# ☕ DATA 514 Section 4 Worksheet

Name: _____

## Entity Relationship Diagrams

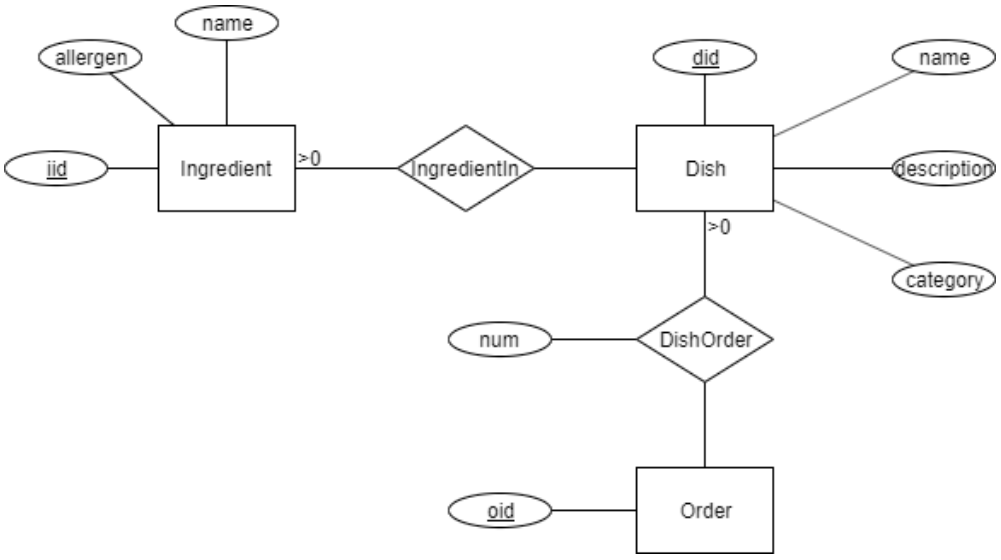
Odegaard Library is in need of a new database, and they have asked you to help design it. Here are some of the requirements for what information needs to be stored in this database:

- Each book has a unique ID, a title, an author, a genre, and a number of pages
- Readers who visit the library have a unique email address, a first name, a last name, and an age
- Readers can "check out" multiple books from the library at a time, and one book can be checked out multiple times. We should keep track of the day that each book was checked out
- To make it easier to recommend books to readers, we should assign a recommended age for each genre
- *(for simplicity, we will assume that Odegaard has exactly one physical copy of each book, so there's no need for our ER diagram to differentiate between a logical edition and a physical printed copy)*

1. Design an ER diagram for the new library database.

2. Convert the ER diagram to a series of CREATE TABLE statements. Include primary key and foreign key statements.

3. Convert the given E/R diagram to CREATE TABLE statements. Include primary key and foreign key statements.



# Functional Dependencies

1. From the (fictional) relation below, identify all the functional dependencies. For each functional dependency, also determine the closure for the determinants (left side of A → B).

| car_type | car_color | is_electric | is_yellow | license_plate |
|---|---|---|---|---|
| RedJeep | “red” | 0 | 0 | ABC1234 |
| Tesla | “blue” | 1 | 0 | TES6520 |
| McQueen | “red” | 1 | 0 | LIG0242 |
| Sedan | “blue” | 0 | 0 | CAR9999 |
| RedJeep | “red” | 0 | 0 | ABC1235 |

# BCNF Decomposition

Example: Decompose into BCNF - **Restaurant(id, name, rating, popularity, rec)**

1. **id → name, rating**
2. **rating → popularity**
3. **popularity → rec**

Given R(A, B, C, D, E), and functional dependencies: A → C, BD → A, D → E

1. Find the following closures: {A}+, {B}+, {D}+, and {BD}+

2. Decompose R into BCNF. In each step, explain which functional dependency you used to decompose and explain why further decomposition is needed. Your answer should consist of a list of table names and attributes. Make sure you indicate the keys for each relation.