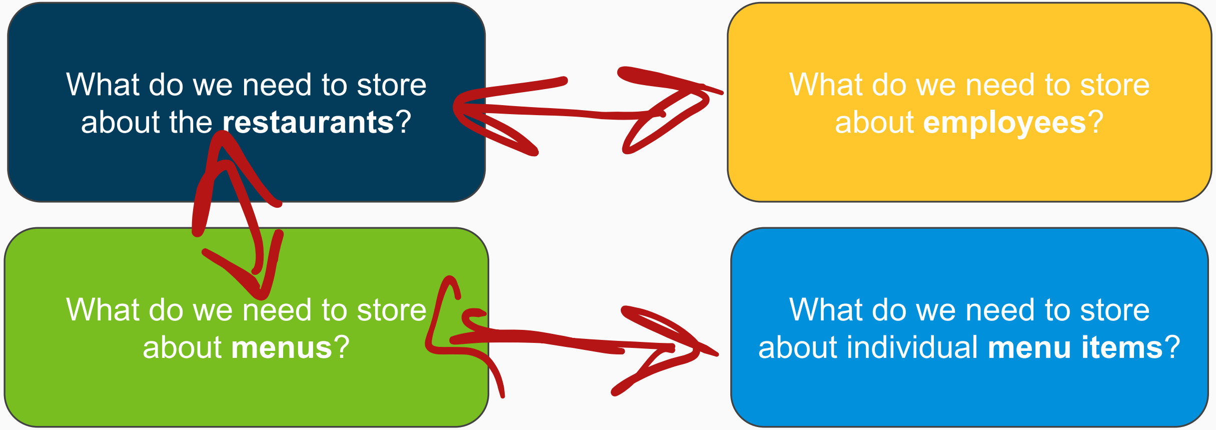
Restaurant Database Design

Gordon Ramsay has 35 restaurants. He needs you to create a database to track his restaurants, employees, and menu offerings. This information can be represented with four **entities**:

1. Restaurants
2. Employees
3. Menus
4. Food Items

ER Diagram Entities

Let’s create an ER Diagram to visualize Gordon’s Restaurant Database!



What do we need to store about the **restaurants**?

What do we need to store about **employees**?

What do we need to store about **menus**?

What do we need to store about individual **menu items**?

ER Relationships

We learned on Monday that entities can be related to one another in different tables.

What relations do we need in our database?

What fields affect one another?

What happens to the employees if a restaurant closes?

Which entities in the restaurant database are related?

Activity 0: ER Diagram

1. In groups at your table, create a ER diagram for our restaurant database with the four entities: Restaurants, Employees, Menus, and Food Items
   - You can use LucidChart or another online diagram tool or draw it on a piece of paper
2. When you’re finished, upload a picture of your diagram to the #lecture-lab channel on Slack
3. React with a ✅ emoji to vote for the diagrams that you think are best!

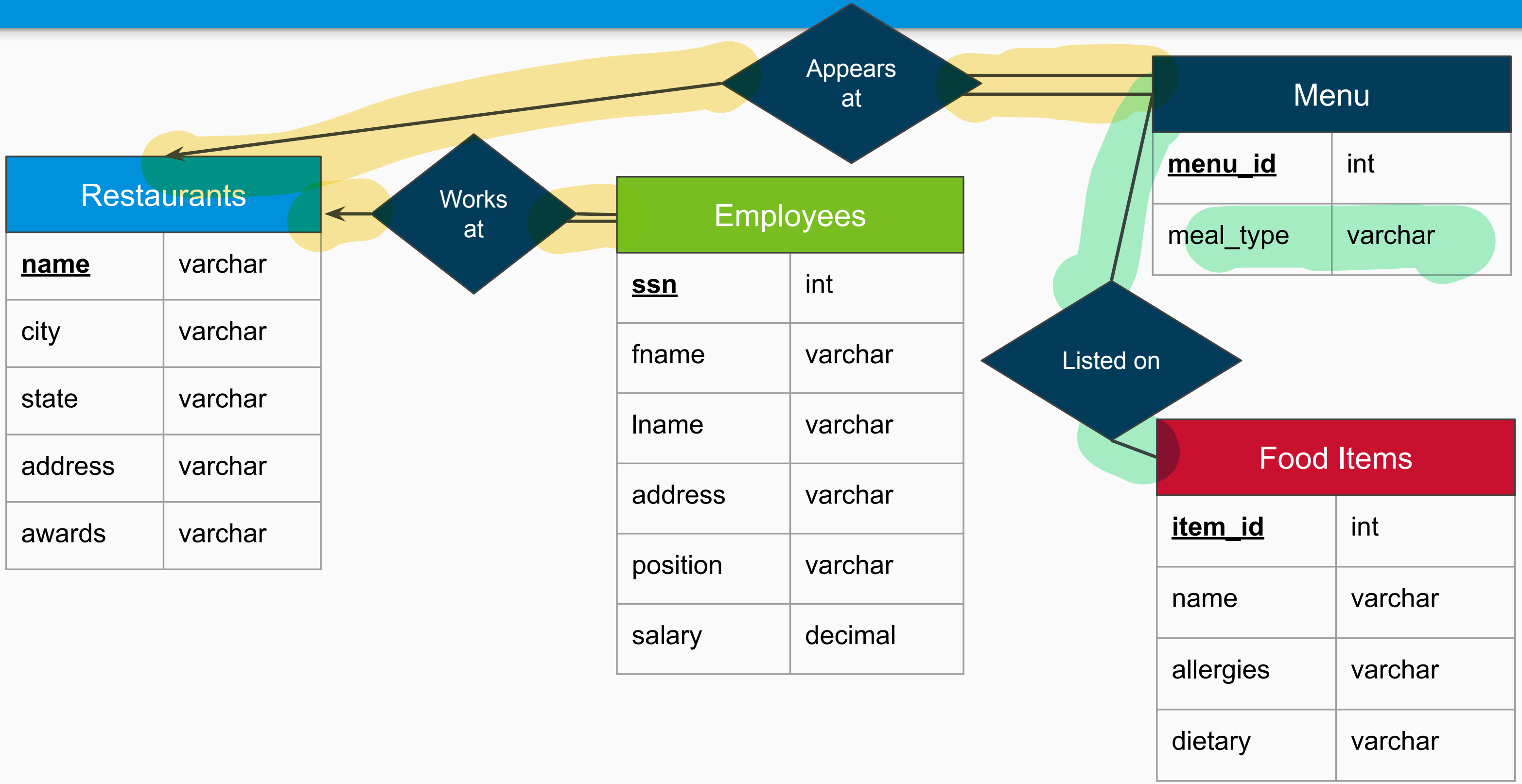
Restaurants	

Employees	

Menu	

Food Items	

Restaurants ER Diagram



Restaurants	
name	varchar
city	varchar
state	varchar
address	varchar
awards	varchar

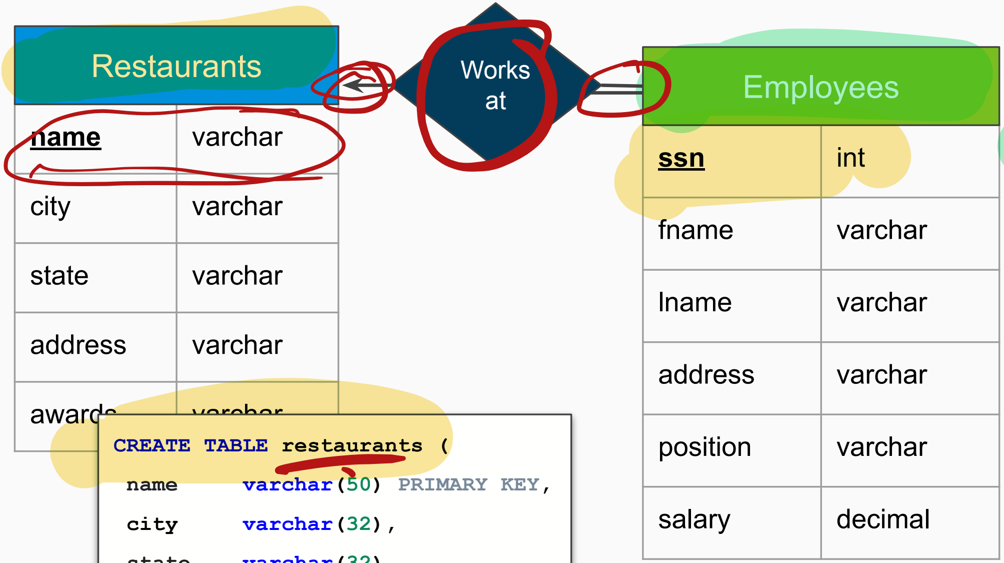
Employees	
ssn	int
fname	varchar
lname	varchar
address	varchar
position	varchar
salary	decimal

Menu	
menu_id	int
meal_type	varchar

Food Items	
item_id	int
name	varchar
allergies	varchar
dietary	varchar

ER Diagram → SQL Script

How do we represent the relationship?



Restaurants	
name	varchar
city	varchar
state	varchar
address	varchar
awards	varchar

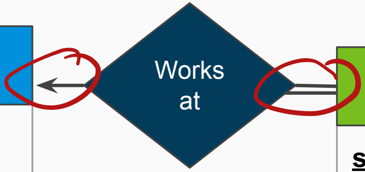
Employees	
ssn	int
fname	varchar
lname	varchar
address	varchar
position	varchar
salary	decimal

```
CREATE TABLE restaurants (
  name      varchar(50)  PRIMARY KEY,
  city      varchar(32),
  state     varchar(32),
  address   varchar(50),
  awards    varchar(128) );
```

```
CREATE TABLE employees  (
  ssn          int(9)  PRIMARY KEY,
  fname        varchar(15),
  lname        varchar(15),
  address      varchar(50),
  salary       decimal(10,2),
  position     varchar(32)         Not Null
works_at        Varchar
); Foreign Key
      (works at)
   Reference —
```

ER Diagram ⟶ SQL Script

Restaurants	
name	varchar
city	varchar
state	varchar
address	varchar
awar	



Employees	
ssn	int
fname	varchar
lname	varchar
address	varchar
position	varchar
salary	decimal

```
CREATE TABLE restaurants (
 name       varchar(50) PRIMARY KEY,
 city       varchar(32),
 state      varchar(32),
 address    varchar(50),
 awards     varchar(128) );
```

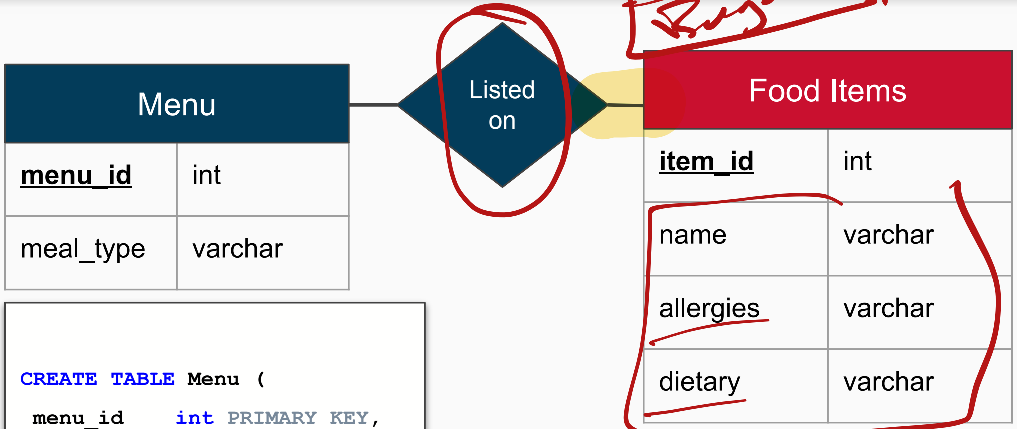
```
CREATE TABLE employees (
 ssn          int(9) PRIMARY KEY,
 fname        varchar(15),
 lname        varchar(15),
 address      varchar(50),
 salary       decimal(10,2),
 position     varchar(32)
 works_at     varchar(50) not null,
 FOREIGN KEY (works_at) REFERENCES
    restaurants(name)
);
```

ER Diagram → SQL Script

McDonald's

Burger King

10 Hamburger



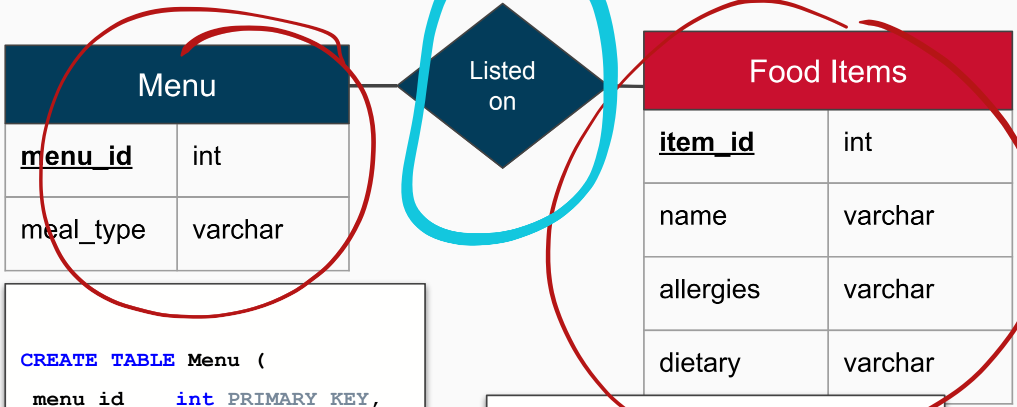
```
CREATE TABLE Menu (
 menu_id    int PRIMARY KEY,
 meal_type  varchar(32),
);
```

```
CREATE TABLE FoodItems (
 item_id      int PRIMARY KEY,
 name         varchar(50),
 allergies    varchar(50),
 dietary      varchar(50),
 on_menu      int ~~not null~~,
 ~~FOREIGN KEY (on_menu) REFERENCES~~
   ~~Menu(menu_id)~~
);
```

Does this match the diagram?

item_id	menu_id
10	3
10	5

ER Diagram → SQL Script



Menu	
menu_id	int
meal_type	varchar

Food Items	
item_id	int
name	varchar
allergies	varchar
dietary	varchar

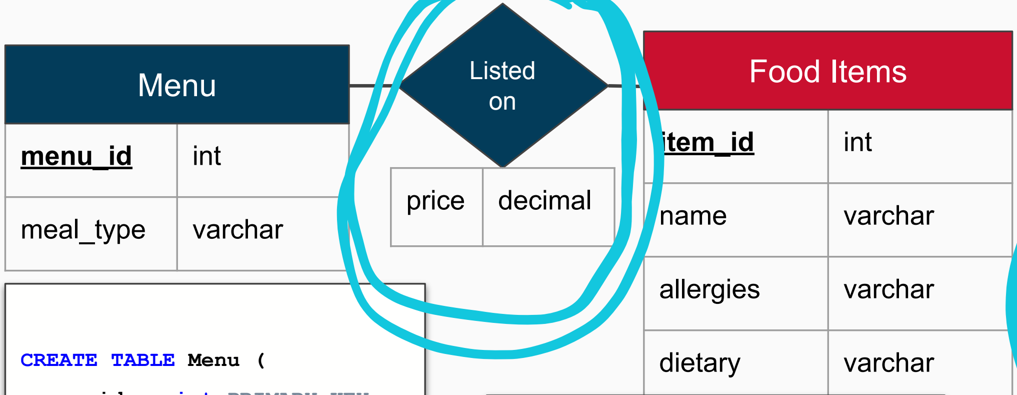
```
CREATE TABLE Menu (
 menu_id     int PRIMARY KEY,
 meal_type   varchar(32),
);
```

```
CREATE TABLE FoodItems (
 item_id      int PRIMARY KEY,
 name         varchar(50),
 allergies    varchar(50),
 dietary      varchar(50),
);
```

```
CREATE TABLE MenuList (
 item_id   int,
 on_menu   int,
 PRIMARY KEY (item_id,
   on_menu),
 FOREIGN KEY (on_menu) REFERENCES
    Menu(menu_id)
 FOREIGN KEY (item_id) REFERENCES
    FoodItems(item_id)
);
```

You may need tables for every Entity AND Relationship!

ER Diagram ⟶ SQL Script



Menu	
menu_id	int
meal_type	varchar

price	decimal

Food Items	
item_id	int
name	varchar
allergies	varchar
dietary	varchar

```
CREATE TABLE Menu (
 menu_id     int PRIMARY KEY,
 meal_type   varchar(32),
);
```

```
CREATE TABLE FoodItems (
 item_id      int PRIMARY KEY,
 name         varchar(50),
 allergies    varchar(50),
 dietary      varchar(50),
);
```

```
CREATE TABLE MenuList (
 item_id   int,
 on_menu   int,
 price   decimal,
 PRIMARY KEY (item_id,
   on_menu),
 FOREIGN KEY (on_menu) REFERENCES
    Menu(menu_id)
 FOREIGN KEY (item_id) REFERENCES
    FoodItems(item_id)
);
```

This is more obvious when relations have attributes

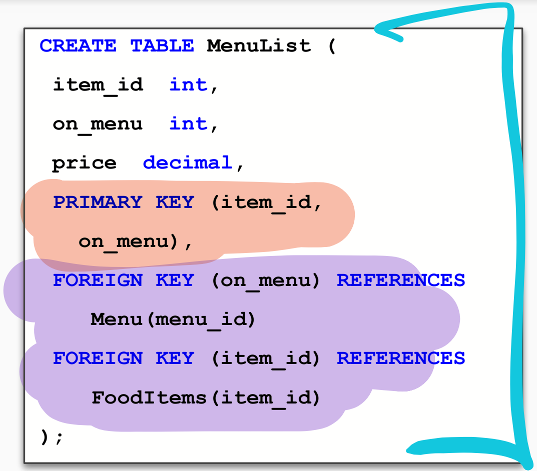
Primary and Foreign Key Reminder

Primary Key

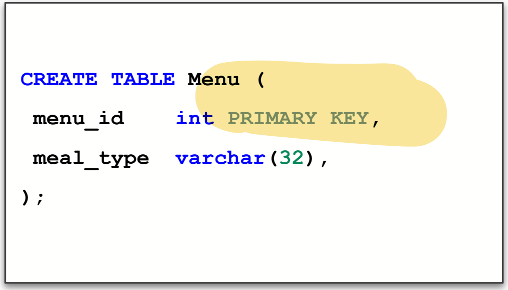
- Determines what must be unique in each row
- Can specify inline or at end of declaration

Foreign Key

- Links two tables together
- Allows us to use Joins (correctly)
- Only needs to be specified in the table which is referring to another



```sql
CREATE TABLE MenuList (
 item_id  int,
 on_menu  int,
 price  decimal,
 PRIMARY KEY (item_id,
   on_menu),
 FOREIGN KEY (on_menu) REFERENCES
    Menu(menu_id)
 FOREIGN KEY (item_id) REFERENCES
    FoodItems(item_id)
);
```



```sql
CREATE TABLE Menu (
 menu_id    int PRIMARY KEY,
 meal_type  varchar(32),
);
```

Activity 1: Do we really need keys?

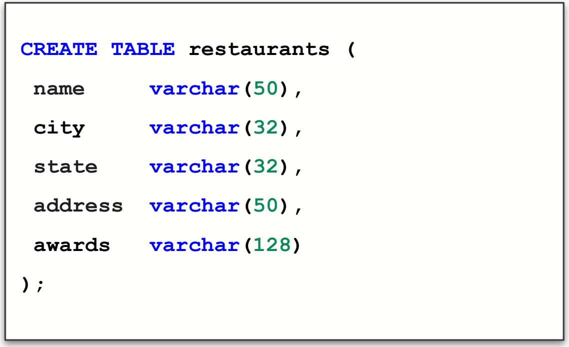
Due Fri 11:59 PM

1. Run the repl (https://replit.com/team/cs2541s22/Lab4-Simple-Table) to create simple tables with no foreign or primary key constraints
2. Try to insert the following data. What happens? Should this be allowed?
   a. Another employee with SSN 888665555
   b. An employee who works at a restaurant not in our database (e.g. ~~works_at_id~~ name = ~~00000002~~ "XYZ")
3. Update the `create.sql` file to have the correct foreign and primary key constraints and run the commands above insert commands again. What happens?
4. Answer the questions in "questions.md" related to this activity.

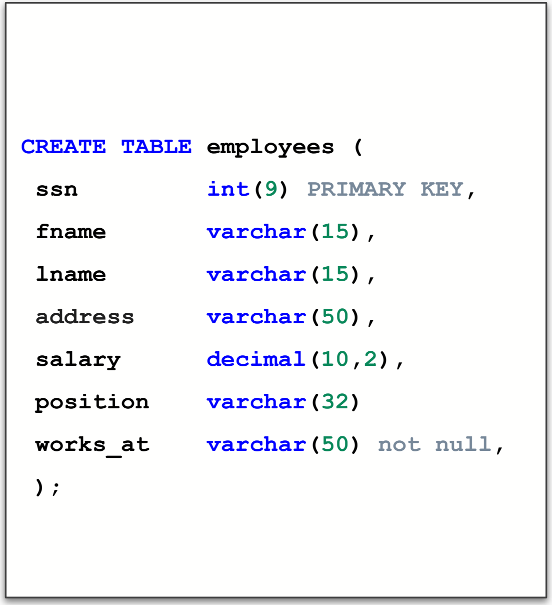
* HTML for image may not work
Use markdown img syntax instead

Activity 1 Solution

- What happened when you tried to insert redundant data?
- What should we add to these tables to fix them?

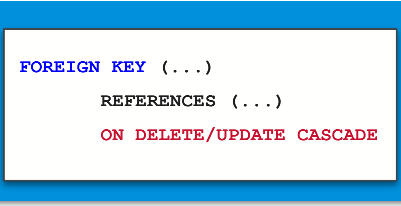


```
CREATE TABLE restaurants (
 name      varchar(50),
 city      varchar(32),
 state     varchar(32),
 address   varchar(50),
 awards    varchar(128)
);
```



```
CREATE TABLE employees (
 ssn           int(9) PRIMARY KEY,
 fname         varchar(15),
 lname         varchar(15),
 address       varchar(50),
 salary        decimal(10,2),
 position      varchar(32)
 works_at      varchar(50) not null,
 );
```

FK Update/Delete Policies



```
FOREIGN KEY (...)
       REFERENCES (...)
       ON DELETE/UPDATE CASCADE
```

- When a “parent” row is updated or deleted, the update / delete rules for the “children” rows are enforced
- DELETE rules:
  - RESTRICT, NO ACTION → error occurs, no rows are deleted
  - CASCADE → all dependents of the deleted row are also deleted
  - SET NULL → every nullable column of the FK of each dependent of the deleted row are set to null
- UPDATE rules:
  - RESTRICT, NO ACTION → error occurs, no rows updated
  - CASCADE → all dependents of the updated row are also updated
  - SET NULL → every nullable column of the FK of each dependent of the updated row are set to null

Activity 2: Cascade, Update, Delete

1. What happens when you run “DELETE FROM restaurants WHERE name=’Gordon Ramsay Pub and Grill’ ;” ?
2. In `create.sql`, add a DELETE CASCADE rule to the employees table.
   a. What happens when you run the above query again?
3. In `create.sql`, add an UPDATE CASCADE rule to the to the employees table.
   a. What happens when you run “UPDATE restaurants SET name=’Gordon Ramsay Burger’ WHERE name=’Gordon Ramsay Fish and Chips’;” ?

Formatting Examples

Emphasis box 1

Emphasis box 2

Emphasis box 3

Emphasis box 4

```
from flask import Flask
app = Flask('app')


@app.route('/')
def hello_world():
 return 'Hello, World!'

app.run(host='0.0.0.0', port=8080)
```