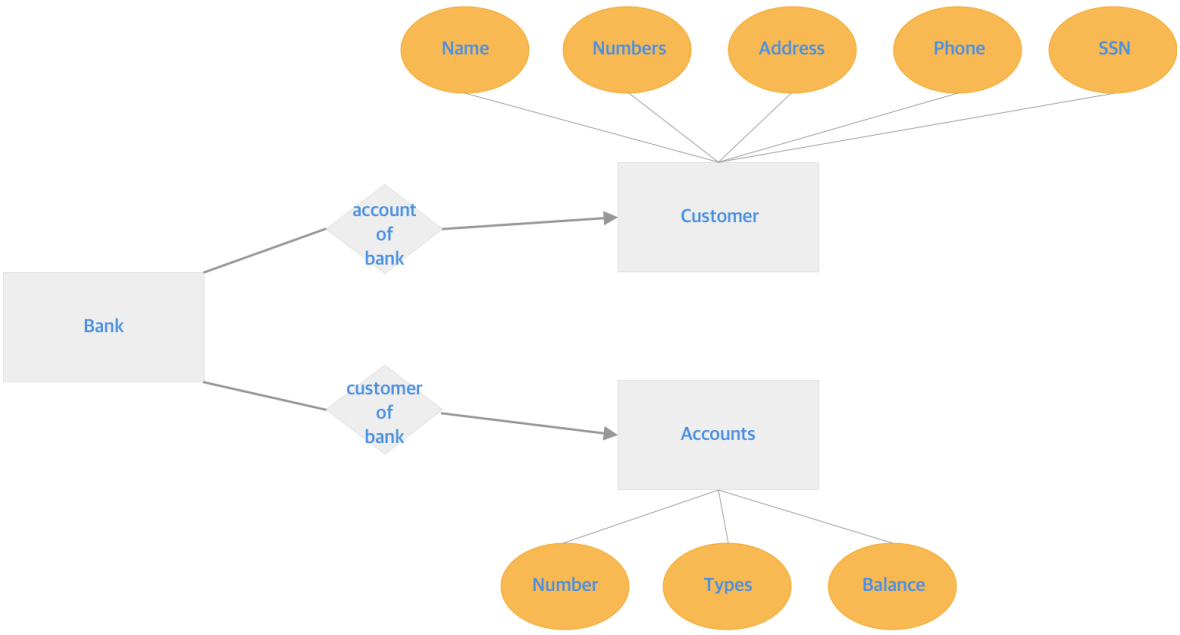
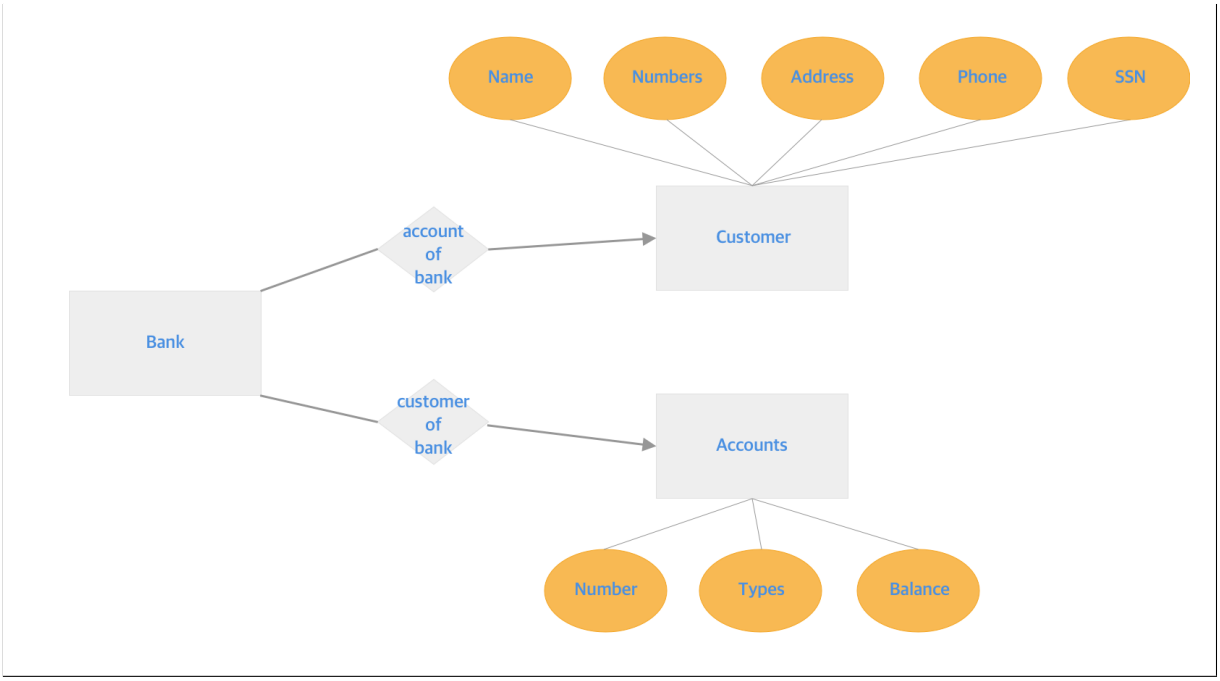
CSC343 Worksheet 14 Solution

July 13, 2020

1.

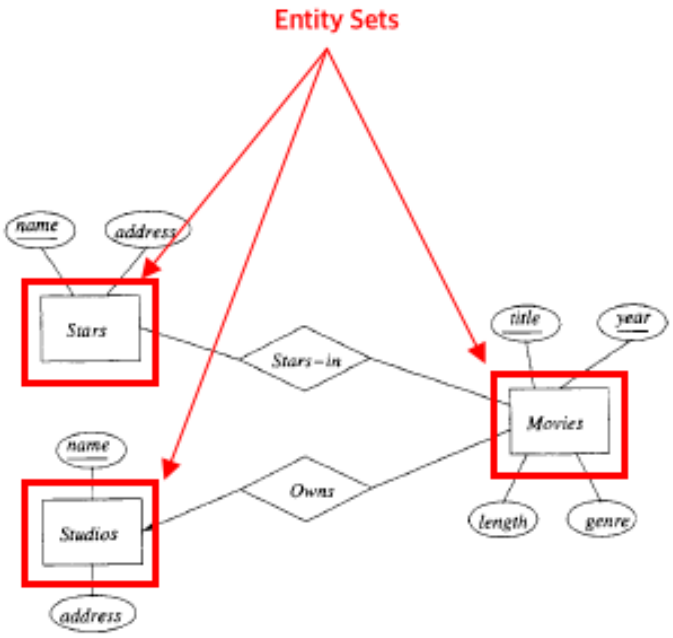


Correct Solution:

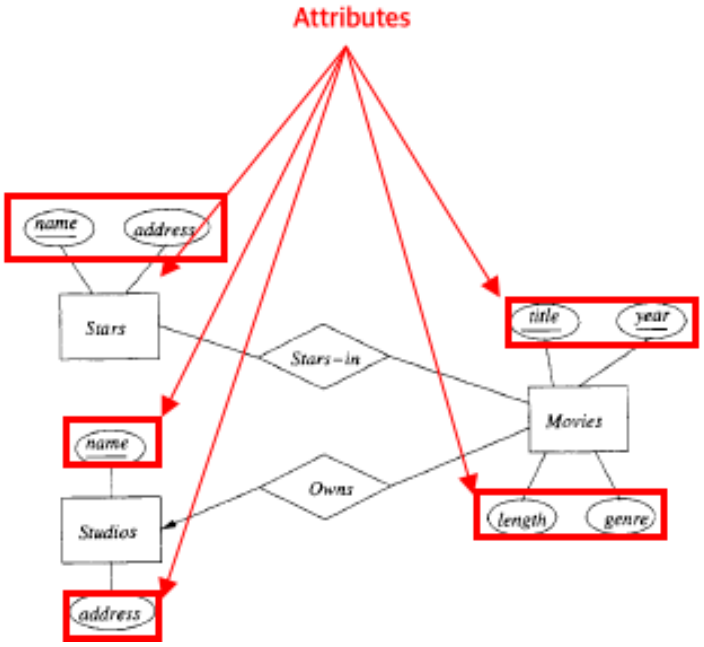


Notes:

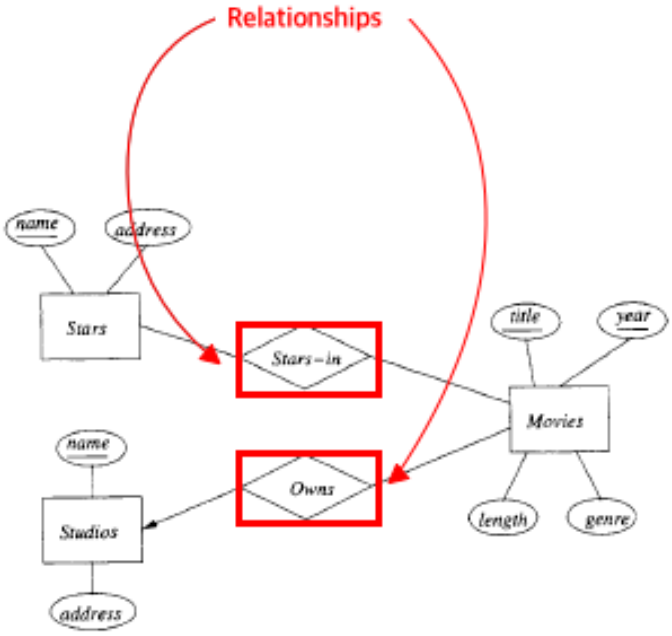
- E/R Model
  - Means **Entity Relationship Model**
  - Entity Relationship Model(ER Modeling) is a graphical approach to database design.
  - Is comparable to class diagram in UML
  - Uses three principle element types:
    1. Entity sets
       * Is an abstract object of some sort (i.e. entitiy)
       * Is not used to represent class
       * Is represented by rectangles



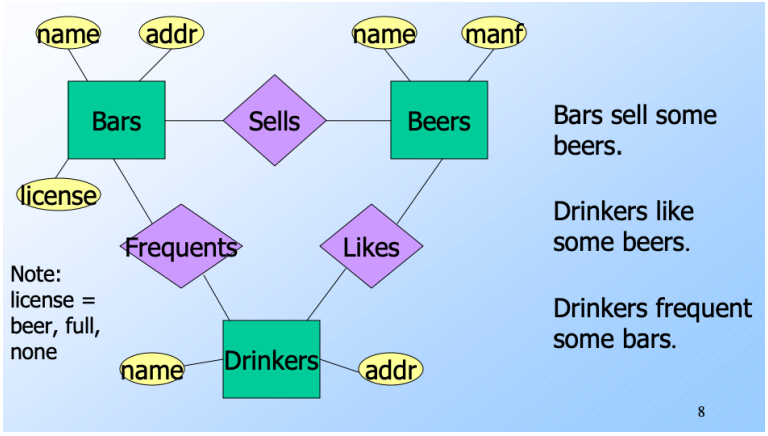
2. Attributes
   * Are properties of entities in a set (i.e. column name)
   * Each has its own primitive data types (e.g. String, integers, Reals)
   * Is represented by ovals



3. Relationships
   * Are connections among two or more entity sets (e.g. intermediary Relations like Stars In)
   * Is represented by diamond

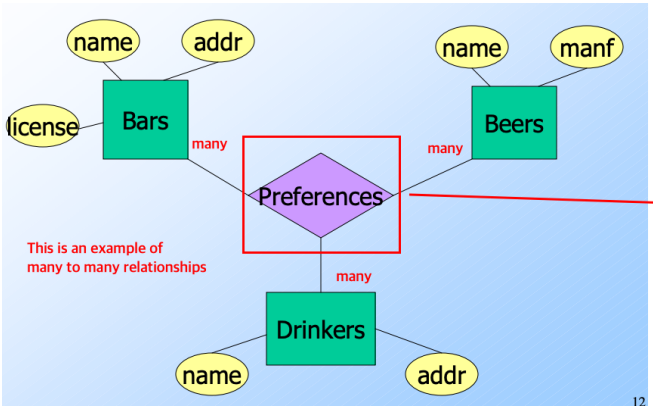


Example:



- Multiway Relationships
  - Connects more than two relationship sets
  - Enables to represent relationships that otherwise is difficult in binary relationship
  - Arrow → 'one'
  - No arrow → 'many'

Example:



Bar	Drinker	Beer
Joe's Bar	Ann	Miller
Sue's Bar	Ann	Bud
Sue's Bar	Ann	Pete's Ale
Joe's Bar	Bob	Bud
Joe's Bar	Bob	Miller
Joe's Bar	Cal	Miller
Sue's Bar	Cal	Bud Lite

Example 2:

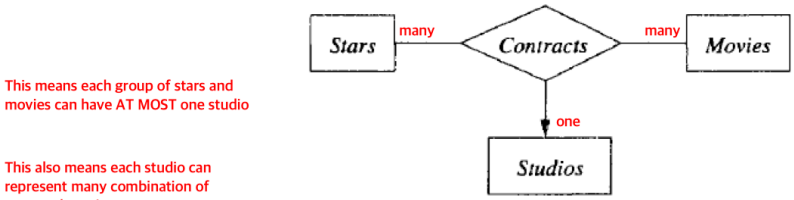


Figure 4.4: A three-way relationship

- Roles in Relationships
  - Is the label of edges between the entity set and relationship
  - Are used to clarify the sementics of relationship

Example:

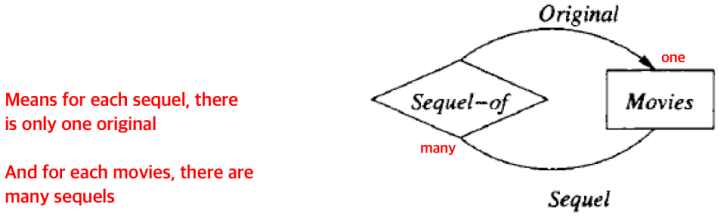


Figure 4.5: A relationship with roles

Example 2:

This means for each combination of stars and movies, there can be a one stduio for star, and one studio for movie

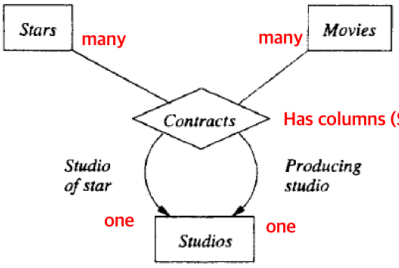
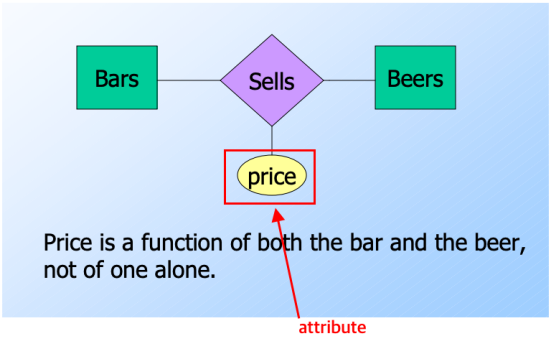


Figure 4.6: A four-way relationship

- Attributes on Relationships
  - can be thought as a property of tuples in the relationship set (i.e. String, Integer, Float, Boolean)

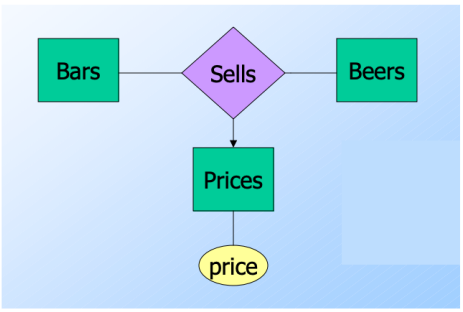
    Example:



Bar	Beers	Price
Bar 1	Canadian	10.99
Bar 2	Budwiser	20.99
Bar 1	Hite	4.99
Bar 1	Cass	15.99

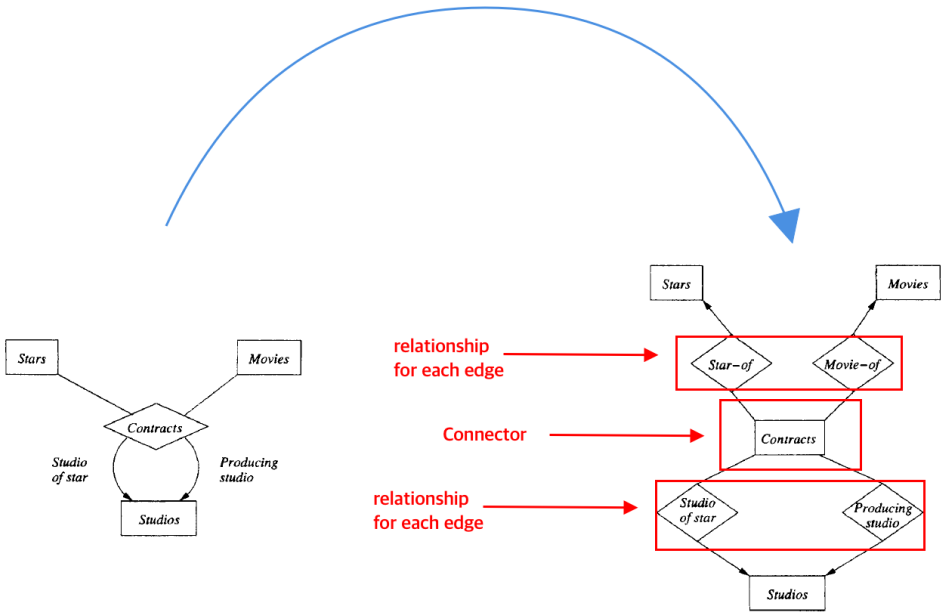
  - Can be removed by creating an entity set with the attribute

    Example:



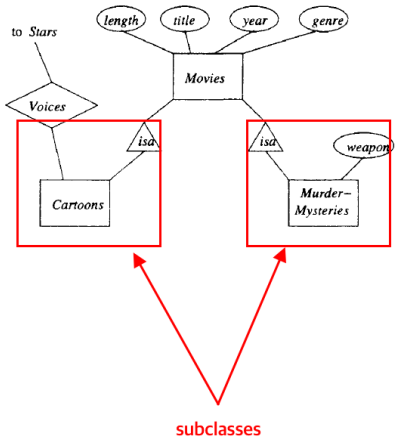
- Conversting Multiway Relationships to Binary

  Example:

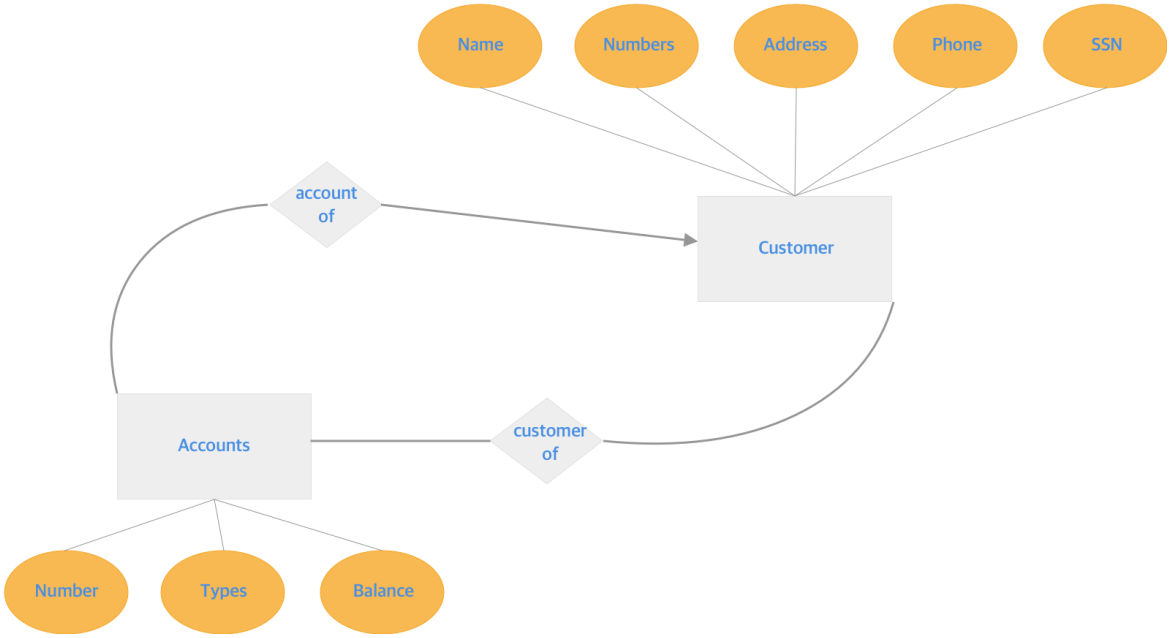


- Subclasses in the E/R Model
  - Has its own special attributes and/or relationships
  - All '*isa*' relationship is <u>one to one</u>
  - Is represented by triangle with label '*isa*' followed by entity set

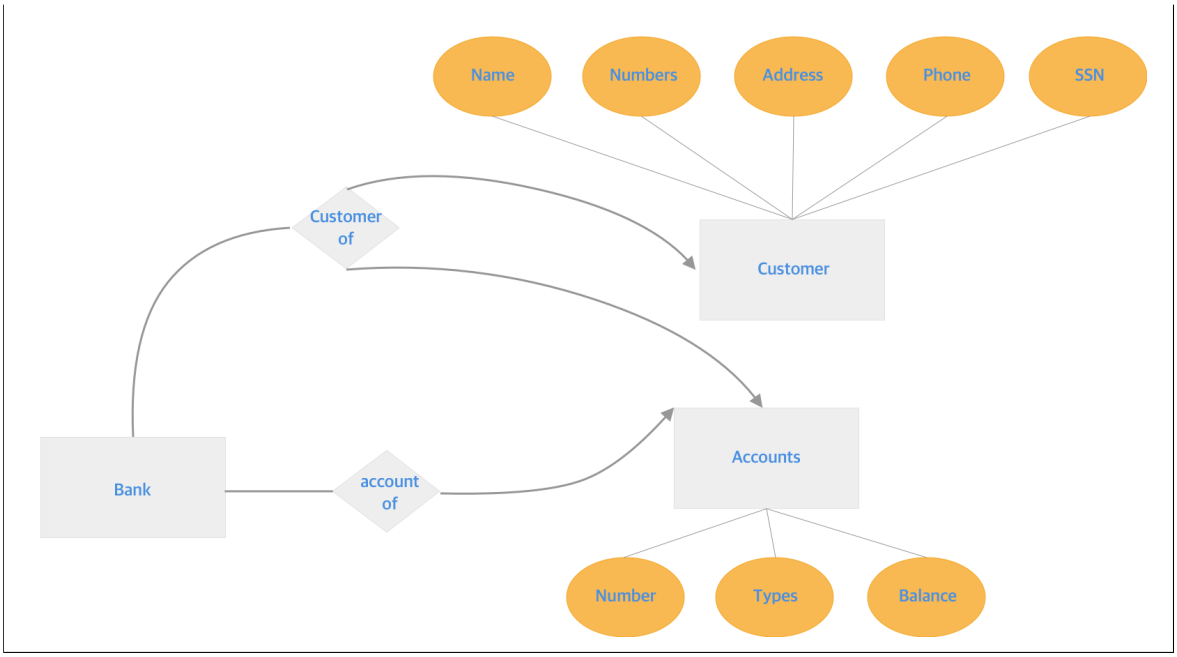
  Example:



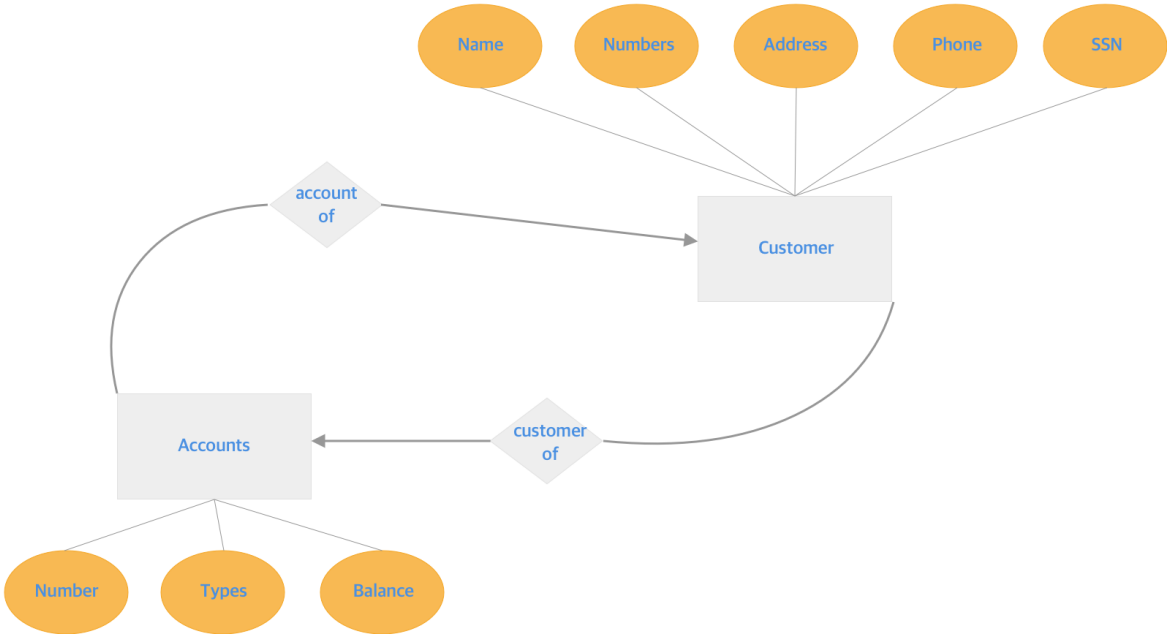
2. a)



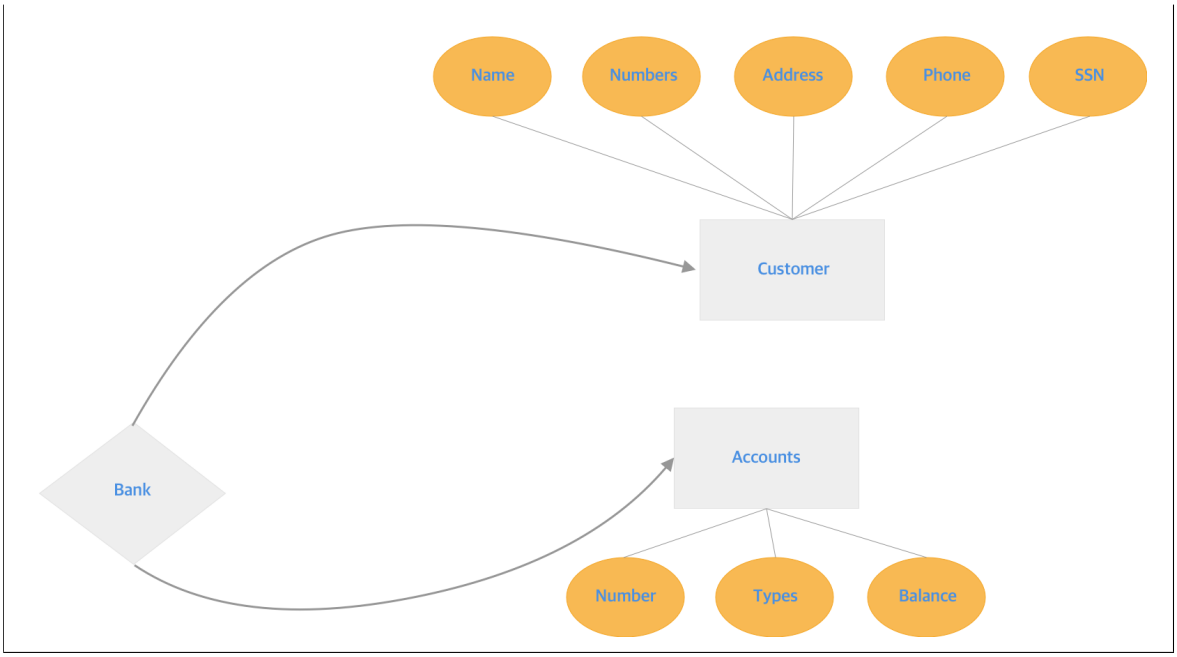
Correct Solution:



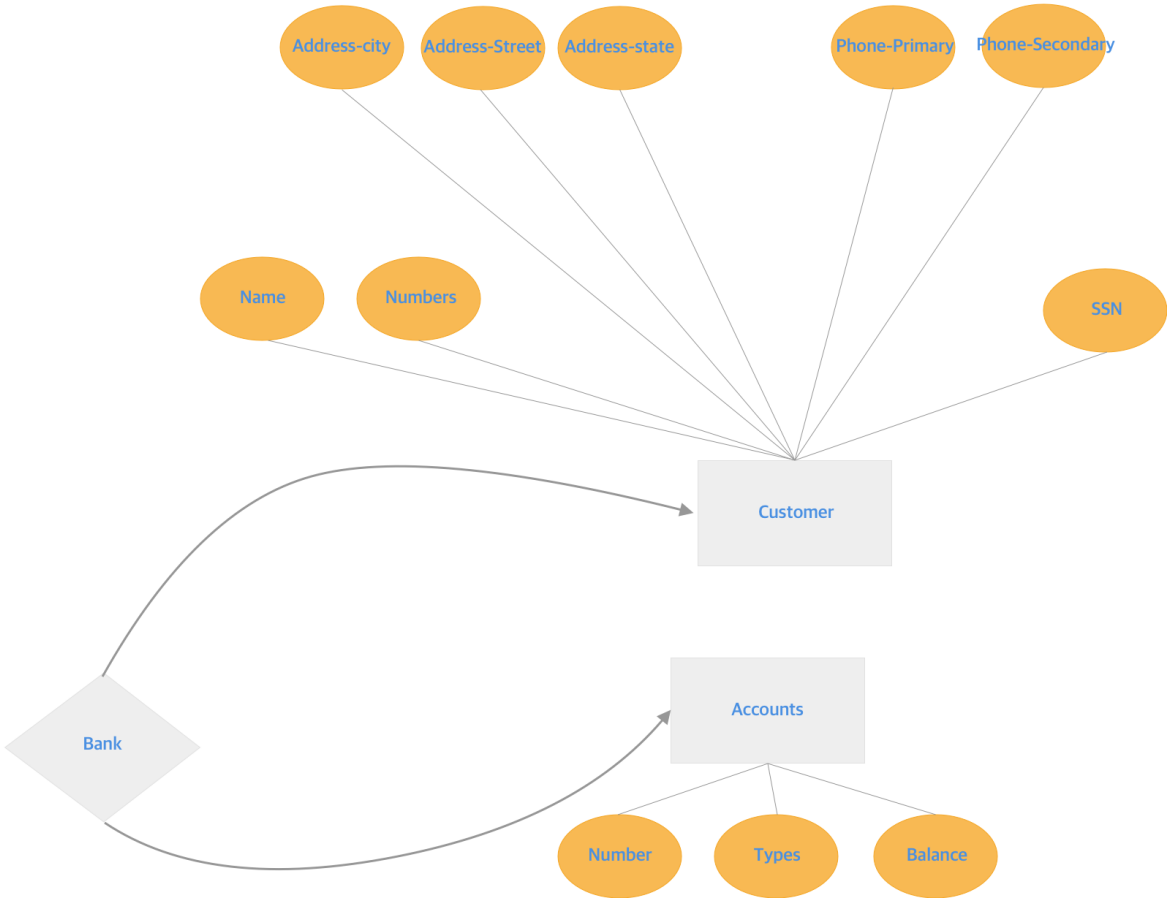
b)



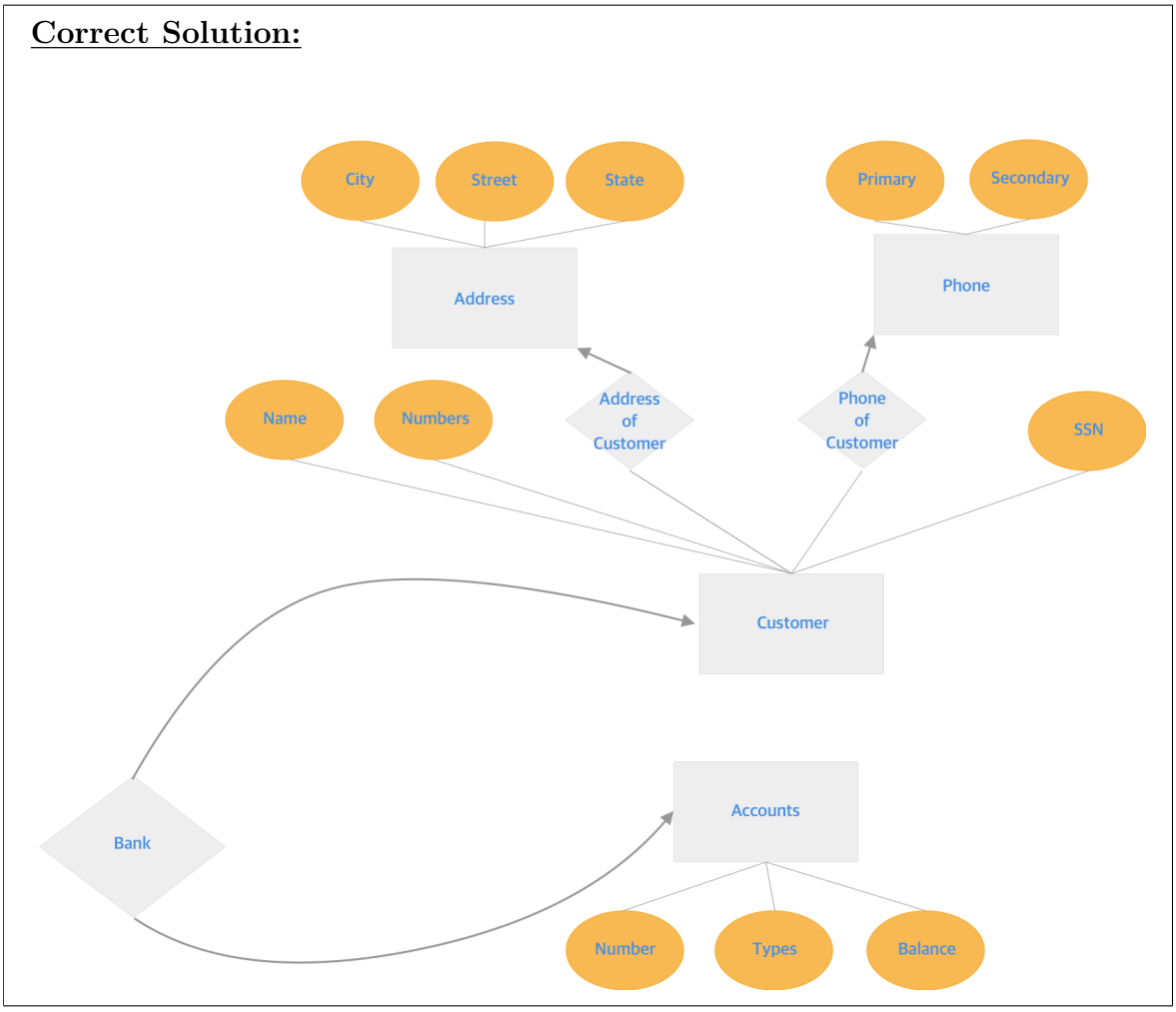
Correct Solution:


Name
Numbers
Address
Phone
SSN
Customer
Accounts
Bank
Number
Types
Balance

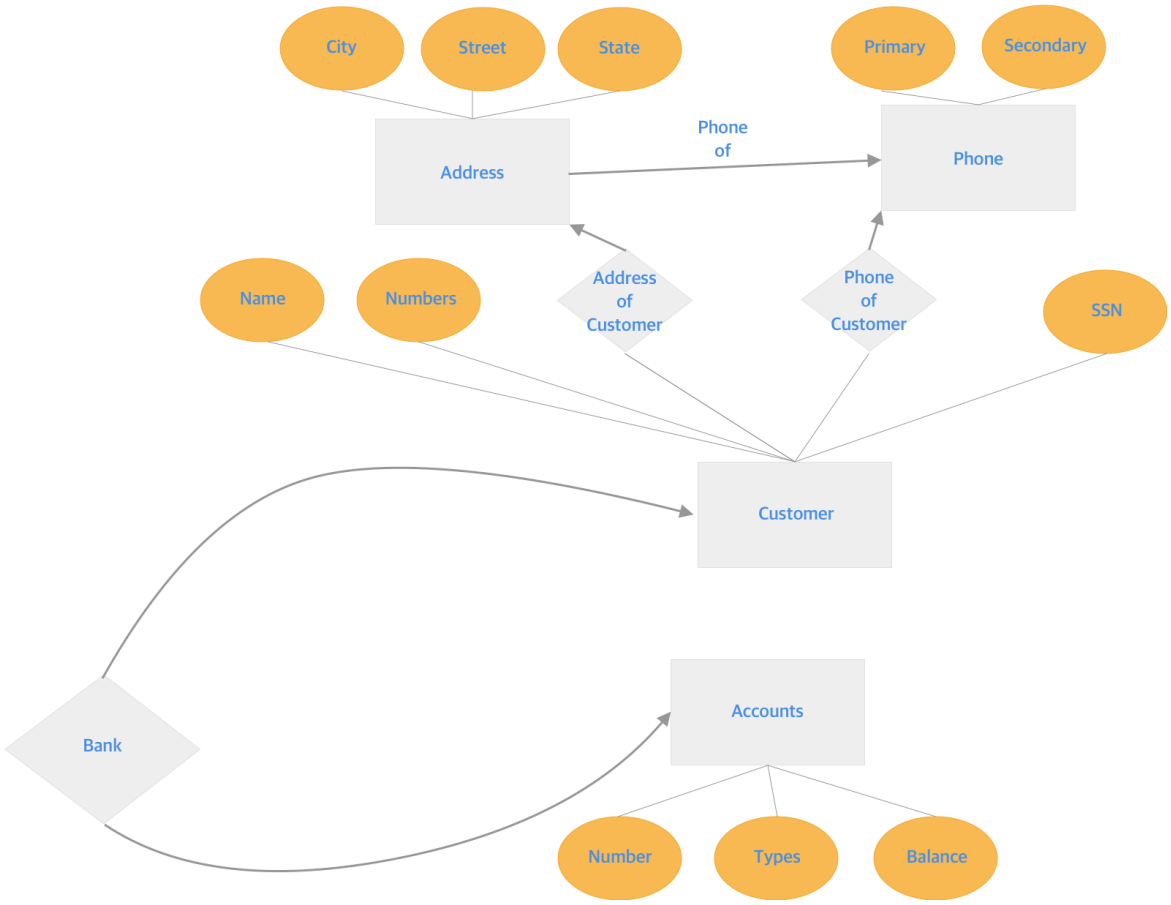
c)


Address-city
Address-Street
Address-state
Phone-Primary
Phone-Secondary
Name
Numbers
SSN
Customer
Accounts
Bank
Number
Types
Balance

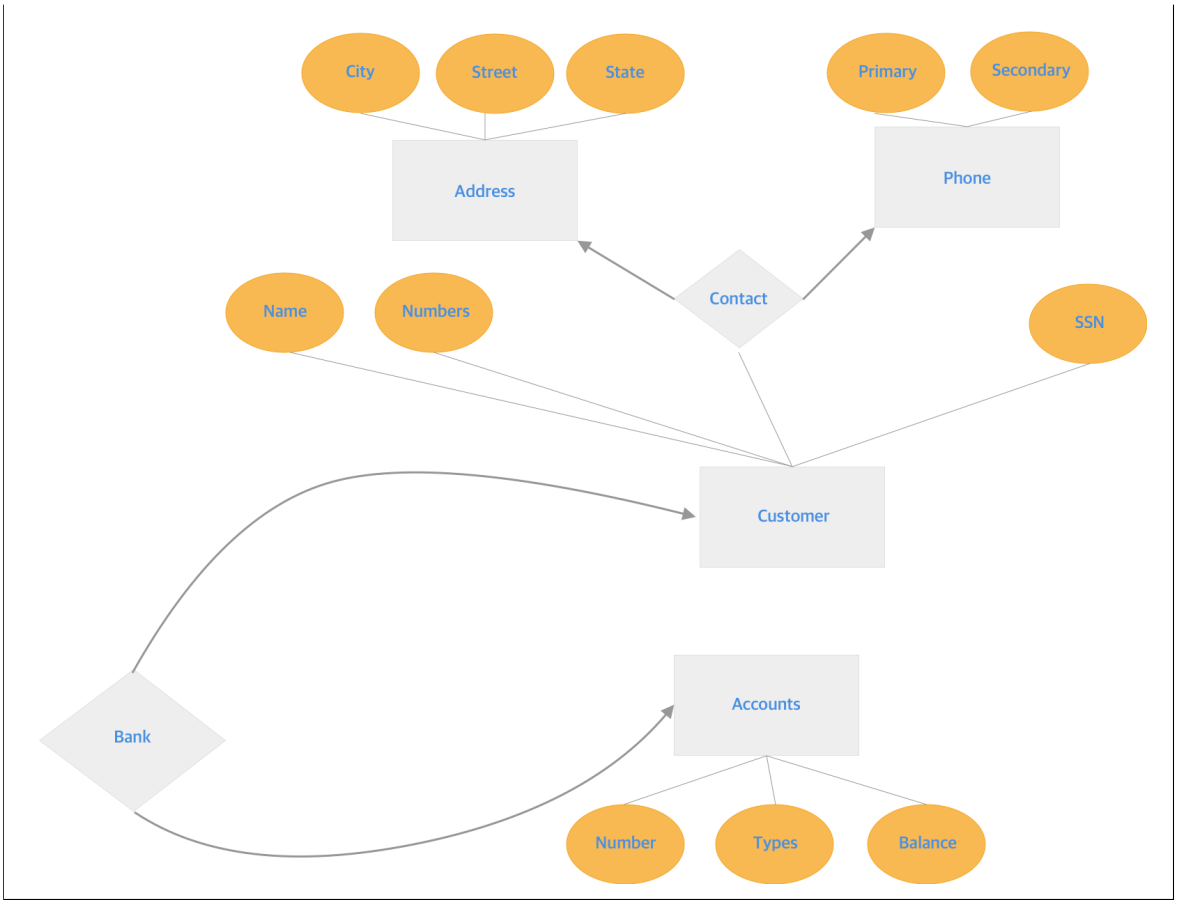
Correct Solution:

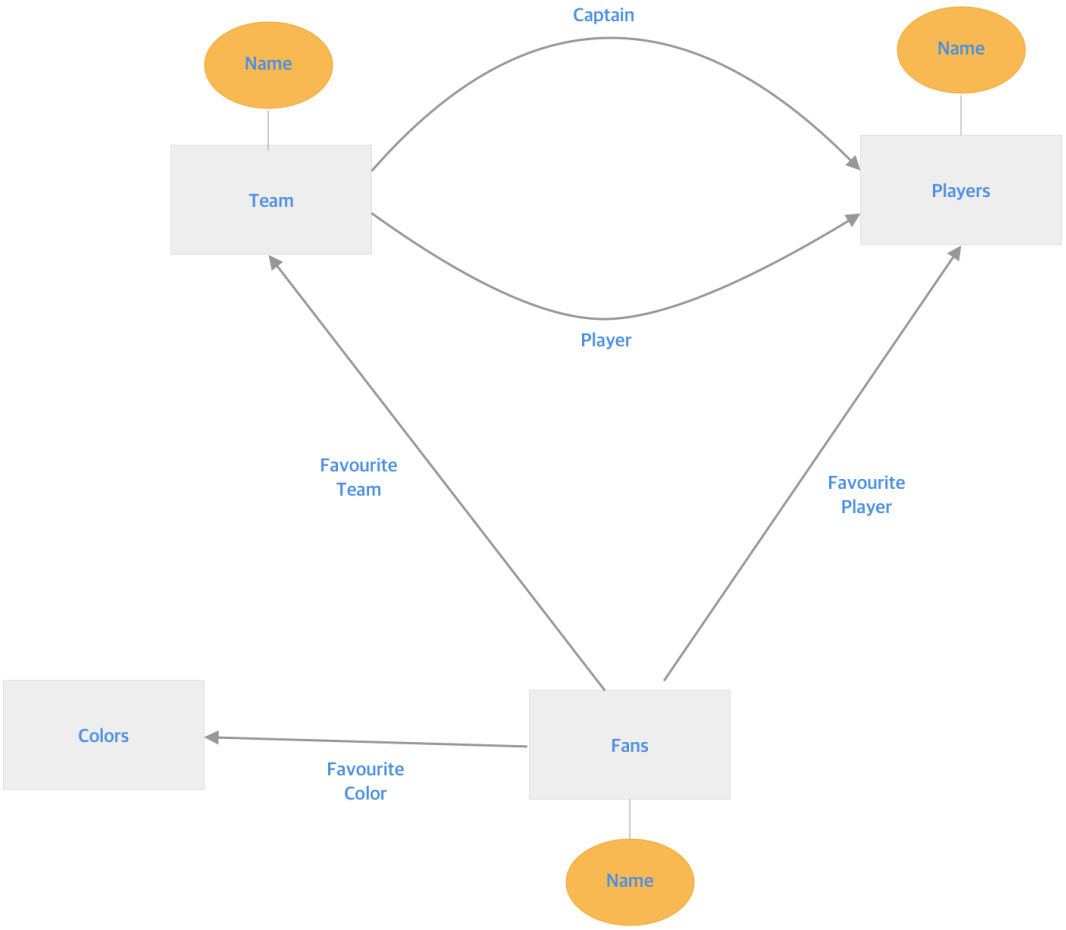


d)



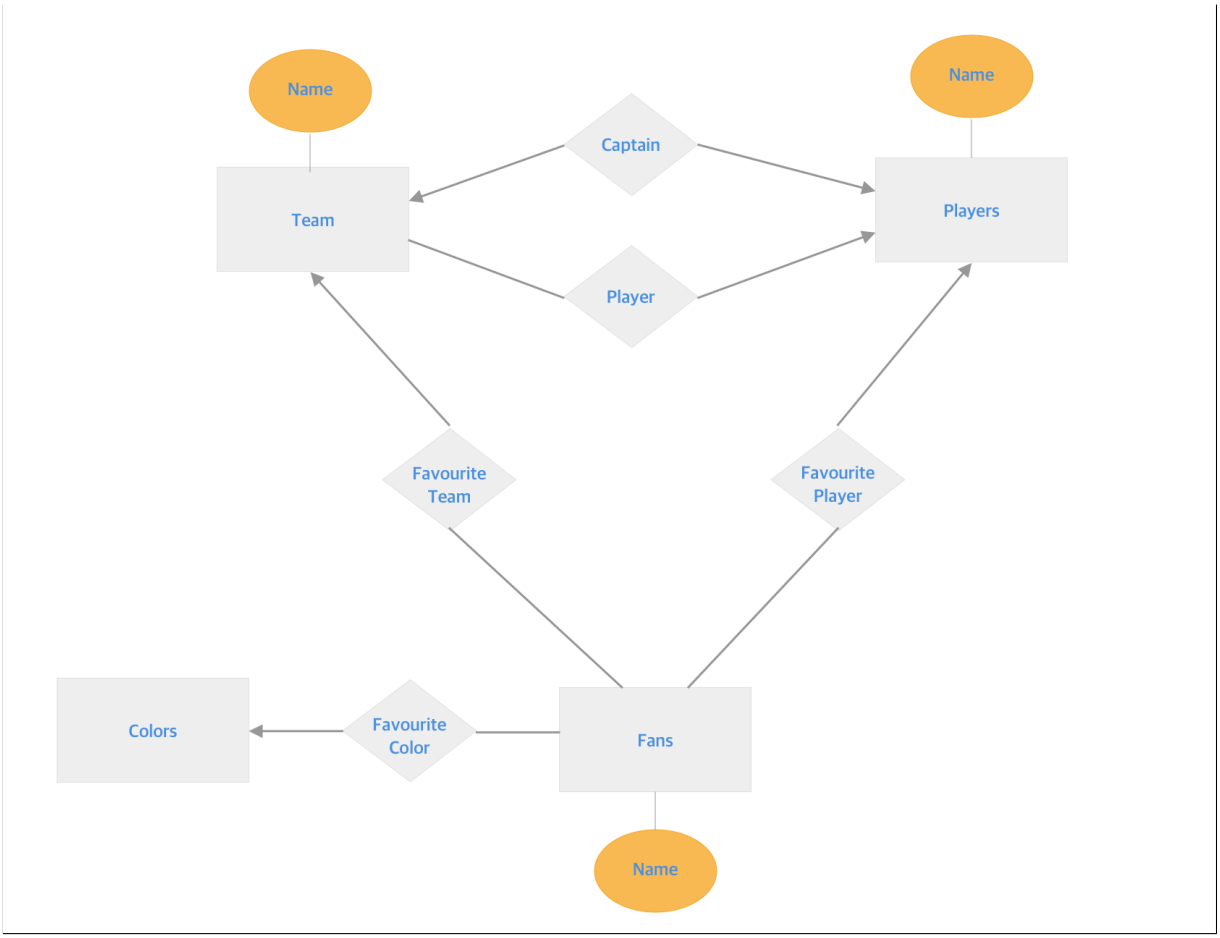
Correct Solution:


City
Street
State
Address
Primary
Secondary
Phone
Contact
Name
Numbers
SSN
Customer
Bank
Accounts
Number
Types
Balance

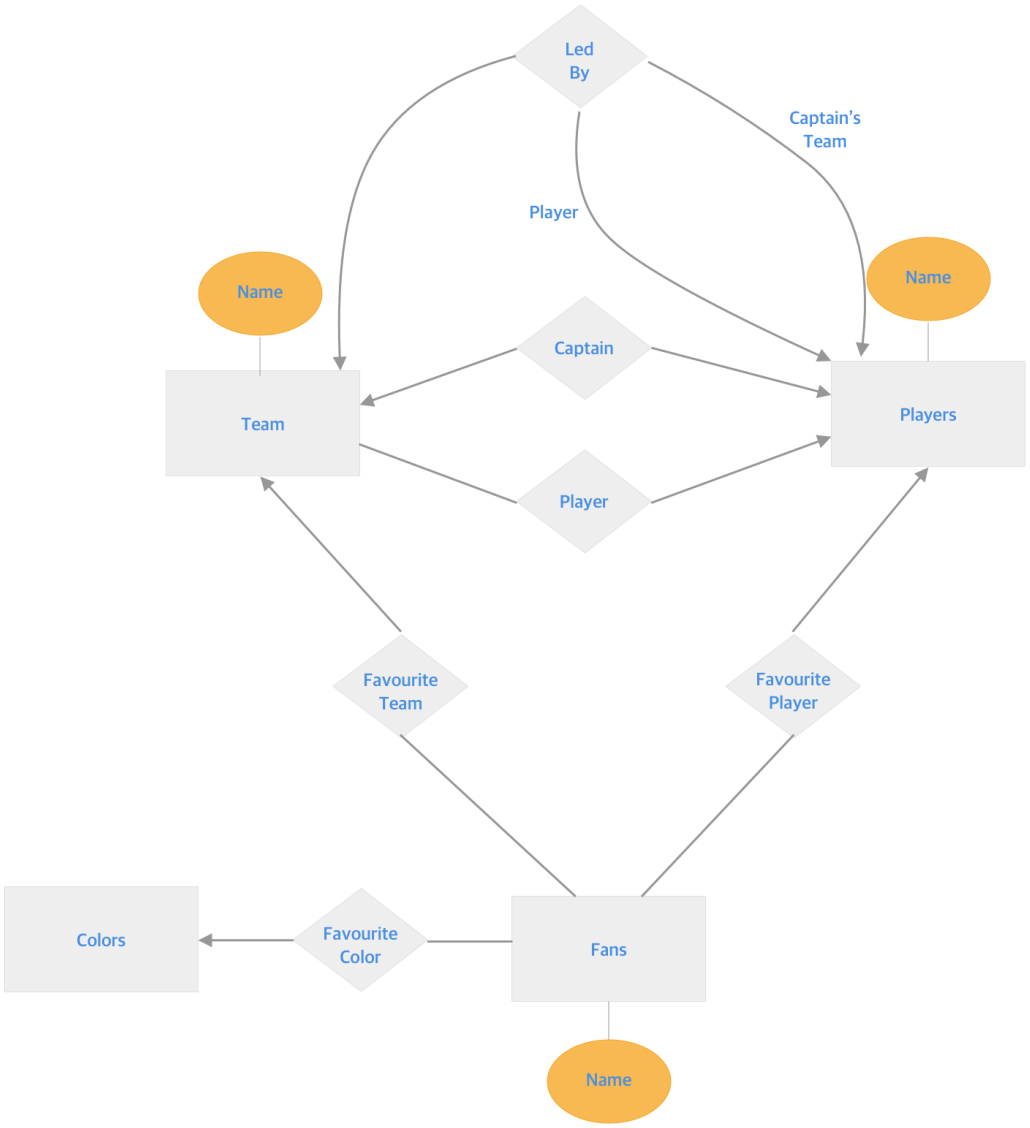


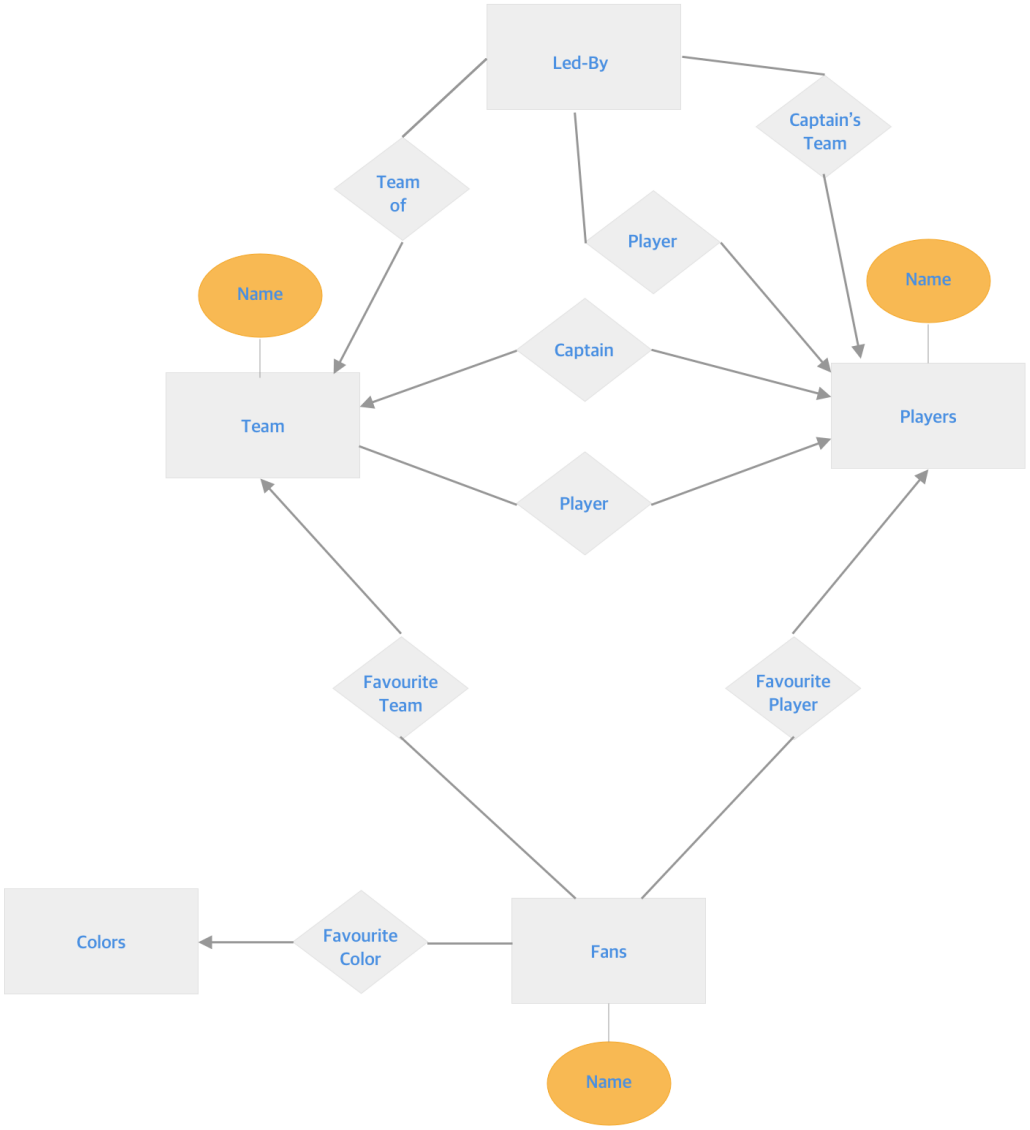
3.

Correct Solution


Name
Name
Captain
Team
Players
Player
Favourite Team
Favourite Player
Colors
Favourite Color
Fans
Name

4. a)


Led By
Captain's Team
Player
Name
Name
Captain
Team
Players
Player
Favourite Team
Favourite Player
Colors
Favourite Color
Fans
Name

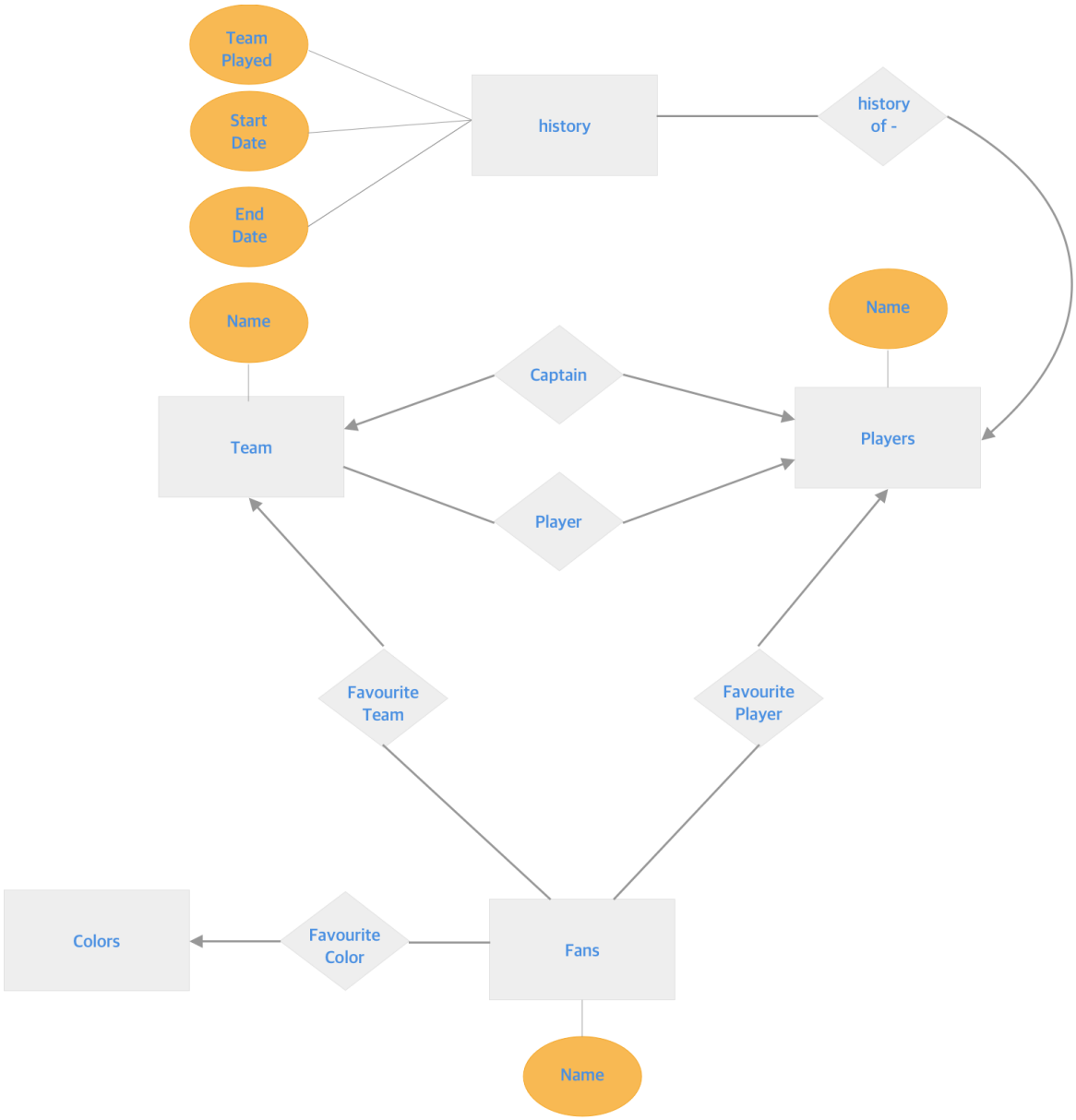


b)

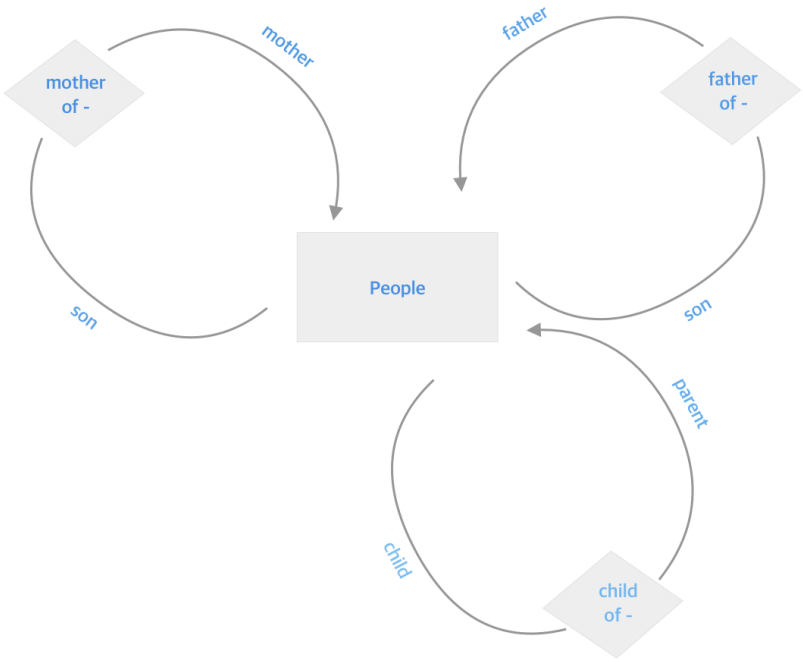
c) They are the same. (I need more work on providing reason).

Notes:

- I should ask professor about this :'(

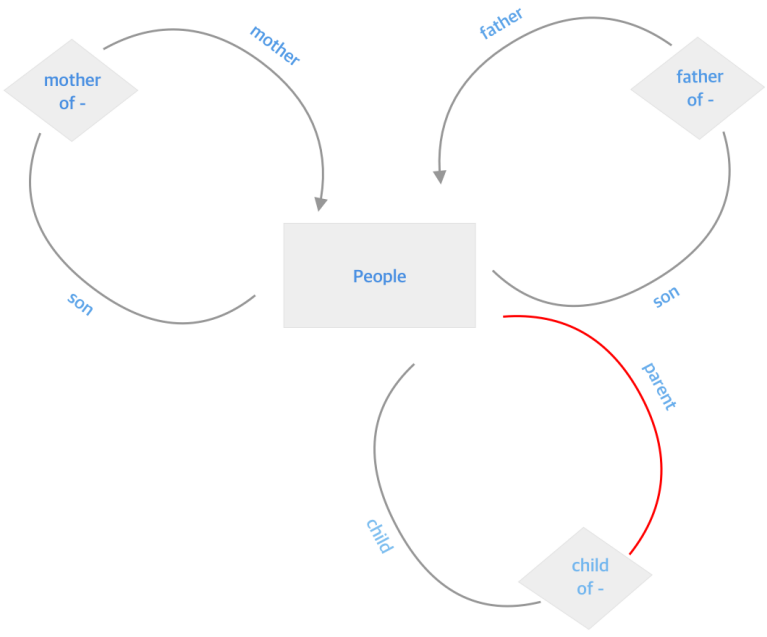

Team Played
Start Date
End Date
history
history of -
Name
Name
Captain
Team
Players
Player
Favourite Team
Favourite Player
Colors
Favourite Color
Fans
Name

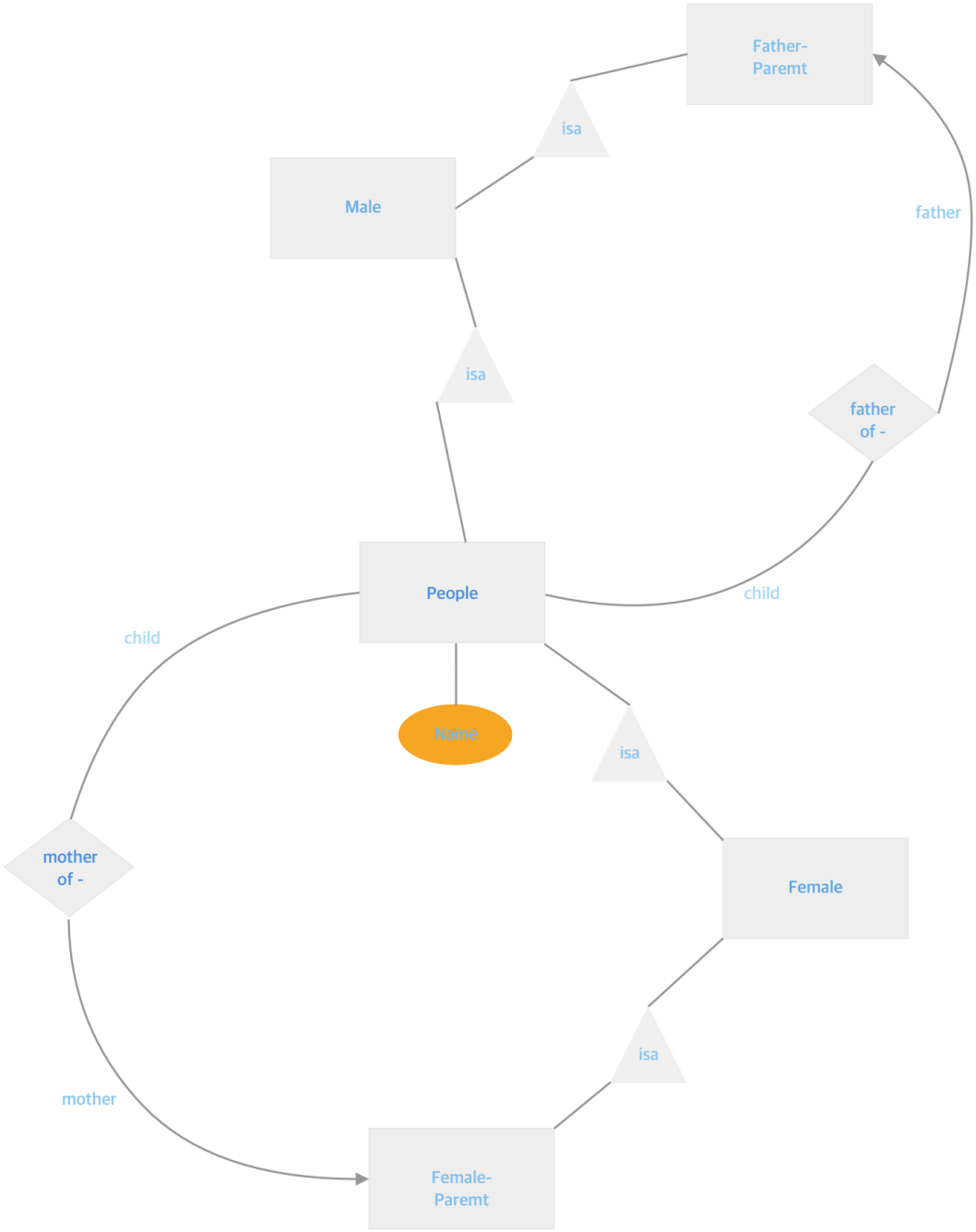
5.



6.

Correct Solution:

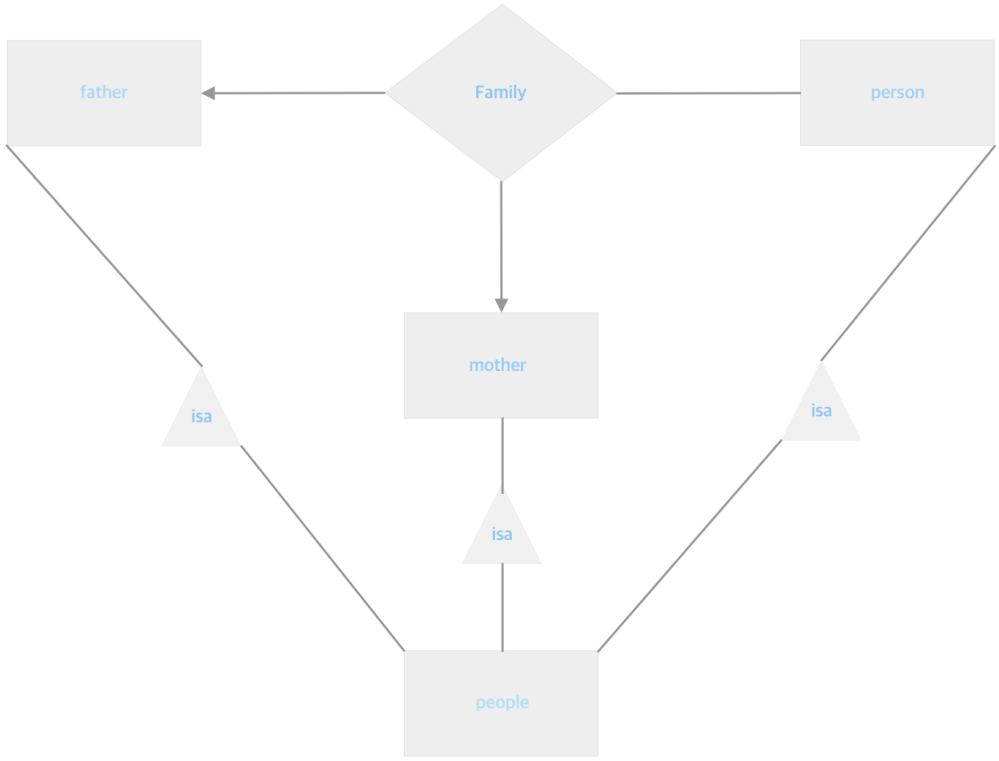




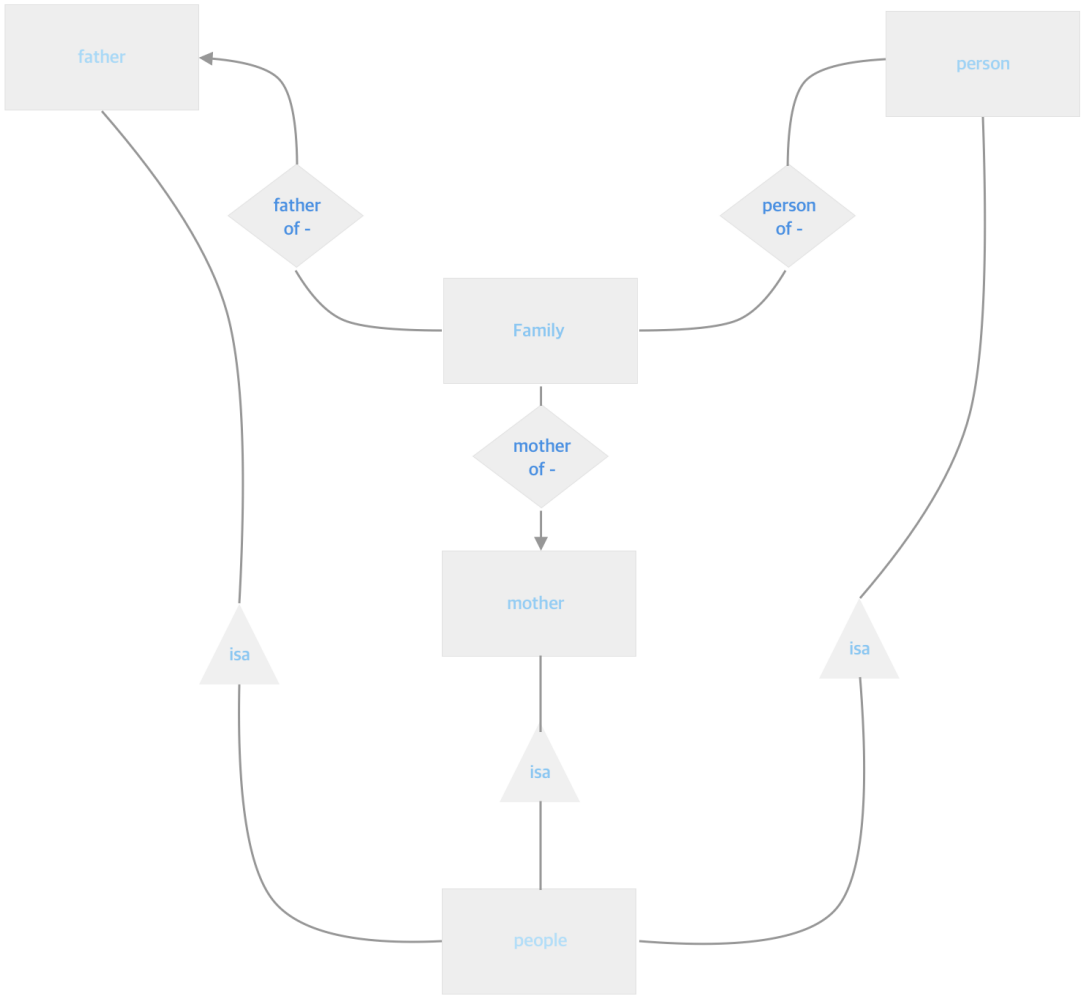
7.

Notes:

- I feel the need to clarify with professor if two parent subclasses can exist
- I feel the need to ask professor whether this design is valid



8. a)



b)

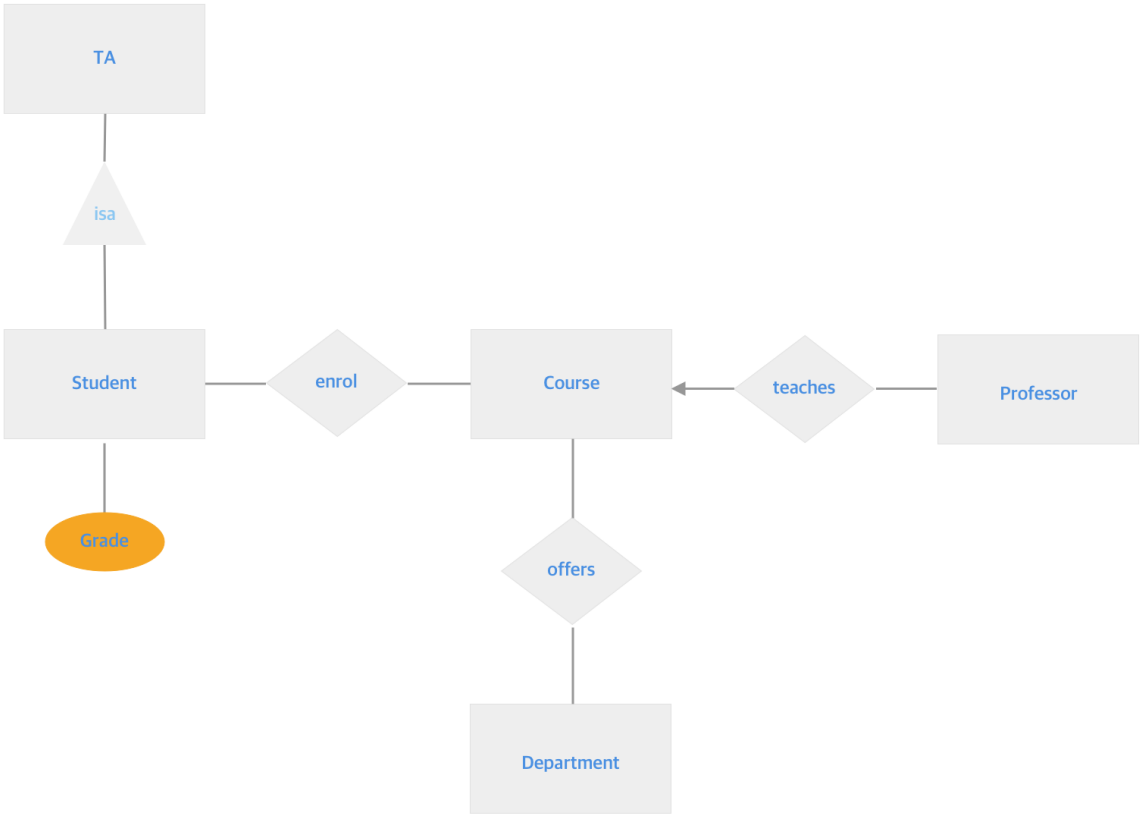
Notes:

- I need to clarify with professor on one-to-many relationship.

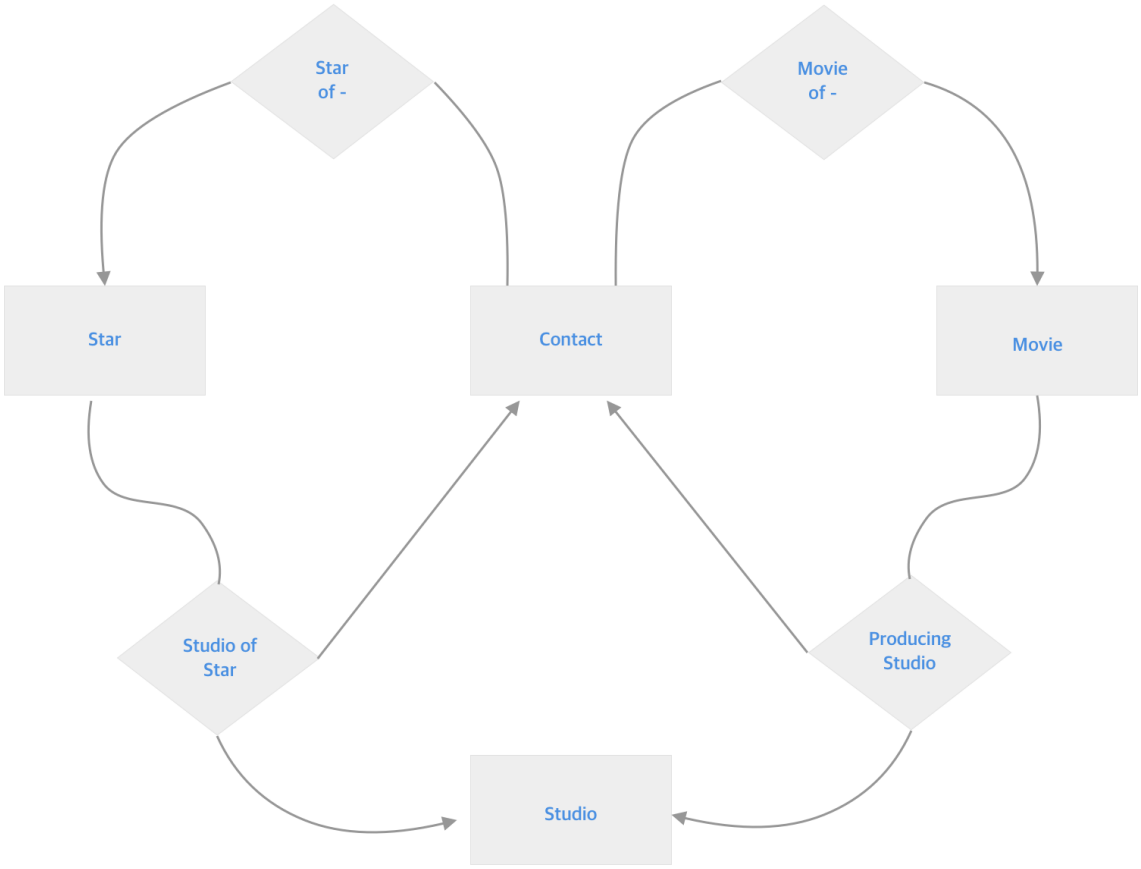
  Is it correct that the 'one' side of 'one-to-many' relationship represent foreign key in terms of SQL?

  But how about the many side? What does it mean it to be many? so for example, ('Josh', 'Neville the father', 'Mary the mother'), ('Jay', 'Neville the father', 'Mary the mother'), is this one to many relationship?

  In tabular terms / example what does one-to-many relationship represent in this context?

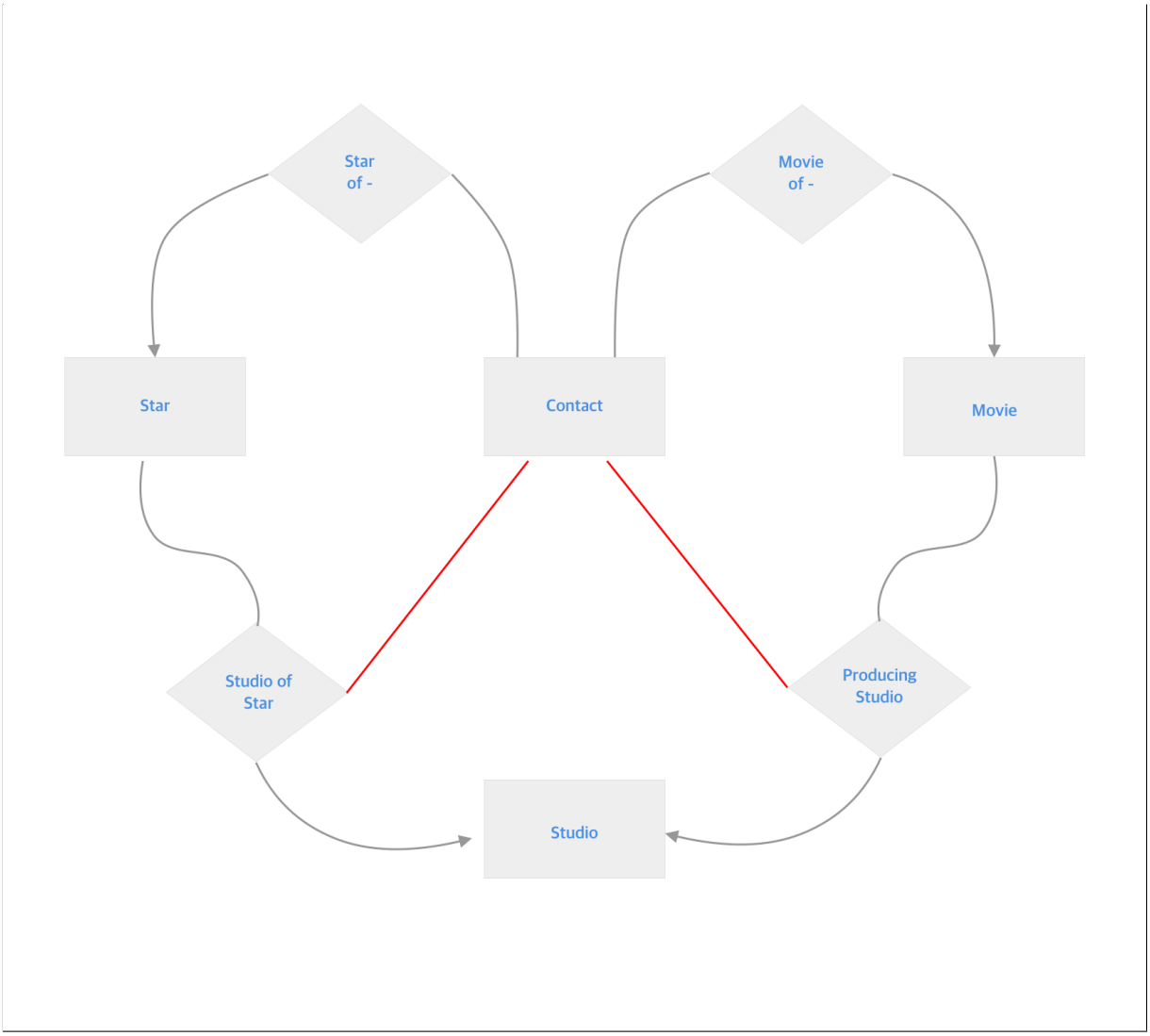

TA
isa
Student
enrol
Course
teaches
Professor
Grade
offers
Department

9.

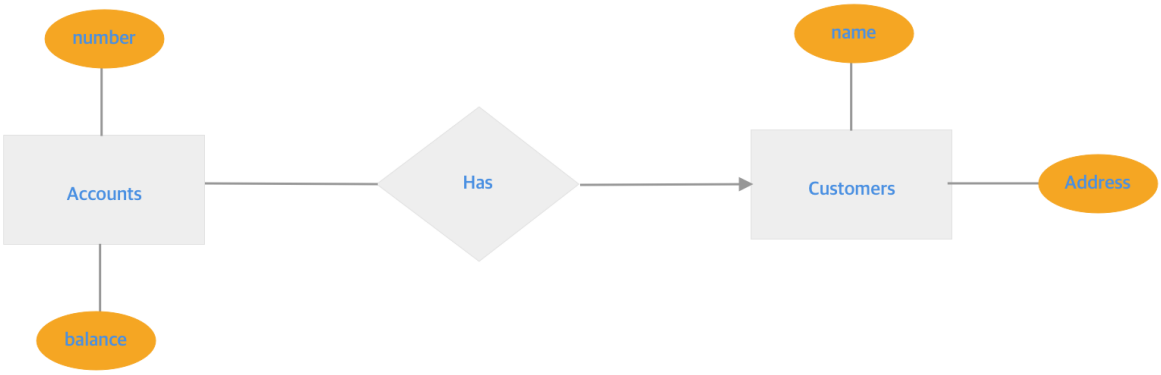


10.

Correct Solution:



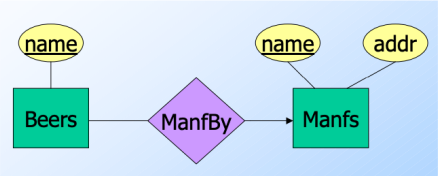
11. Simplicity count is violated. There is more than necessary number of entitiy sets and attributs for address and accounts.



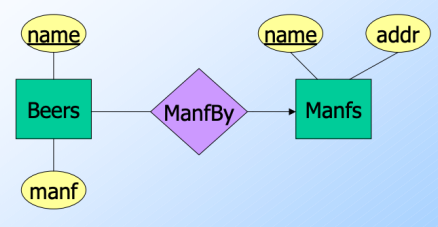
Notes:

- Design Principles
  1. Faithfulness
     - means design should make sense and meet its specification
     - e.g. Adding attribute *number-of-cylinders* to *Stars* → NONO
  2. Avoiding Redundancy
     - *Redundancy* means saying the same thing in two (or more) different ways

Example (The good example):

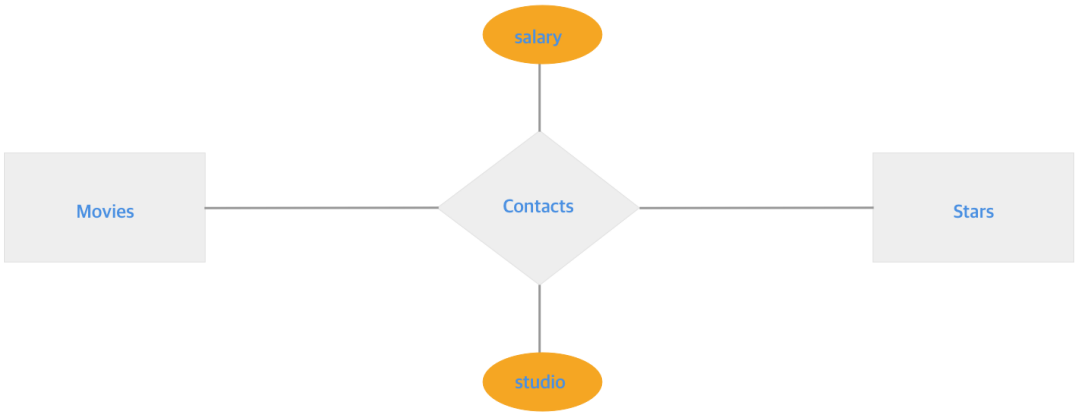


Example (The bad example):

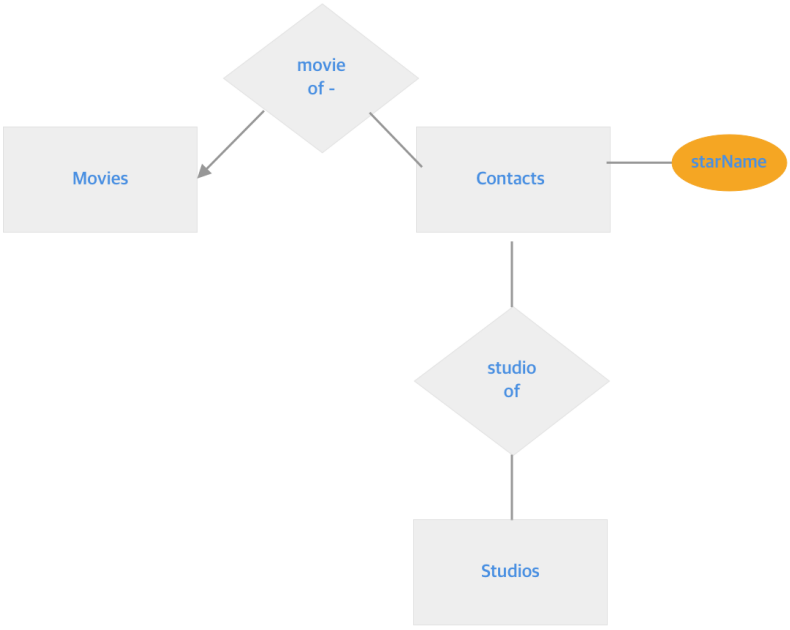


3. Simplicty Counts
   - Avoid adding more more elements than necessary
4. Choosing the Right Relationships
   - Don't add relationships more than necessary
5. Picking the Right Kind of Element
   - Many of the choices are between using attributes and using entity set / relationship combinations

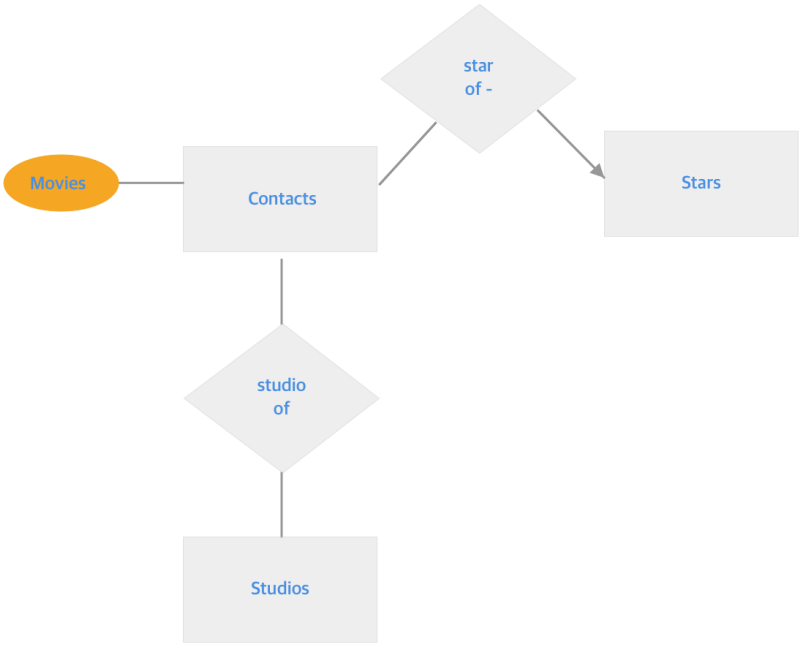
12. They should be combined when each studio has unique president
13. **Solution:**



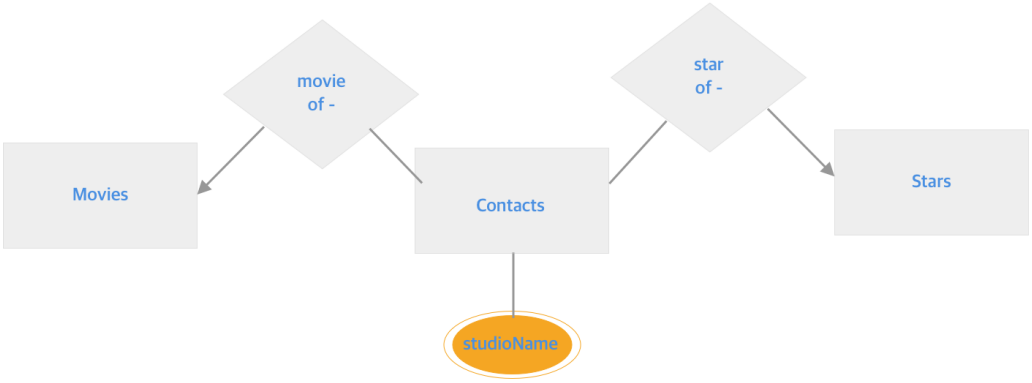
14. a) **Solution:**



b) **Solution:**

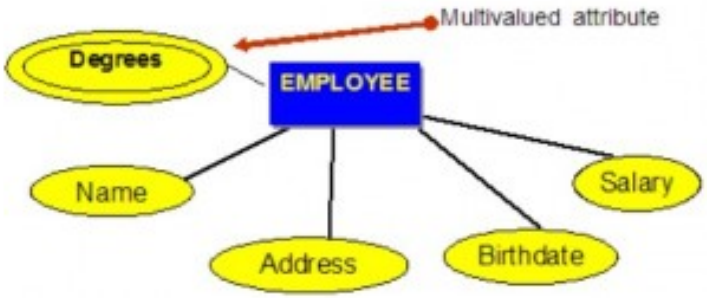


c) **Solution:**



Notes:

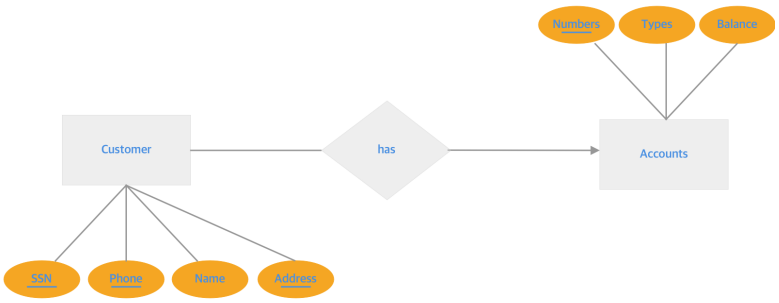
- Multivalued attributes is denoted by the following [1]



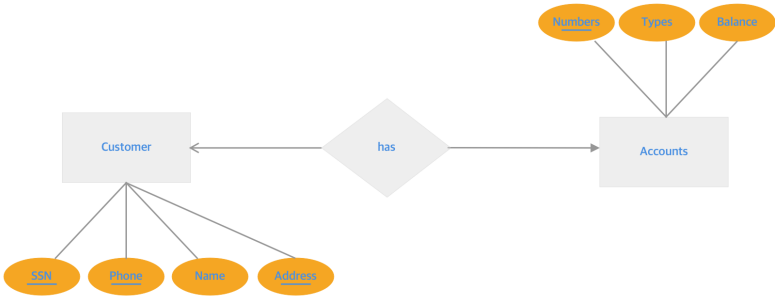
References:

1) OpenTextBC, The Entity Relationship Model, link

15. a) **Solution:**



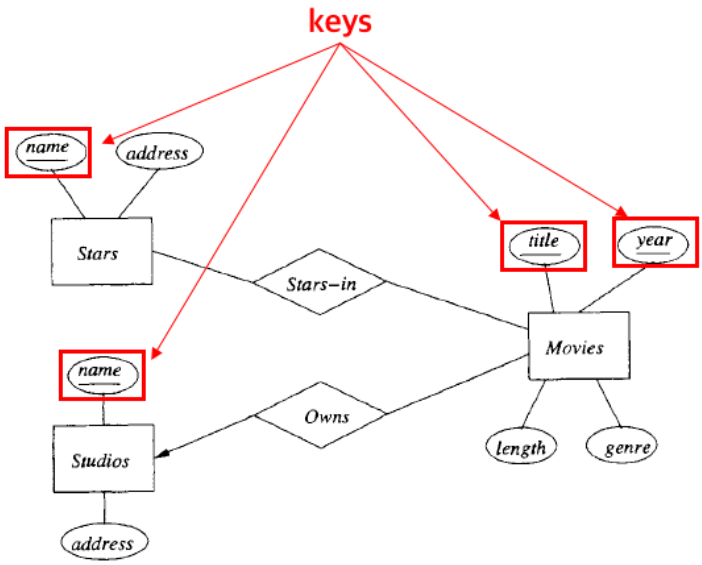
i)



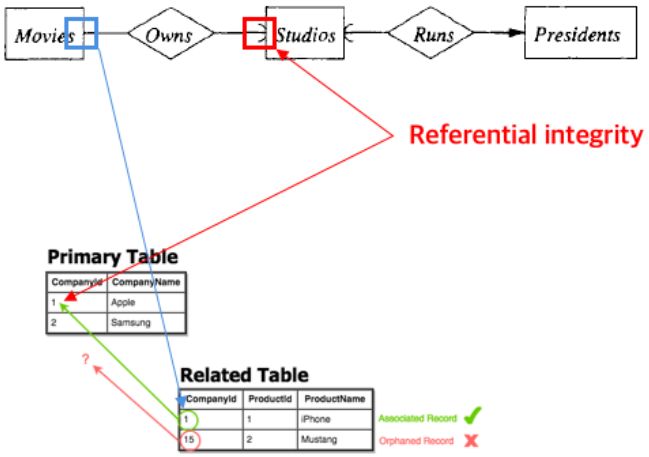
ii)

Notes:

- Keys in the E/R Model
  - *key* is an attribute or a group of attributes whose values can be used to uniquely identify an individual entity in an entity set [1]
  - Keys are represented using 'underline' under each attribute



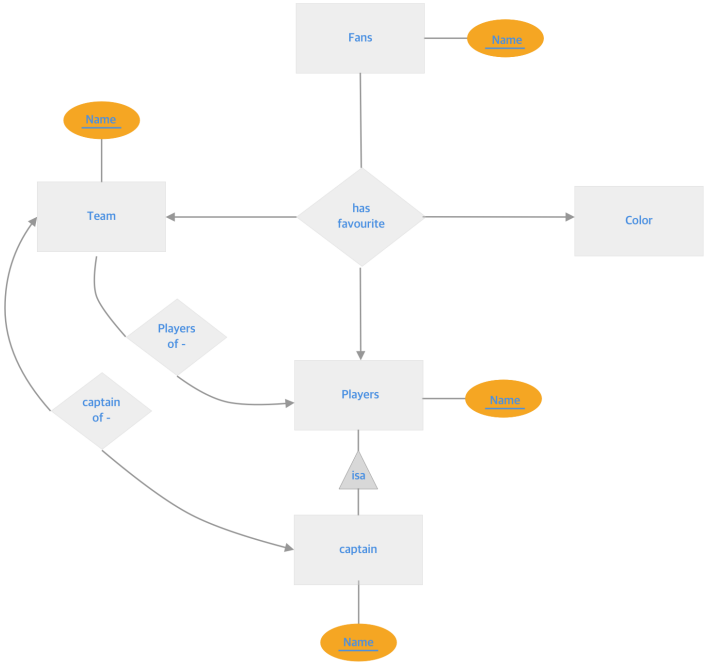
- Referential Integrity
  - Means value appearing in one context must also appear in another
  - Functions like Foriegn Key in SQL
  - Is represented by a rounded arrow



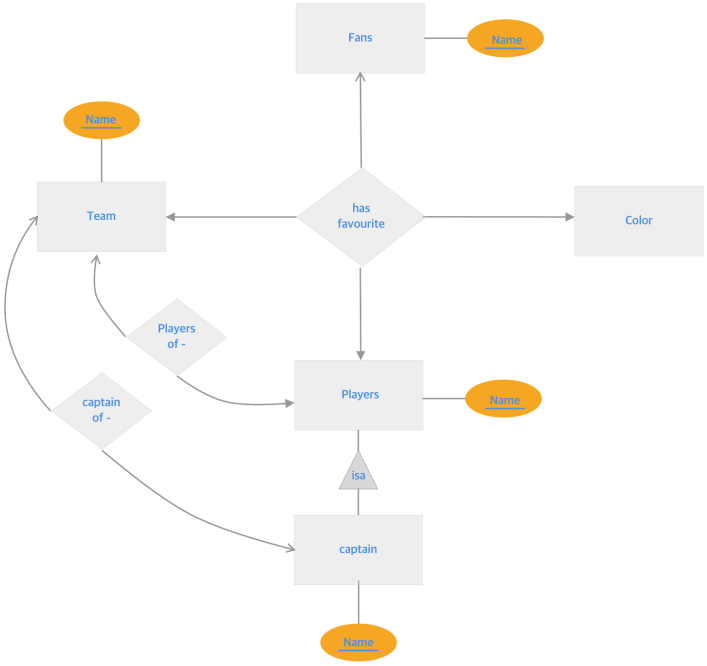
References:

1) OpenTextBC, The Entity Relationship Model, link

b) **Solution:**

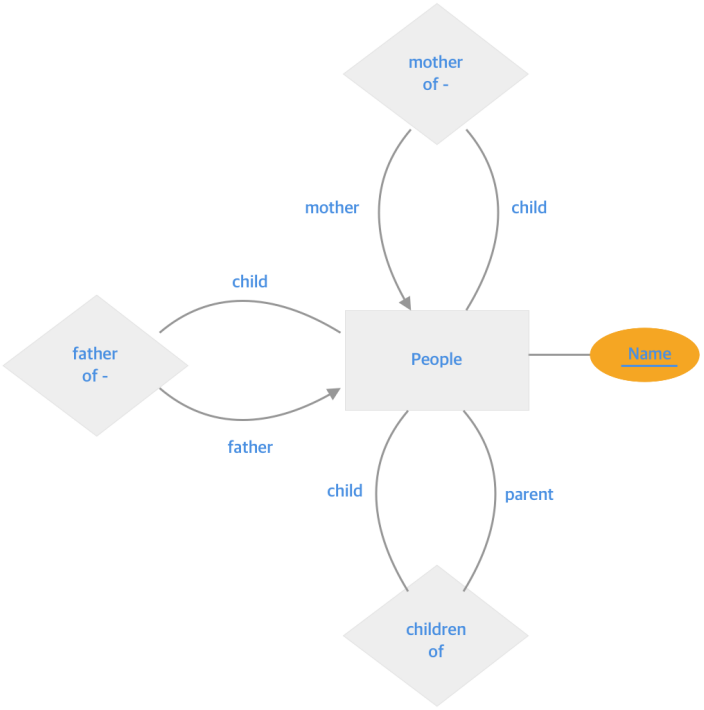


i)

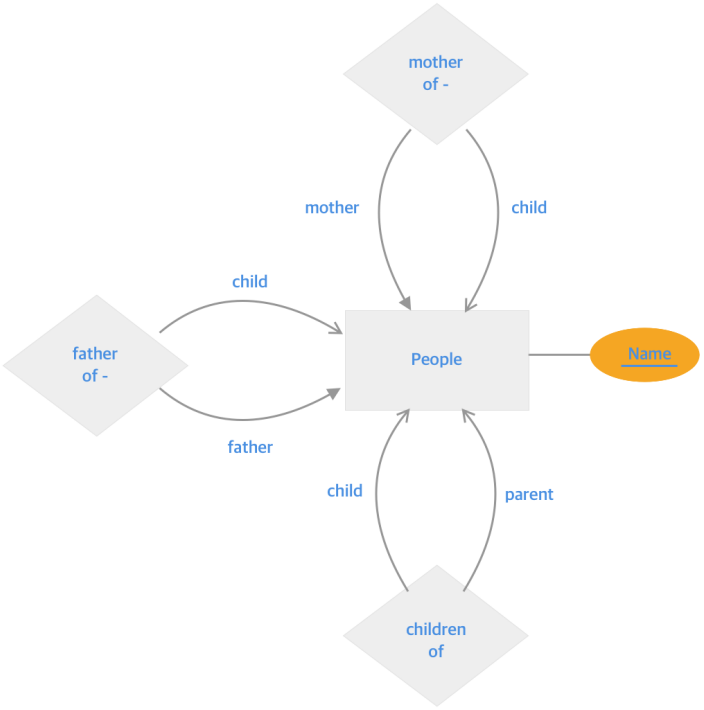


ii)

c) **Solution:**

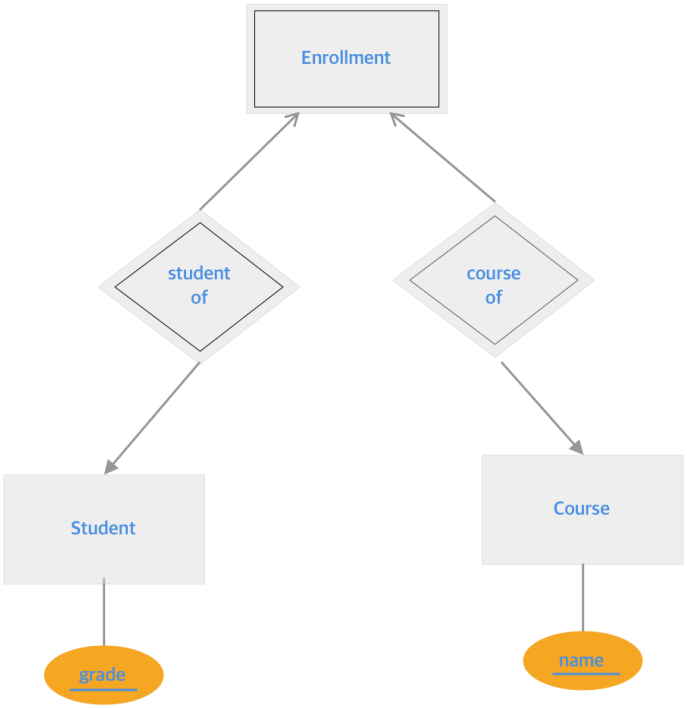

mother
of -
mother
child
child
father
of -
People
Name
father
child
parent
children
of

i)

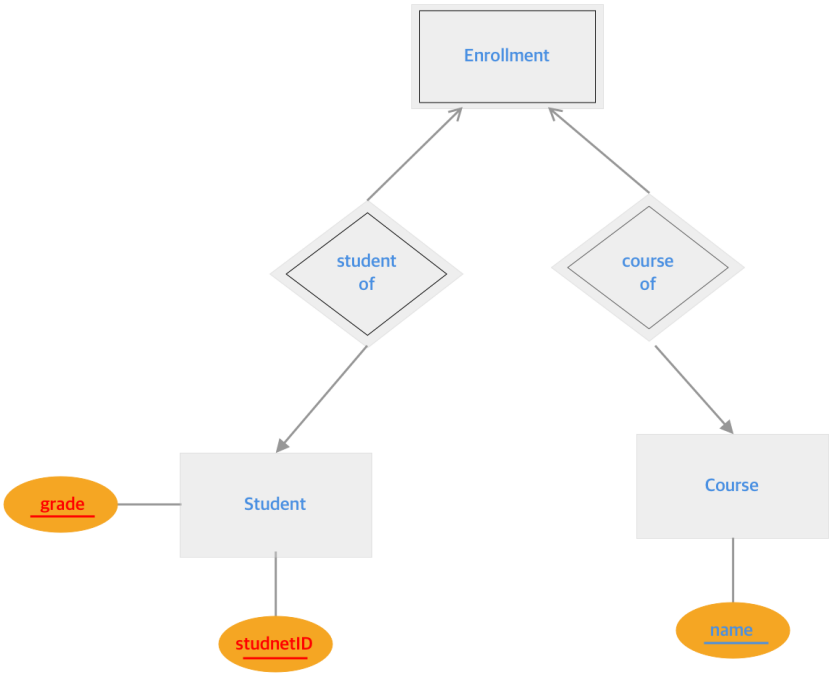


ii)

16. **Solution:**



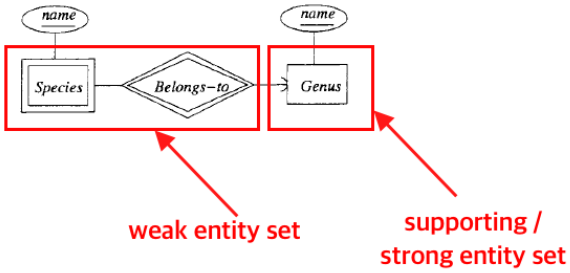
Correct Solution:



- Yes. grade is a part of a key for enrollent.

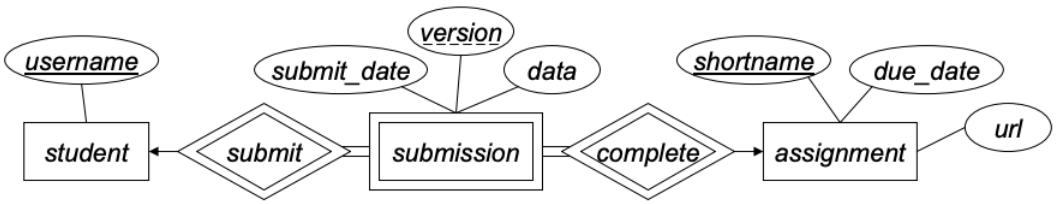
Notes:

- Weak Entity Sets
  - Is an entity set of which some or all of attributes belong to another entity set
  - The usual reason is that there is no global authority capable of creating unique ID's.
  - Is denoted by the following symbol:



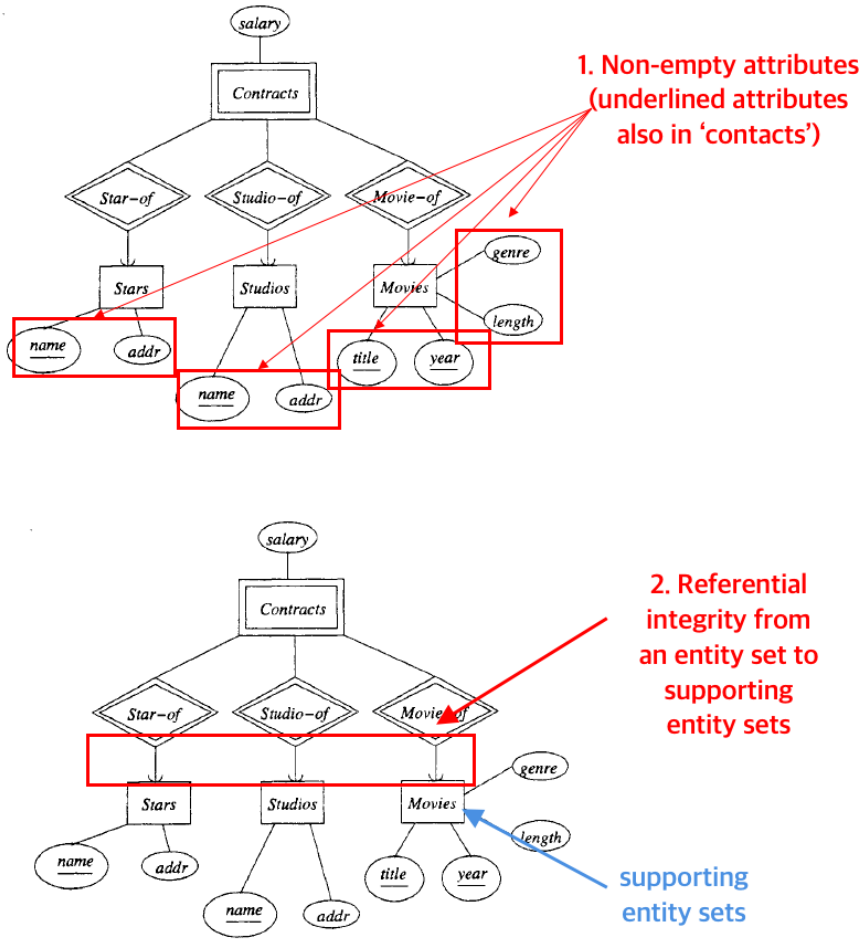
- Depends on a dominant entity, and it cannot exist without a strong entity. [1]
- Has attributes in both weak entity sets and the entity sets

Example:



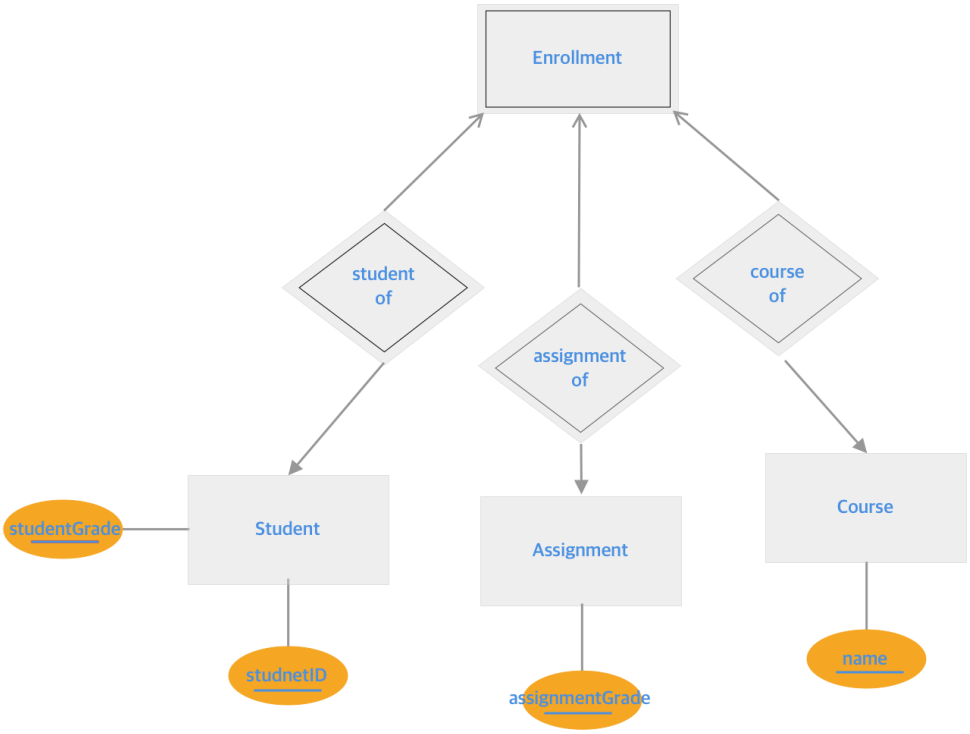
  - Schemas for the strong entity sets
    - student (<u>username</u>)
    - assignment (<u>shortname</u>, due_date, url)
  - Schemas for the weak entity set
    - submission(<u>username</u>, <u>shortname</u>, <u>version</u>, submit_date, data)

- Requirements for Entity Sets
  - E is a weak entity if it consists of
    1. Zero or more of its own attributes, and
    2. One or more many-one relationships to other (supporting) entity sets. [2]



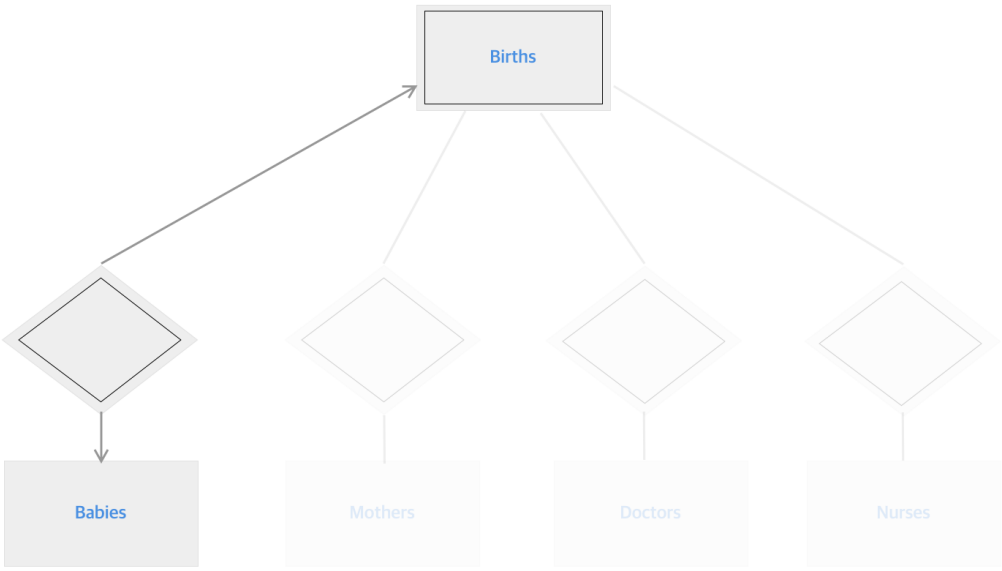
References:

1) StackOverflow, Example of a strong and weak entity types, link
2) Stanford, Entity-Relationship Model, link
3) Caltech, Converting E-R Diagrams to Relational Model, link

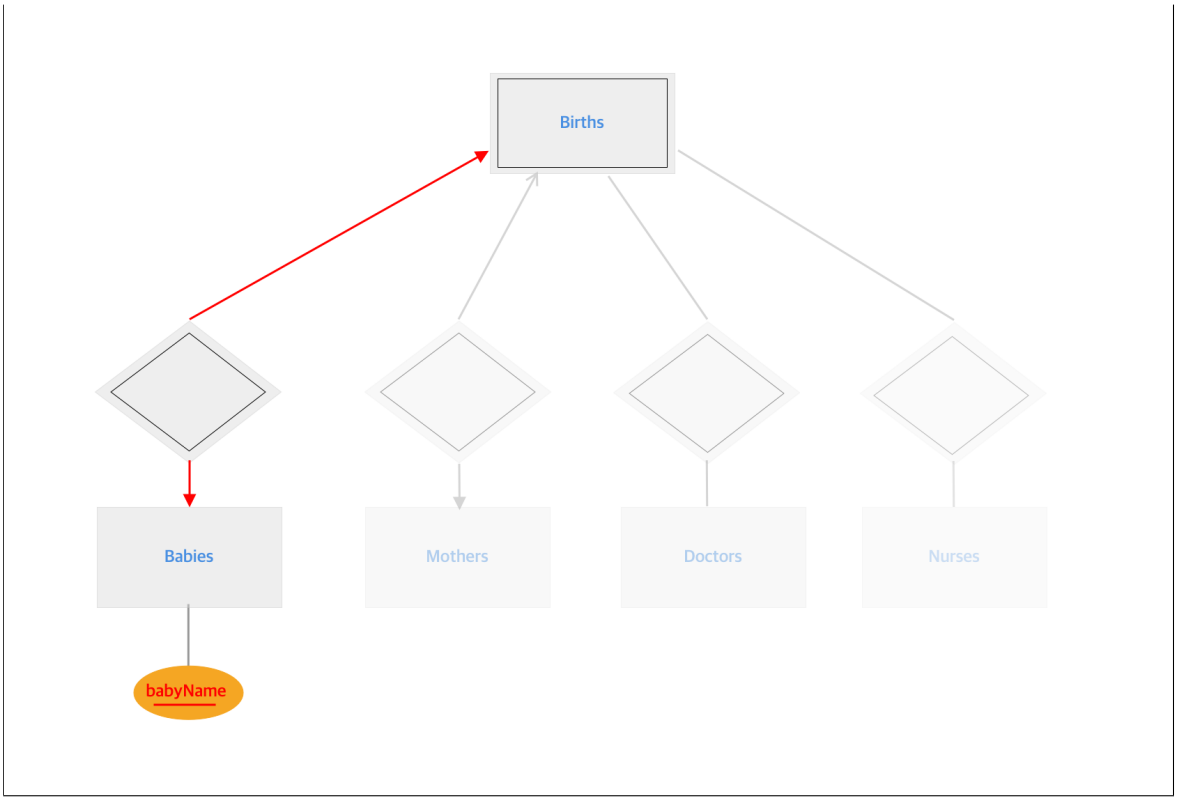


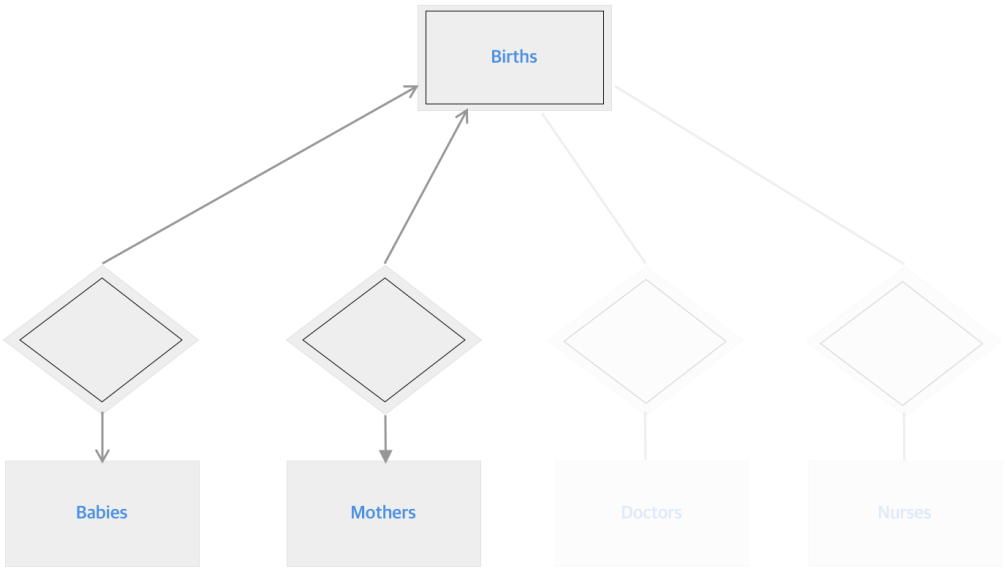
17.

18. a) **Solution:**



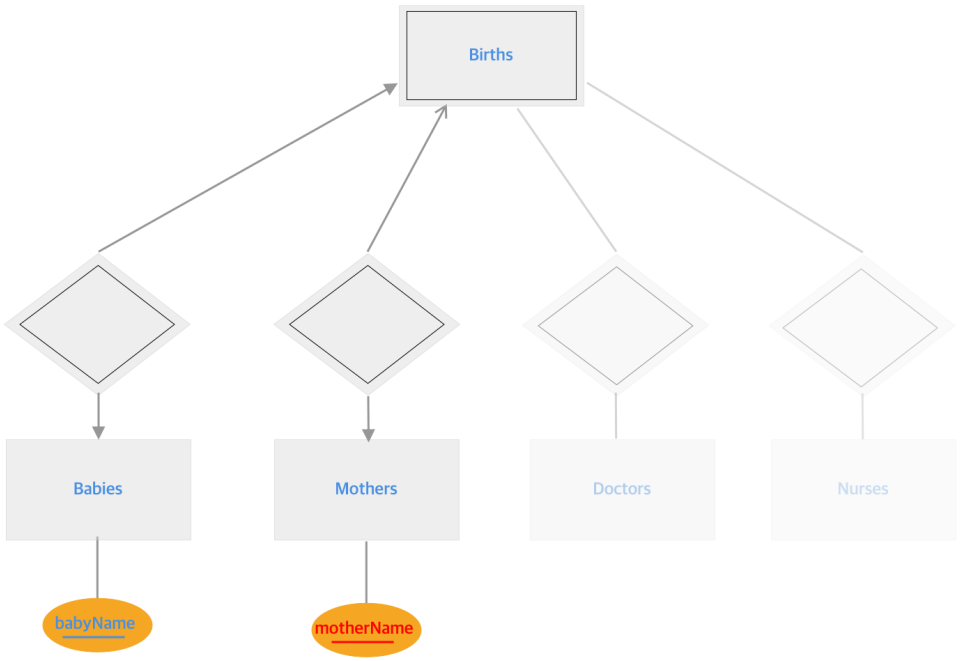
Correct Solution:

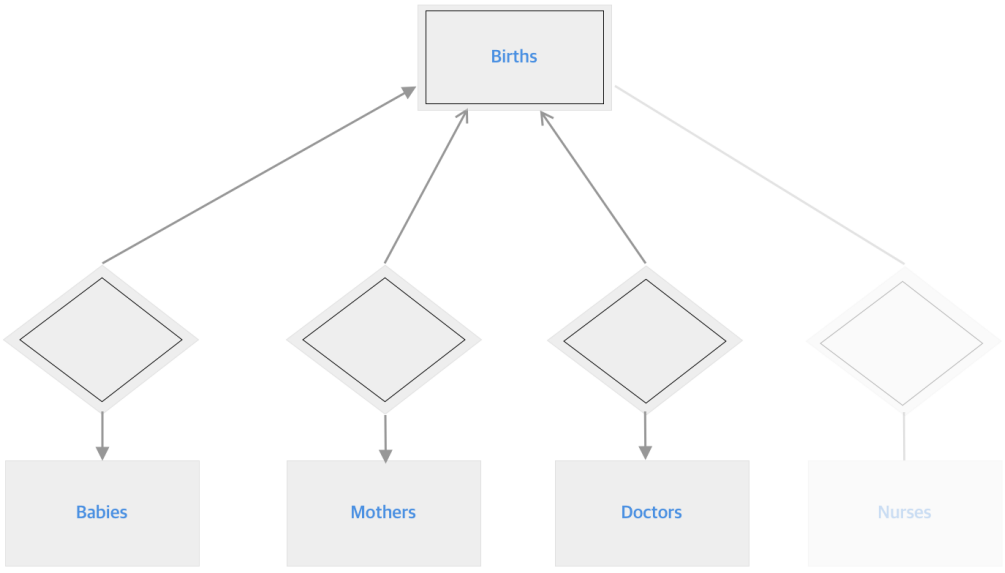

Births
Babies
Mothers
Doctors
Nurses
babyName


Births
Babies
Mothers
Doctors
Nurses

b)

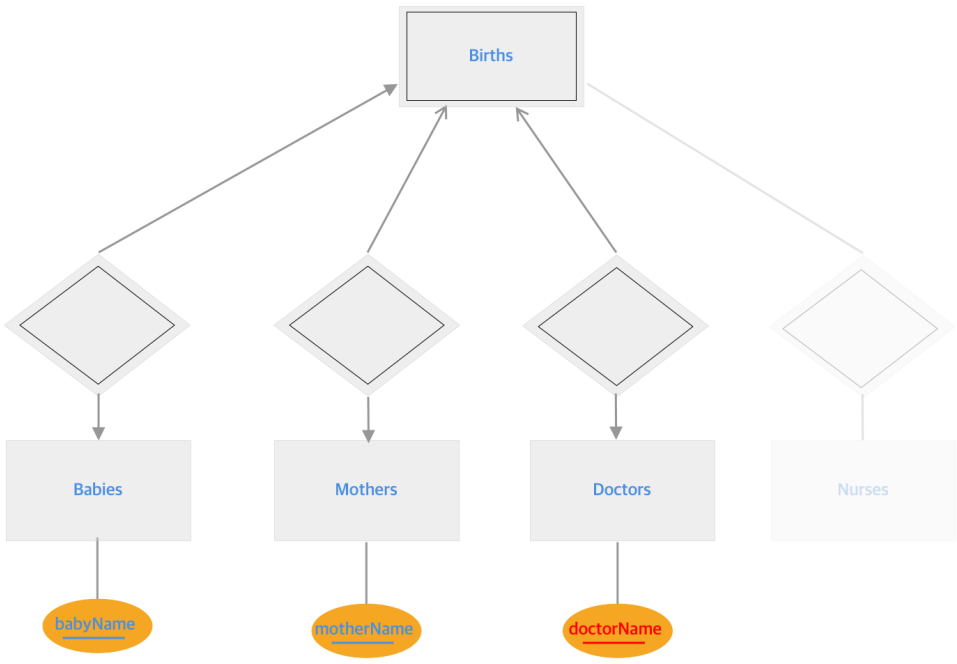
Correct Solution:



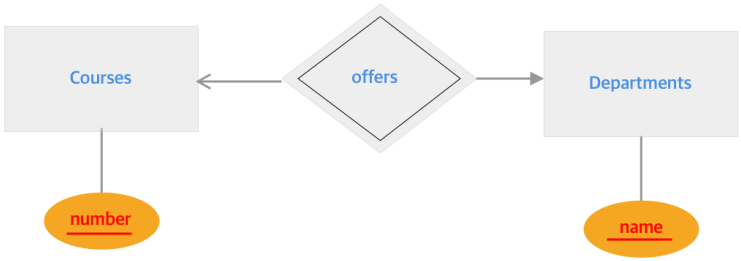


c)

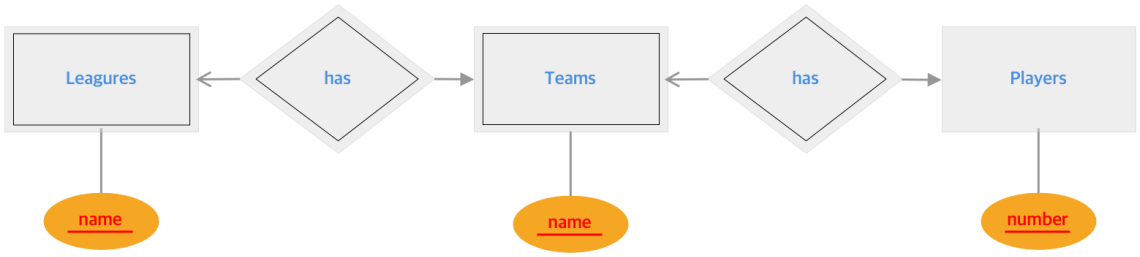
Correct Solution:



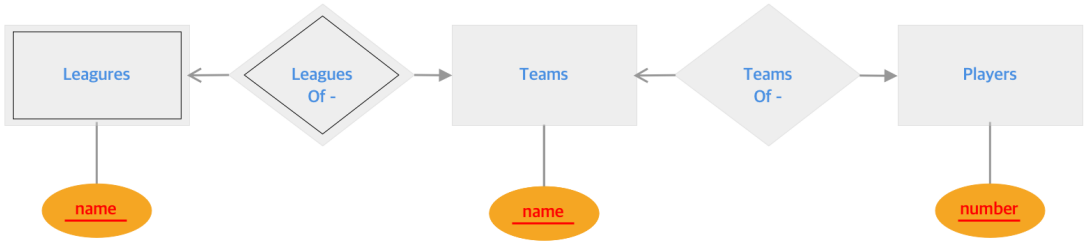
19. a) **Solution:**


Courses
offers
Departments
number
name

b) **Solution:**


Leagures
has
Teams
has
Players
name
name
number

Correct Solution:



20.

- Customers

  Customer(SSNo, number, addr, phone)

- Flights

  Flights(number, day, aircraft)

- Bookings

  Bookings(SSNo, number, row, seat)

- toCust

  toCust (SSNo) Can be eliminated since subset of Customers

- ToFit

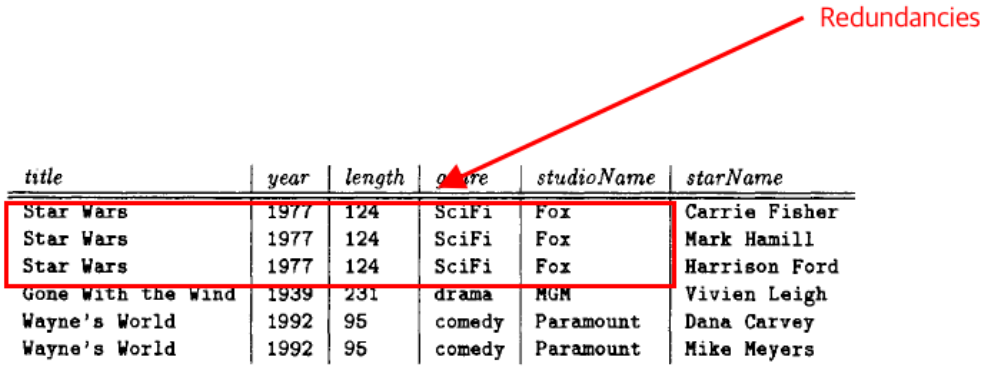
  toFit (number) Can be eliminated since subset of Flights

Notes:

- From entity sets to Relations
  - There are two basic steps
    1. Turn each entity set into a relation with the same set of attributes, and
    2. Replace a relationship by a relation whose attributes are the keys for the connected entity sets

    Steps:

    a. Take key attributes in E and put to the relation of R
    b. Take attributes of R, and put into its relation
    c. **Notes:**Don't try to combine entity E with relationship R
       * Doing so can lead to redundancy → requires normalization



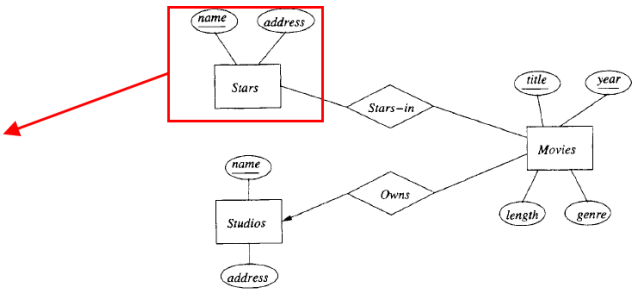
title	*year*	*length*	*genre*	*studioName*	*starName*
Star Wars	1977	124	SciFi	Fox	Carrie Fisher
Star Wars	1977	124	SciFi	Fox	Mark Hamill
Star Wars	1977	124	SciFi	Fox	Harrison Ford
Gone With the Wind	1939	231	drama	MGM	Vivien Leigh
Wayne's World	1992	95	comedy	Paramount	Dana Carvey
Wayne's World	1992	95	comedy	Paramount	Mike Meyers

  - With more difficult steps
    1. Weak entity sets cannot be translated straightforwardly to relation
    2. 'Isa' relationship and subclasses require careful treatment
    3. Sometimes, we do well to combine two relations of different types (many-to-one → many-to-one) the connected entity sets

    Example:

    1. Turning each entity into relation

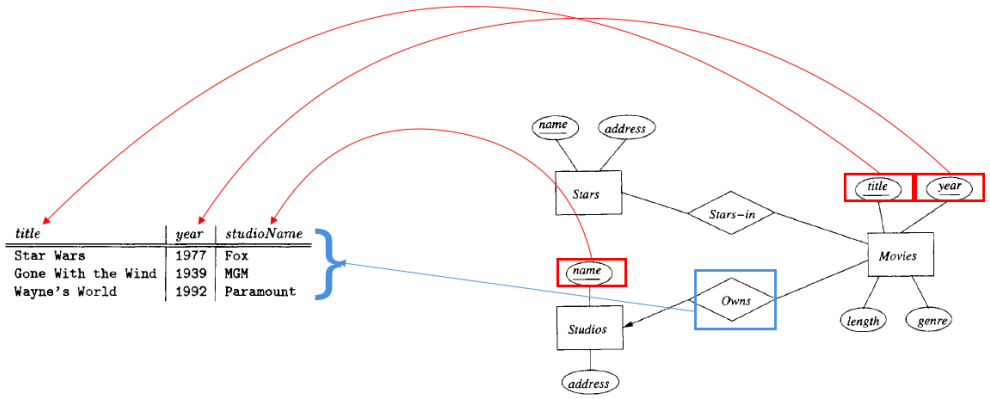
name	*address*
Carrie Fisher	123 Maple St., Hollywood
Mark Hamill	456 Oak Rd., Brentwood
Harrison Ford	789 Palm Dr., Beverly Hills



    2. Turning E/R Relationships to Relations

* The schema of the relation 'Owns' is:

$$Owns(titleyear, studioName)$$



- Handling weak entity sets
  - Three things must be done differently
    1. The relation for the weak entity set W must include the its own attributes, but also the attributes of the supporting entity sets
    2. W should use key of it's attributes in addition to other entitity sets that contribute to W's key
    3. Do not convert the supporting sets to relation

Example:

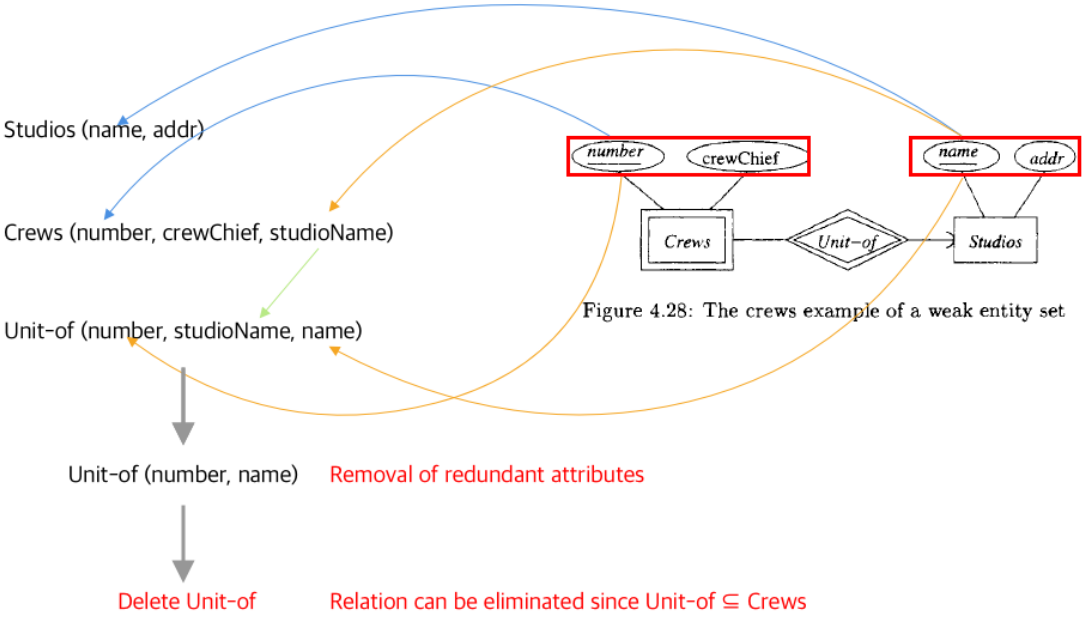
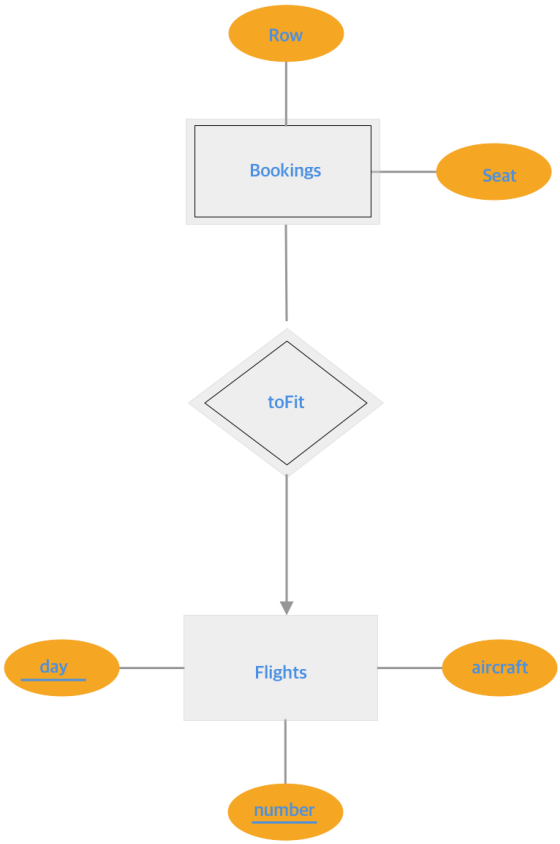


Figure 4.28: The crews example of a weak entity set



21. a)

    b)
    - Bookings (<u>number</u>, <u>day</u>, row, seat)
    - Flights (<u>day</u>, <u>nunber</u>, aircraft)

No. It's not the same as the E/R in exercise 5.2.

22.
- SisterOf(shipName, sisterName)
- Ships(name, yearLaunched)

23. a)
- Stars

  Stars(name, addr)

- Studios

  Studios(name, addr)

- Movies

  Studios(name, addr)

- Contracts

  Contracts(title, year, length, genre)

- Movies

  Movies(title, year, length, genre)

- StarOf

  StarOf(name) Can be eliminated. Is a subclass of Stars

- StudioOf

  StudioOf(name) Can be eliminated. Is a subclass of Studio

- StudioOf

  StudioOf(title, year) Can be eliminated. Is a subclass of Movies

b)
- Enrollment

  Enrollment(grade, name)

- Student

  Student(grade)

- Course

  Course(name)

- studentOf

  studentOf(grade) Can be eliminated. Is a subset of Student

- courseOf

  courseOf(name) Can be eliminated. Is a subset of Course

c)
- Courses

  Courses(number)

- Departments

  Departments(name)

- Offers

  Offers(number, name)

d)
- Players

  Players(number)
- TeamsOf

  TeamsOf(name, number)

- Teams

  Teams(name, number)

- LeaguesOf

  LeaguesOf(leagueName, teamsName) Can be eliminated since it's the subset of League
- Leagues

  Leagues(name, teamsName)

Notes:

- I should clarify with professor on this question. Something doesn't feel right.

24. a)
- Depts

  Depts(name, chair)

- GivenBy

  GivenBy(deptName, CoursesNumber) Can be eliminated since it's the subclass of Courses

- Courses

  Courses(number, deptName, room)

- Lab Courses

  LabCourses(number, deptName, computerAllocation)

Notes:

- Coverting Subclass Structure to Relations (Three different approaches)
  1. *E/R Style Conversion:*
  2. *An Object-Oriented Approach*
  3. *Use Null Values*
- E/R-Style Conversion
  a) Create a relation that includes key attributes from it's parent
  b) From a) include all attributes from its own

Example:

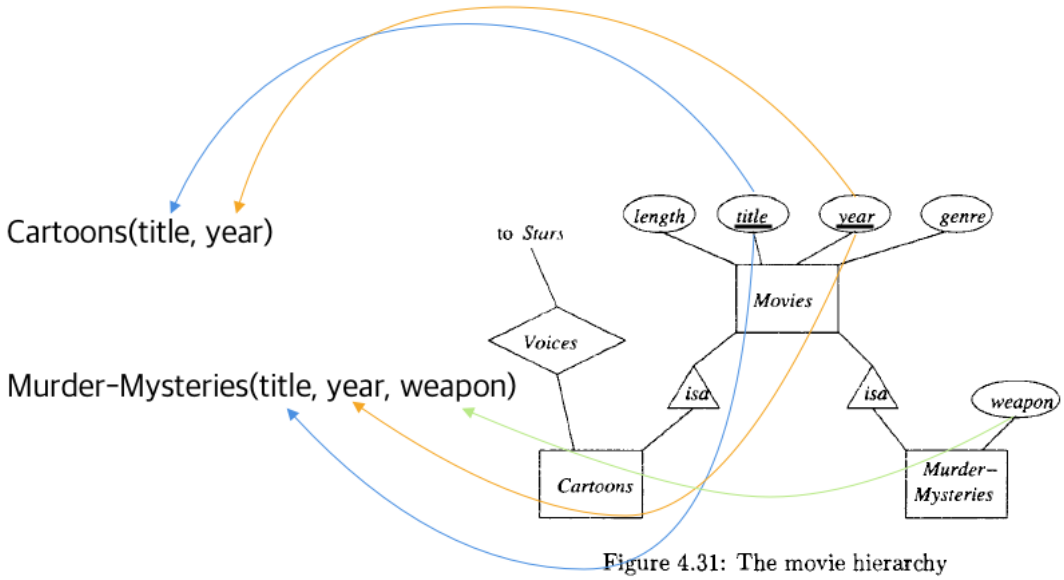
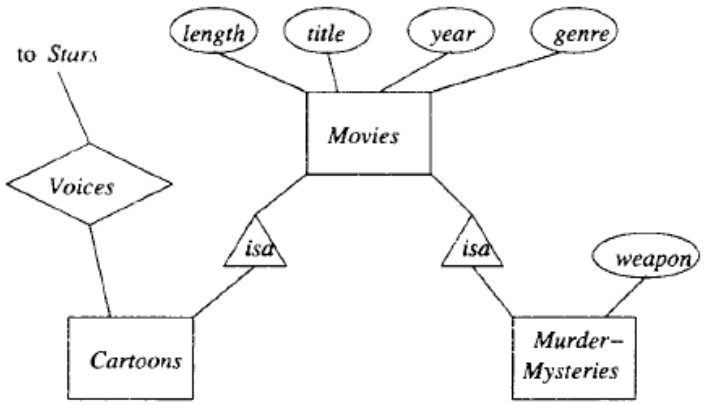


Figure 4.31: The movie hierarchy

- An Object-Oriented Approach

– A strategy is to enumerate all the possible subtrees of the hierarchy

Example:



1. *Movies* alone

   Movies(title, year, length, genre)

2. *Movies* and *Cartoons* only

   MoviesC(title, year, length, genre)

3. *Movies* and *Muder-Mysteries* only

   MoviesMM(title, year, length, genre, weapon)

4. All three entity-sets

   MoviesCMM(title, year, length, genre, weapon)

5. Voice for MoviesCMM and MoviesMM

   Voices(title, year, starName)

- Use Null values to Combine Relations
  – Has all attributes belonging to any entity set in the hierarchy
  – Use 'NULL' in each attribute that is not defined for that entity

Example:

Movies

Movies (title, year, genre,length,weapon)

NULL

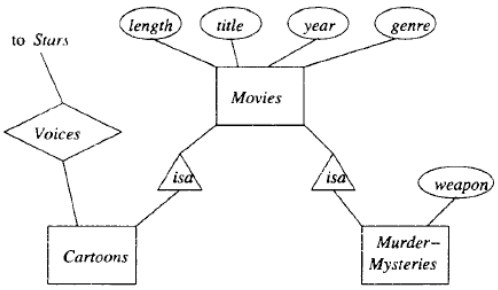
Cartoons

Movies (title, year, genre,length,weapon)

NULL

Murder-Mysteries

Movies (title, year, genre,length,weapon)



b)

- Depts

  Depts(name, chair)

- GivenBy

  GivenBy(deptName, courseNumber) Can be eliminated since it's the subclass of Courses

- Courses

  Courses(number, deptName, room)

- Lab Courses

  LabCourses(number, deptName, room, computerAllocation)

c)

- Depts

  Depts(name, chair)

- GivenBy

  GivenBy(deptName, courseNumber) Can be eliminated since it's the subclass of Courses

- Courses

  Courses(number, deptName, room, computerAllocation (NULL))

- Lab Courses

  Courses(number, deptName, room, computerAllocation)

25. a)

- Person

  Person (name, address)

- Child

  Child (name, address)

- Father

  Father(name, address)

- Mother

  Mother (name, address)

- ChildOf

  ChildOf(nameOfPerson, addressOfPerson, nameOfChild, addressOfChild)

- FatherOf

  ChildOf(nameOfChild, addressOfChild, nameOfFather, addressOfFather)

- Married

  Married(nameOfHusband, nameOfHusband, nameOfWife, addressOfWife)

- MotherOf

  MotherOf(nameOfChild, nameOfChild, nameOfMother, addressOfMother)

b)

- Person

  Person (name, address)

- Child

  PersonC (name, address)

- Father

  PersonF(name, address)

- Mother

  PersonM (name, address)

- Person-Child-Father

  PersonCF (name, address)

- Person-Child-Mother

  PersonCM (name, address)

- Person-Father-Mother

  PersonFM (name, address)

- Person-Child-Father-Mother

  PersonCFM (name, address)

- ChildOf (For PersonChild, PersonChildMother, PersonChildFather, PersonChildFatherMother)

  ChildOf(nameOfPerson, addressOfPerson, nameOfChild, addressOfChild)

- FatherOf (For PersonFather, PersonChild, PersonChildFather, PersonChildFatherMother)

  ChildOf(nameOfChild, addressOfChild, nameOfFather, addressOfFather)

- Married (For PersonFather, PersonMother, PersonFatherMother, PersonChildFatherMother)

  Married(nameOfHusband, nameOfHusband, nameOfWife, addressOfWife)

- MotherOf (For PersonMother, PersonChild, PersonChildMother, PersonChildFatherMother)

  MotherOf(nameOfChild, nameOfChild, nameOfMother, addressOfMother)

c)

- Person

  Person (name, address)

- Child

  Child (name, address)

- Father

  Father(name, address)

- Mother

  Mother (name, address)

- ChildOf

  ChildOf(nameOfPerson, addressOfPerson, nameOfChild, addressOfChild)

- FatherOf

  ChildOf(nameOfChild, addressOfChild, nameOfFather, addressOfFather)

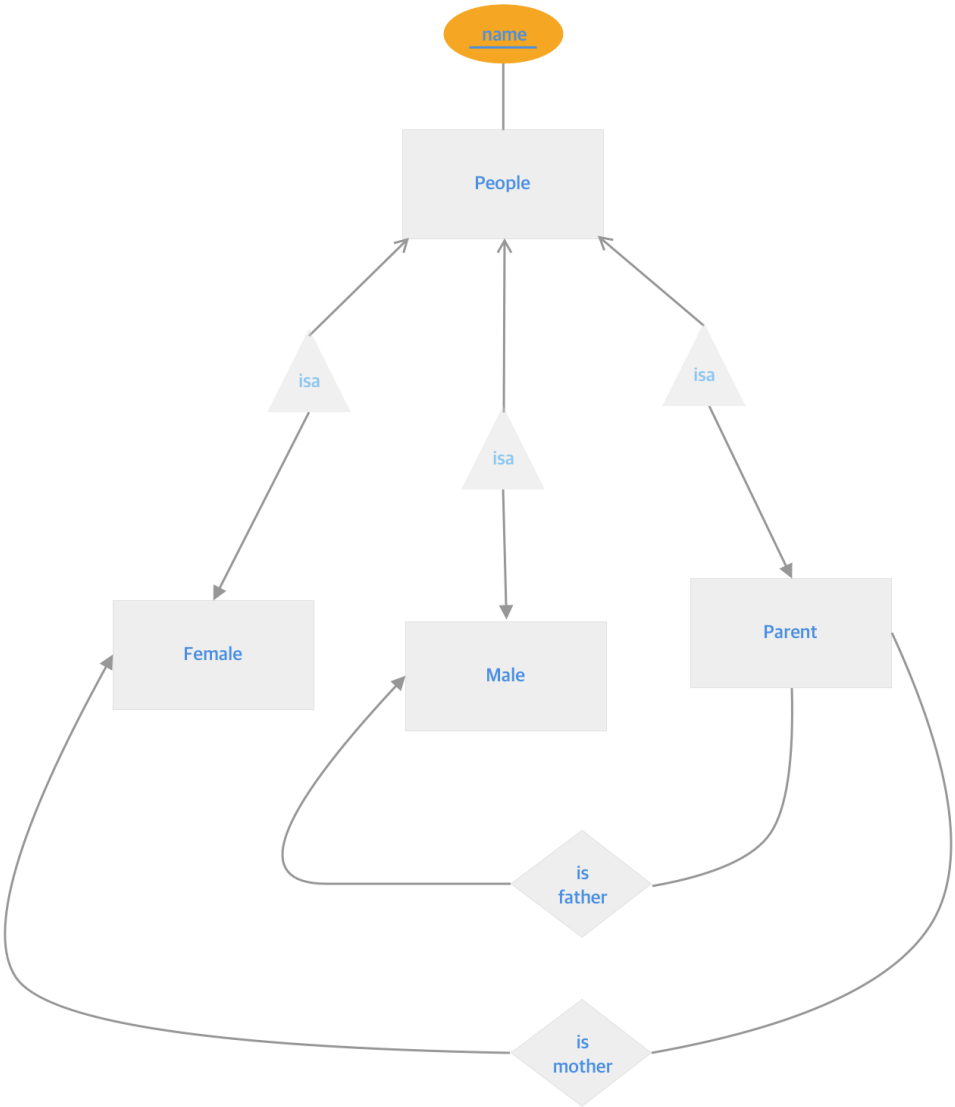
- Married

  Married(nameOfHusband, nameOfHusband, nameOfWife, addressOfWife)

- MotherOf

  MotherOf(nameOfChild, nameOfChild, nameOfMother, addressOfMother)

26.



a)
- People

  People(<u>name</u>)
- Female

  Female(<u>name</u>)
- Male

  Male(<u>name</u>)
- Parent

  Parent(<u>name</u>)
- isFather

  isFather(<u>maleName</u>, <u>femaleName</u>)
- isMother

  isMother(<u>femaleName</u>, <u>maleName</u>)

b)
- People

  People(<u>name</u>)
- Female

  PeopleF(<u>name</u>)
- Male

  PeopleM(<u>name</u>)
- Parent

  PeopleP(<u>name</u>)
- People-Female-Male

  PeopleFM(<u>name</u>)
- People-Female-Parent

  PeopleFP(<u>name</u>)

- People-Male-Parent

  PeopleMP(<u>name</u>)

- People-Female-Male-Parent

  PeopleFMP(<u>name</u>)

- isFather (For PeopleMale, PeopleParent, PeopleMaleParent, PeopleFemaleMaleParent)

  isFather(<u>maleName</u>, <u>femaleName</u>)

- isMother (For PeopleFemale, PeopleParent, PeopleFemaleParent, PeopleFemaleMaleParent)

  isMother(<u>femaleName</u>, <u>maleName</u>)

c)
- People, Male, Female, Parent

  People(<u>name</u>)

- isFather

  isFather(<u>maleName</u>, <u>femaleName</u>)

- isMother

  isMother(<u>femaleName</u>, <u>maleName</u>)