CSE 344 Section 5 Worksheet

1. Consider the following database schema for a restaurant.

      Ingredient(iid, name, allergen)
      Dish(did, name, description, category)
      IngredientIn(iid, did)
   **Order**(oid, customer)
      DishOrder(oid, did, num)

Draw an E/R diagram to represent the database, with the Ingredient, Dish, and Order tables as the entities, and IngredientIn and DishOrder as the relationships.

Make sure to enforce the following constraints:
- Ingredient.**iid,** Dish.**did,** Order.**oid** are the primary keys of the respective tables
- A Dish should have **at least one** Ingredient.
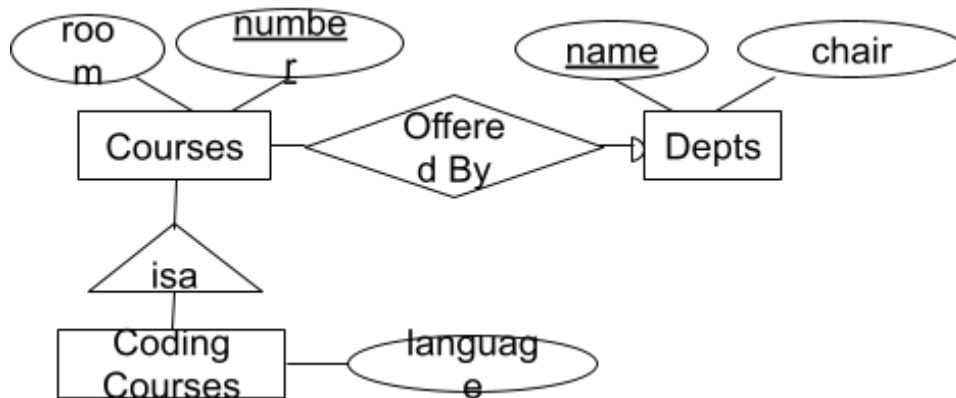- An Order should have **at least one** Dish.

Solution:
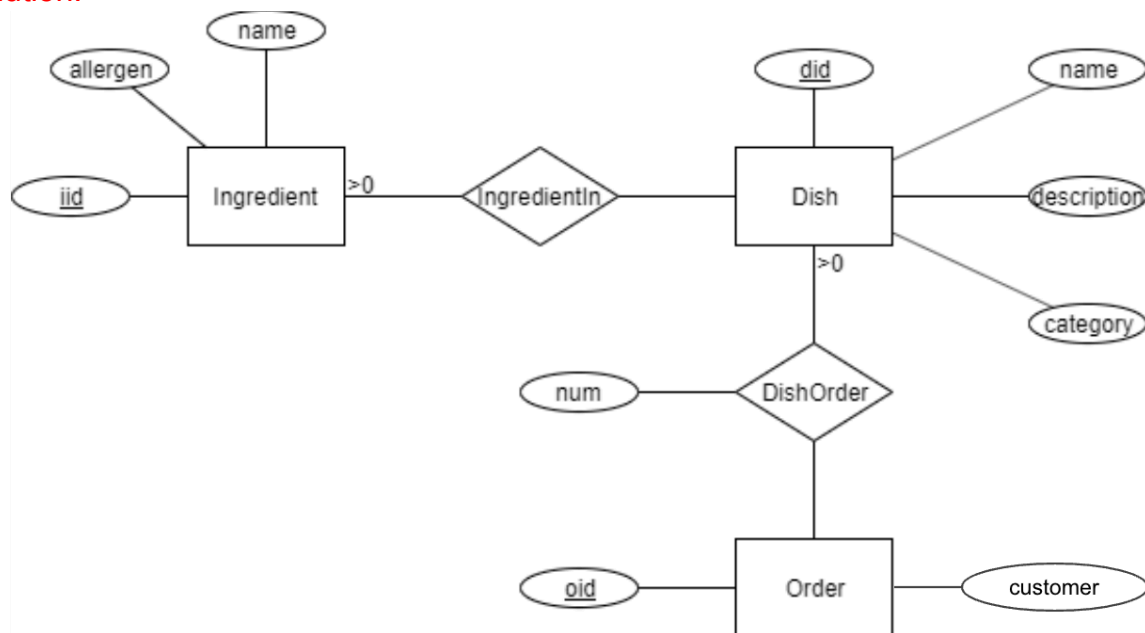
2. Convert the E/R diagram below to relations in BCNF form. Assume no values are NULL, and the arrow between OfferedBy and Depts is a round one. Include all keys and foreign keys. Use the following notation and explicitly state foreign key relationships.

For instance:
R(a, b)
S(c, d) -- c is a foreign key to R

Courses(number, room, name) -- name is foreign key to Depts

CodingCourses(language, number) -- number is foreign key to Courses

Depts(name, chair)

3. Given R(A, B, C, D, E), and functional dependencies: A → B, BC → E, DE → A.
   a. Find minimal key(s) for R.
      Minimal key: BCD or ACD or CDE

   b. Is ACDE a super key?
      ACDE is a superkey because it determines all attributes. (We can easily deduce this because one of the minimal keys is a subset.)

   c. Is CDE a super key?
      CDE is a superkey because it is also a minimal key, and all minimal keys are superkeys

4. Given R(A, B, C, D, E, F) and FDs: B → A, E → B, D → C, A → C

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.

1. Use B → A, A → C
Decompose R into R1(B, A, C) and R2(B, D, E, F)

R1 violates A → C, so we need to further decompose R1
R2 violates E → B, so we need to further decompose R2

2. Use A → C
Decompose R1 into R11(A, C) and R12(A, B)

3. Use E → B
Decompose R2 into R21(E, B) and R22(E, D, F)

Final Decompositions: R11(A, <u>B</u>), R12(<u>A</u>, C), R21(<u>E</u>, B), R22(E, D, F)

5. *(17WI Final Q4)* Given R(A, B, C, D, E), and FDs: A → C, BD → A, D → E

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.

One possible decomposition:

1. Use A → C:
Decompose R into R1(A, C) and T(A, B, D, E)

T violates BD → A and D → E, so we need to further decompose T

2. Use D → E:
Decompose T into R2(B, D, A) and R3(D, E)

Final relations: R1(<u>A</u>, C), R2(<u>B, D</u>, A), and R3(<u>D</u>, E)