344 Section 4 Practice Worksheet

Entity Relationship Diagrams

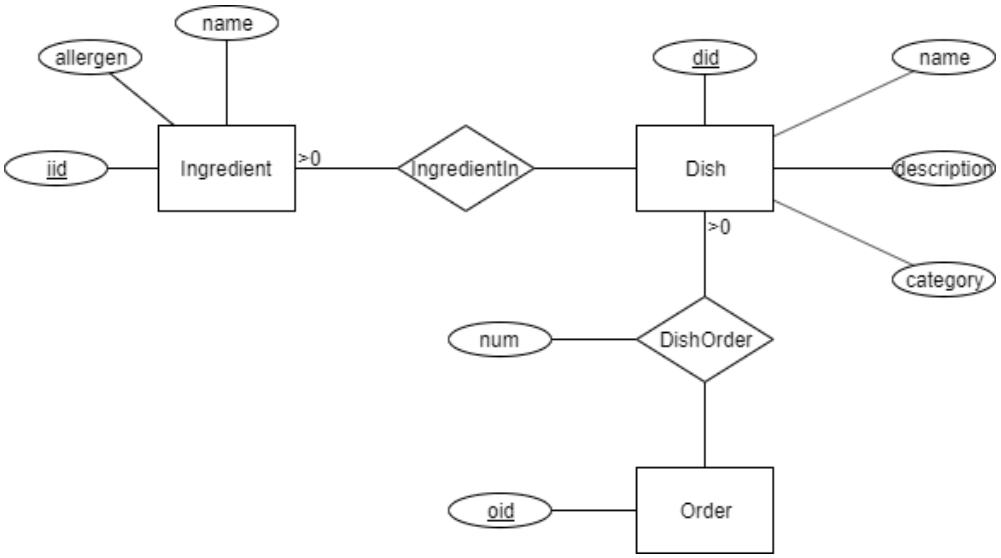
Odegaard Library is in need of a new database, and they have asked you to help design it. Here are some of the requirements for what information needs to be stored in this database:

- 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

2. Given R(A, B, C, D, E) and the following queries give the closure of every element from the output of the query. Assume all attributes are integers. Give the closure of all elements of the output (i.e. A^+ , B^+ , C^+ , D^+ , E^+).

A)
```
SELECT *
FROM R x
WHERE x.a = 20;
```

B)
```
SELECT *
FROM R x
WHERE x.a = 20 and x.b = 30;
```

C)
```
SELECT *
FROM R x
WHERE x.a = 20 and x.b = 30 and x.c = 40;
```

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.