2022/23: first semester Teacher : Carmelo Vaccaro

## Tutorial 3.2 + 4 with answers

**Exercise 1** Determine whether a relation R(A, B, C, D) with the functional dependencies  $AB \to C$ ,  $C \to D$ ,  $D \to A$  is in 3NF or not.

**Answer.** First we find the keys and for that purpose we find the closures of the subsets of the attributes.

The keys are  $\{A,B\}$ ,  $\{B,C\}$  and  $\{B,D\}$ . All the attributes are prime, so R is in 3NF.

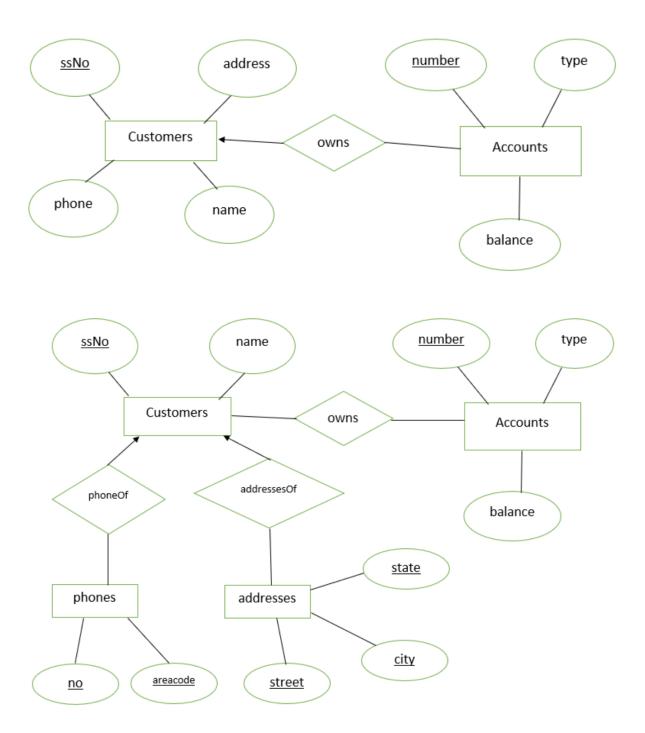
Exercise 2 1. Draw the E/R diagram for a database about a bank that includes information about customers and their accounts. Select and specify a key for each entity set.

Information about a customer includes their name, address, phone, and Social Security number. Accounts have numbers, types (e.g., savings, checking) and balances. An account can have only one customer.

2. Change your diagram so: an account can have any number of customers and a customer can have a set of addresses (which are street-city-state triples) and a set of phones (made by area code and number). We assume that an address and a phone number are related to at most one customer.

#### Answer.

- 1. The E/R diagram is
- 2. The E/R diagram is

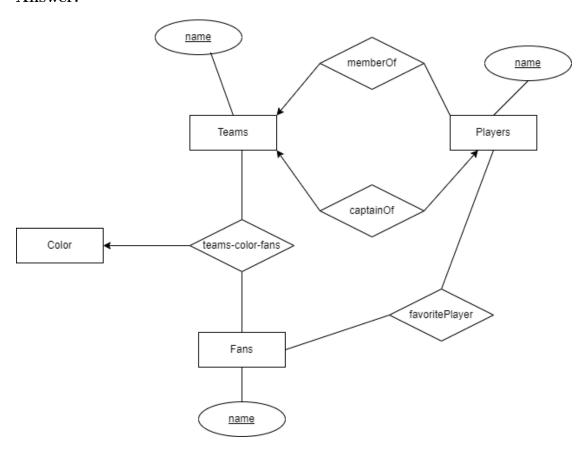


**Exercise 3** Give an E/R diagram for a database recording information about football teams, players, and their fans, including:

- For each team, its name, its players, its team captain (one of its players), and the colors of its uniform.
- For each player, his/her name.
- For each fan, his/her name, favorite players, and favorite teams. For each favorite team, the favorite color for that team.

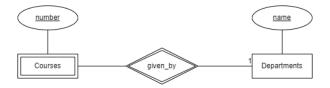
Select and specify a key for each entity set.

### Answer.



**Exercise 4** Draw the E/R diagrams for the relation describing Courses and Departments. A course is given by a unique department, but its only attribute is its number. Different departments can offer courses with the same number. Each department has a unique name.

## Answer.



Exercise 5 Convert the E/R diagrams of Exercise 3 into relational schemas.

# Answer.

1. Customers(<u>ssNO</u>, name, phone, address)
Accounts(<u>number</u>, type, balance, customerSSNo)

 $2. \ \mathit{Customers}(\underline{\mathit{ssNO}}, \ \mathit{name})$ 

 $Accounts(\underline{number},\ type,\ balance)$ 

 $owns(\underbrace{customerSSNo}, \underbrace{accountNumber})$ 

 $Phones(\underline{no}, \underline{areacode}, customerSSNo)$ 

 $Addresses(\underline{street},\ \underline{city},\ \underline{state},\ customerSSNo)$