Chapter 5

Exercise 5.1

Consider the E-R schema in Figure 5.25: the schema represents various properties of men and women.

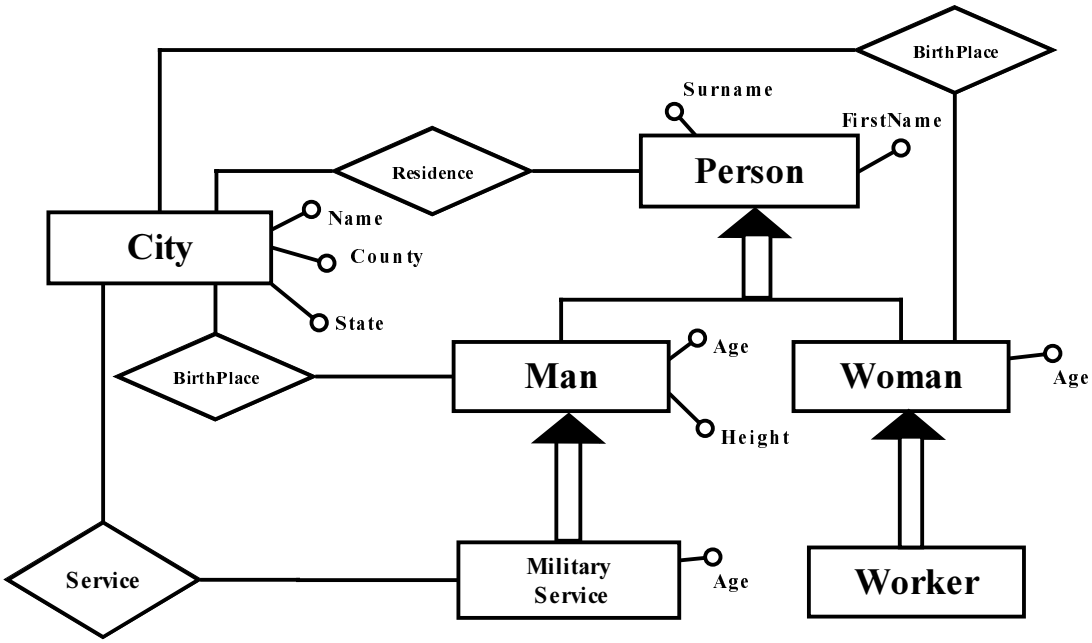
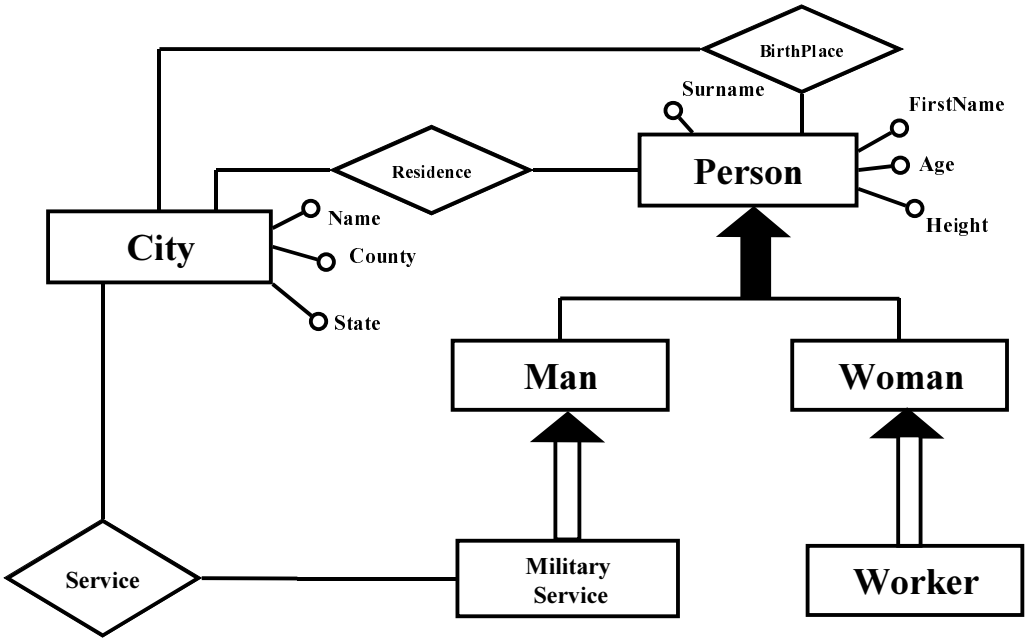


Figure 5.25

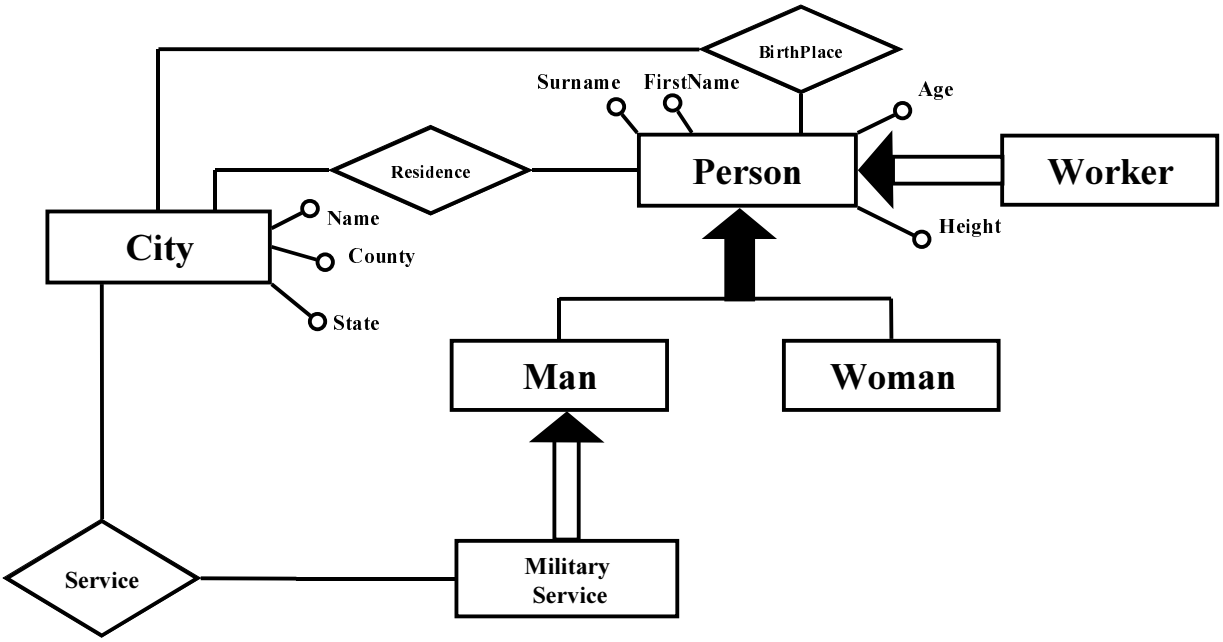
1. Correct the schema , taking into account the fundamental properties of the generalizations.
2. The schema represents only the female workers; modify the schema to represent all the workers, men and women.
3. Among the properties of cities, the State attribute can be seen also as an subproperty of the attribute County. Restructure the schema in this sense.

Solution:

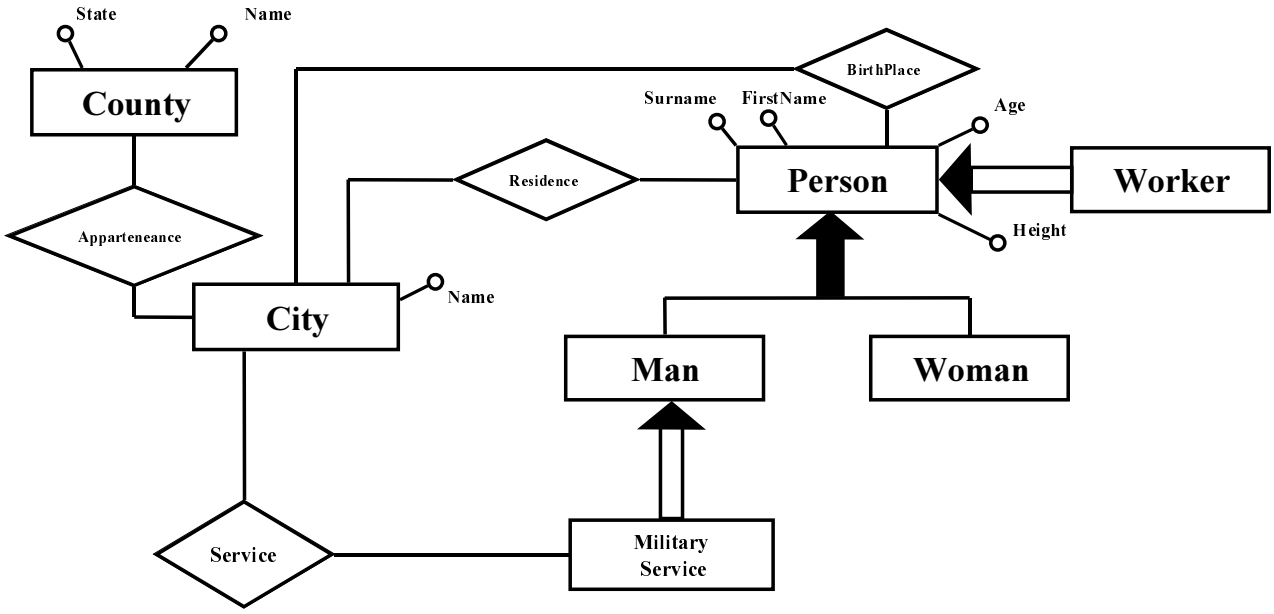
1)


BirthPlace
Surname
FirstName
Residence
Person
Age
Height
City
Name
County
State
Man
Woman
Service
Military Service
Worker

2)


BirthPlace
Surname
FirstName
Age
Residence
Person
Worker
Height
City
Name
County
State
Man
Woman
Service
Military Service

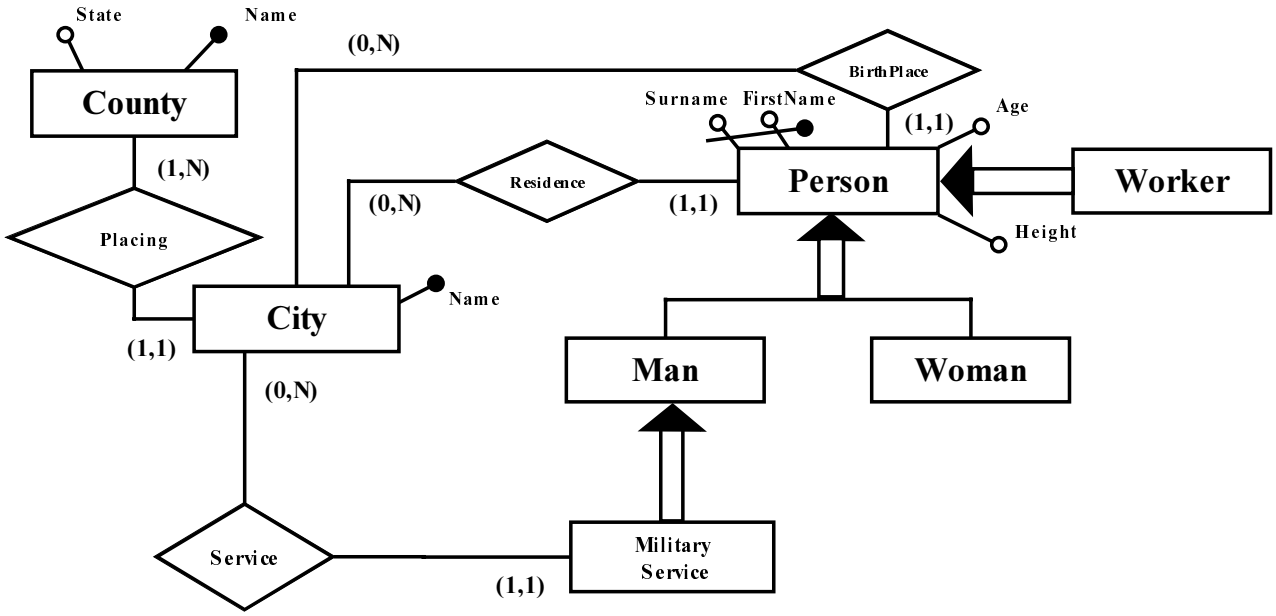
3)


State
Name
County
BirthPlace
Surname
FirstName
Age
Residence
Person
Worker
Apparteneance
Height
City
Name
Man
Woman
Service
Military
Service

Exercise 5.2

Add the minimum and maximum cardinalities and the identifiers to the schema produced in Exercise 5.1. State whether there are integrity constraints on the schema that cannot be expressed by the Entity-Relationship model.

Solution:



Constraints:

- The age of men in Military Service must be 18 or more
- Workers must be at least 14 years old
- The height of men in Military Service must be equal or greater than the minimum height required

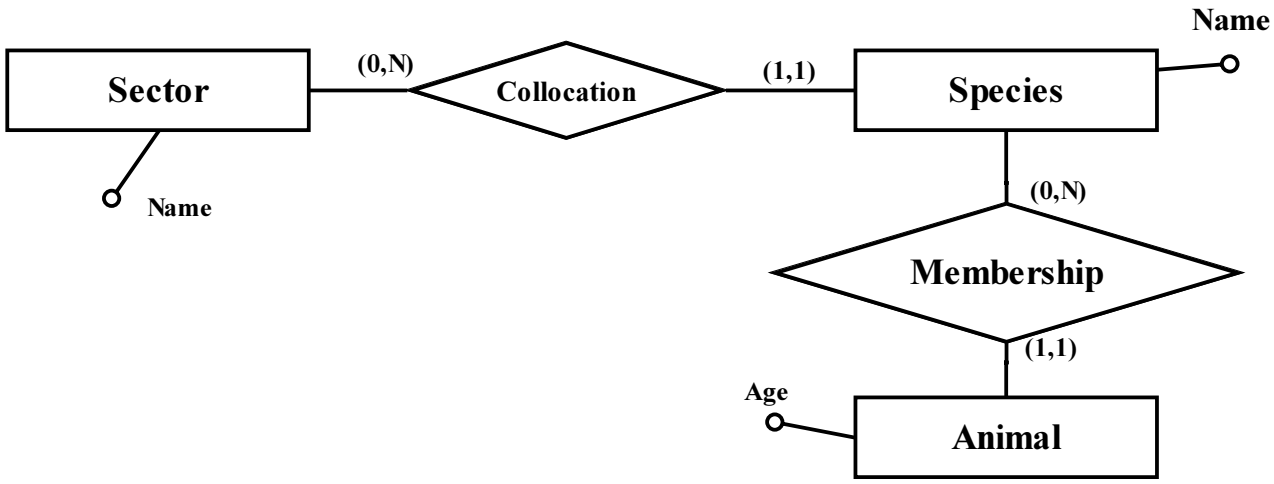
Exercise 5.3

Represent the following, using the constructs of the Entity-Relationship model.

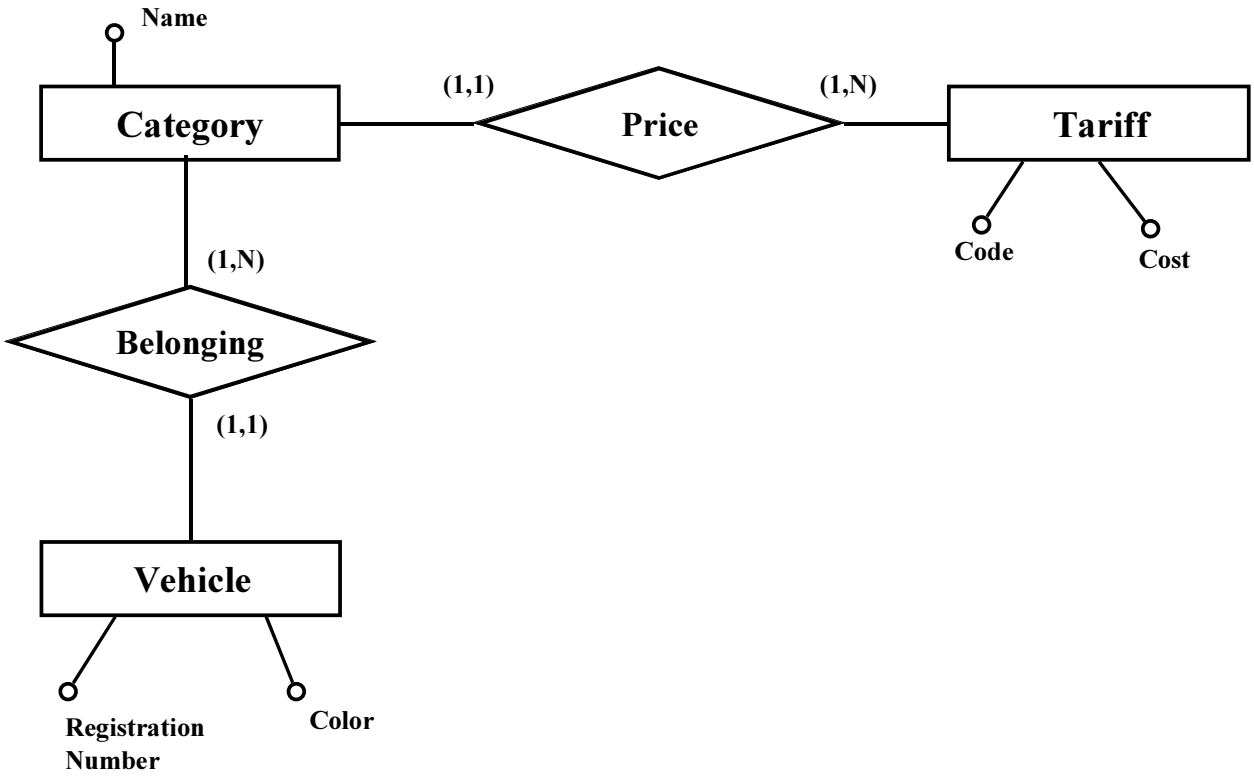
1 In a zoological garden there are animals belonging to a species and having a certain age; each species is situated in a sector (having a name) of the zoo.
2 An automobile rental firm has a vehicle pool, in which each automobile has a registration number and a colour and belong to one category; for each category, there is a rental tariff.
3 A company produces CDs with a code and a title; each CD has been recorded by one or more singer, each of whom has a name and a address and some of whom have a stage name.

Solution:

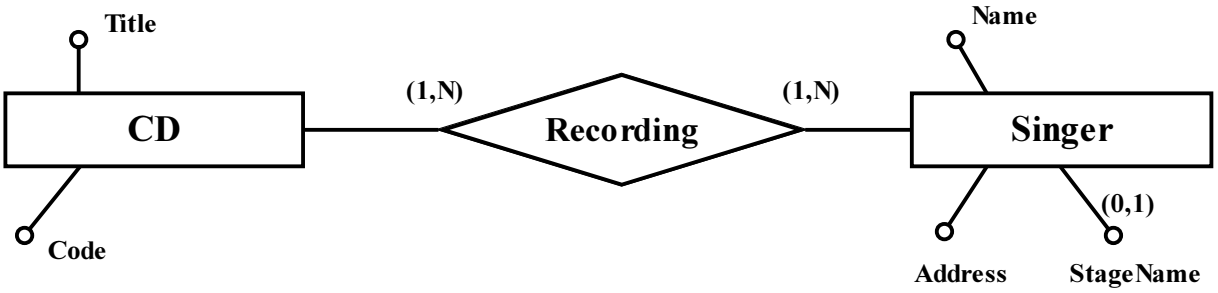
1)



2)



3)


Title
CD
Code
(1,N)
Recording
(1,N)
Name
Singer
(0,1)
Address
StageName

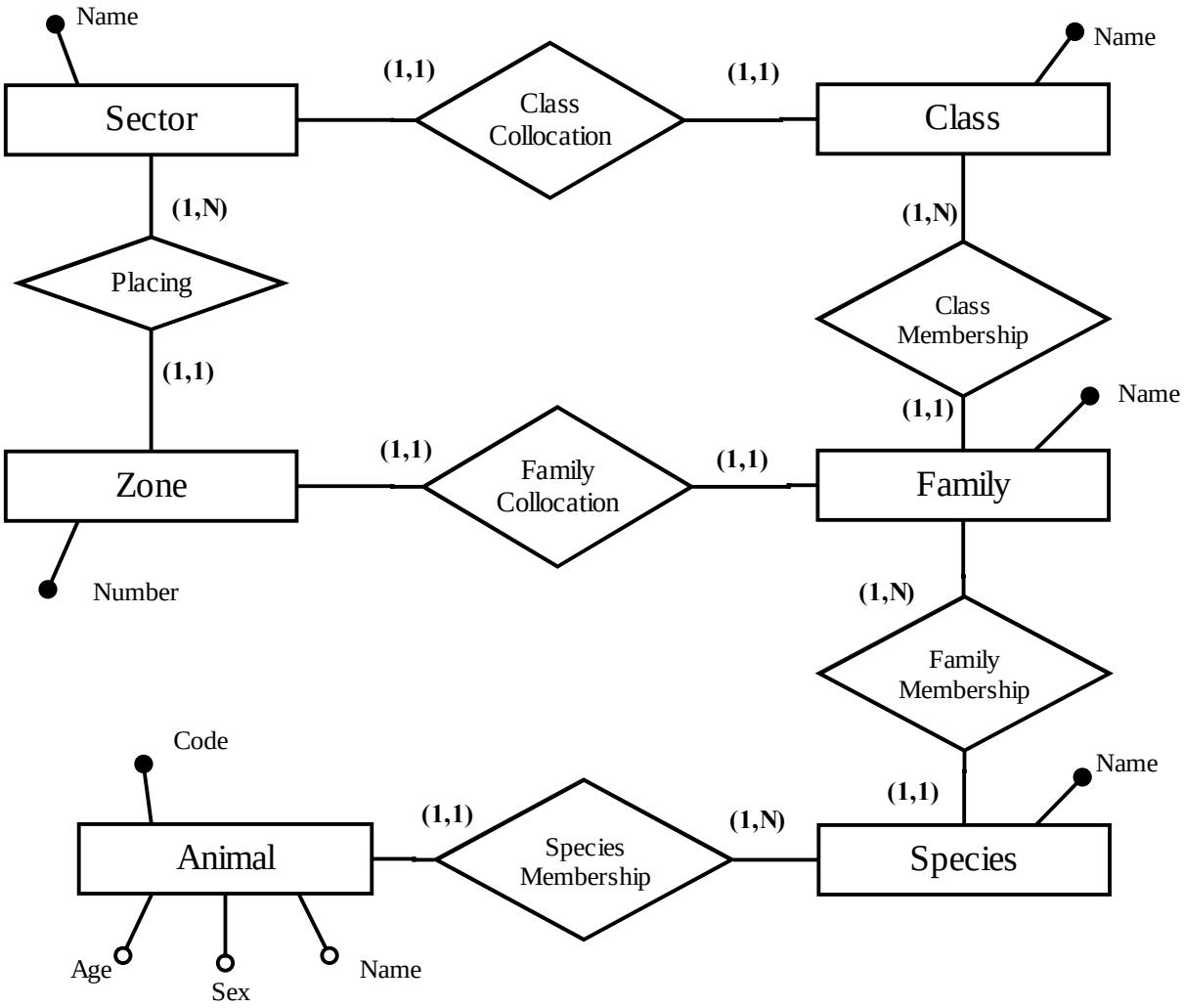
Exercise 5.4

Complete the schemas produced in the exercise above with further information based on reasonable assumption about each one.

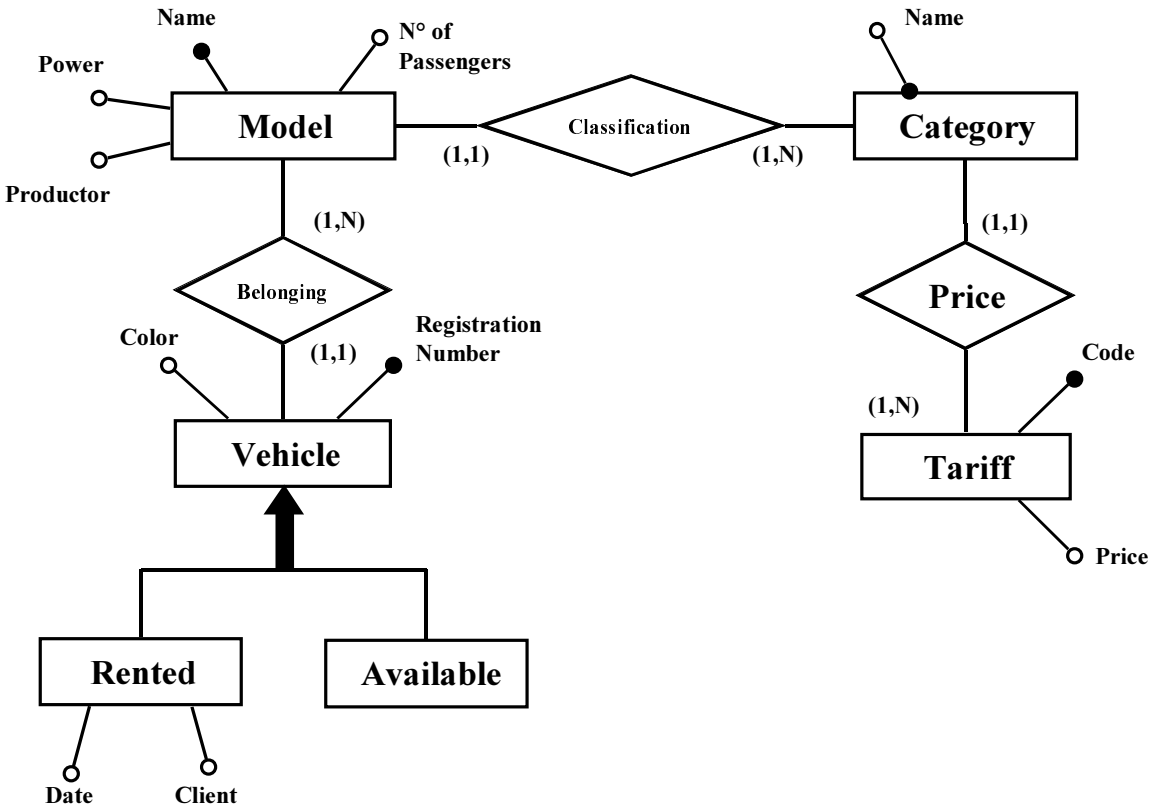
Solution:

Possible solutions are:

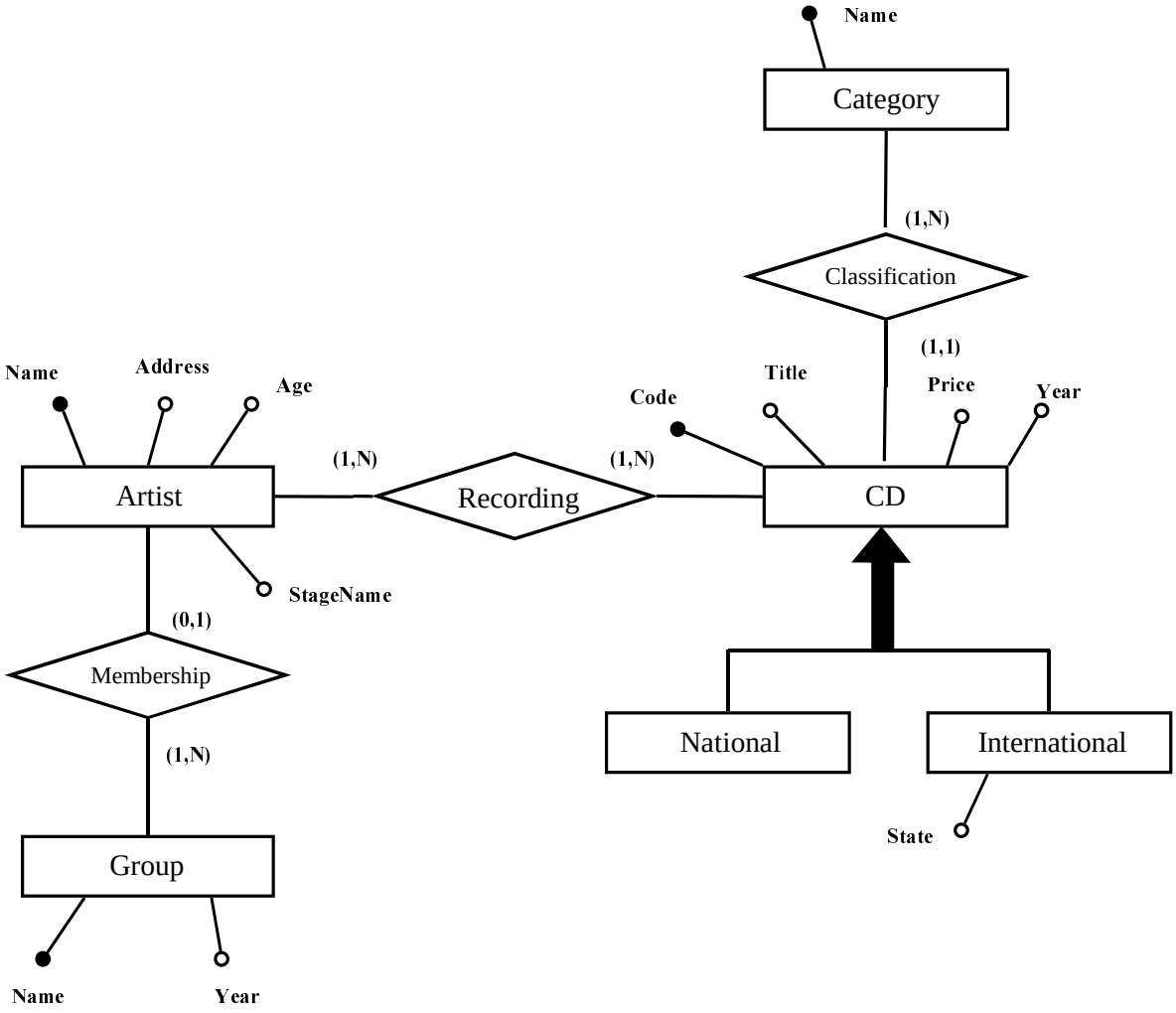
1)



2)


Name
N° of Passengers
Power
Model
Productor
Classification
(1,1)
(1,N)
Name
Category
(1,N)
Belonging
(1,1)
(1,1)
Price
Color
Registration Number
Code
(1,N)
Vehicle
Tariff
Price
Rented
Available
Date
Client

3)


Name
Category
(1,N)
Classification
(1,1)
Name
Address
Age
Code
Title
Price
Year
(1,N)
(1,N)
Artist
Recording
CD
StageName
(0,1)
Membership
(1,N)
National
International
State
Group
Name
Year

Exercise 5.5

Show the following concepts, using, where appropriate, the generalization construct of the Entity-Relationship model. Indicate, in each case, the attributes of the various entities and the type of generalization, resolving the cases of overlapping.

1. The employees of a company are divided into managers, programmers, analysts, project leaders and secretaries. There are analyst who are also programmers. The project leader must be a manager. Each employee has a code, a name and a surname. Each category of employees has its own basic salary. Each employee, apart from the managers, has fixed working hours.

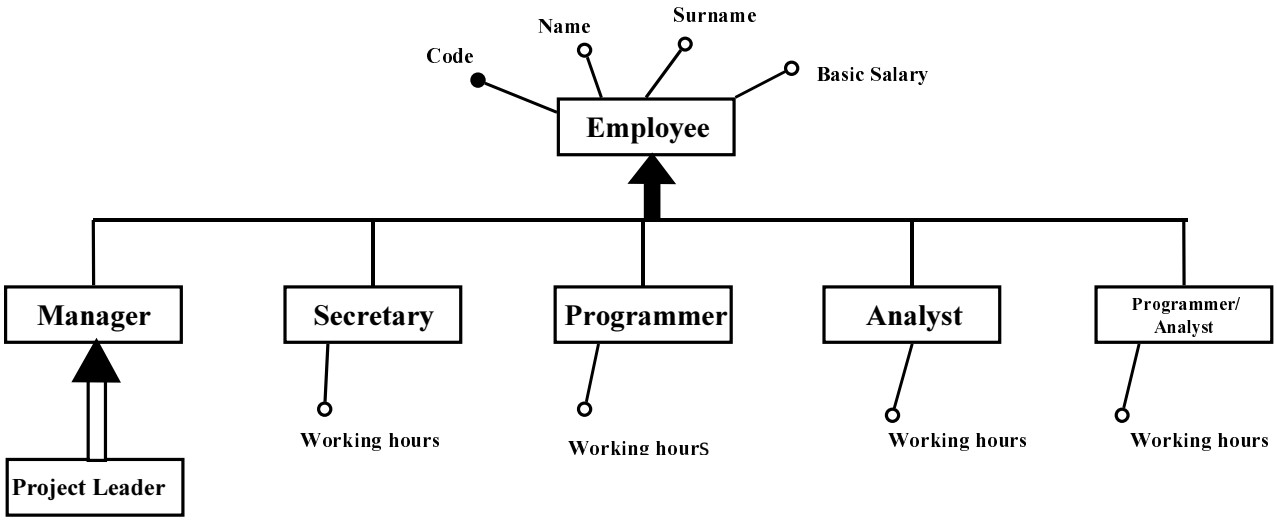
2. A French airline offers flights, each of which has a number that identifies the flight (for example Paris-Boston), a date (25 march 2000), a departure time (8:00) and an arrival time (12:00), a departure airport and an arrival airport. There are national and international flights. The international flights can have one ore more stopovers. For completed flights, information to be recorded is the actual time of departure and arrival (for example with reference to the flight given above, 8:05 and 12:07). For future flights, the number of seats available must be know.

3. An automobile company produces cars, motor cycles, lorries and tractors. The vehicles are identified by a chassis number and have a name (for example Punto), a cylinder capacity and a colour. The cars are subdivided according to size: compact (up to 2.5m in length) and family (over 2.5m); and according to engine capacity: small (up to 1200cc), medium (from 1200cc to 2000cc) and large (over 2000cc). The motorcycles are divided into mopeds (cylinder capacity below 125cc) and roaster (above 125cc). The lorries have a weight and can be articulated.

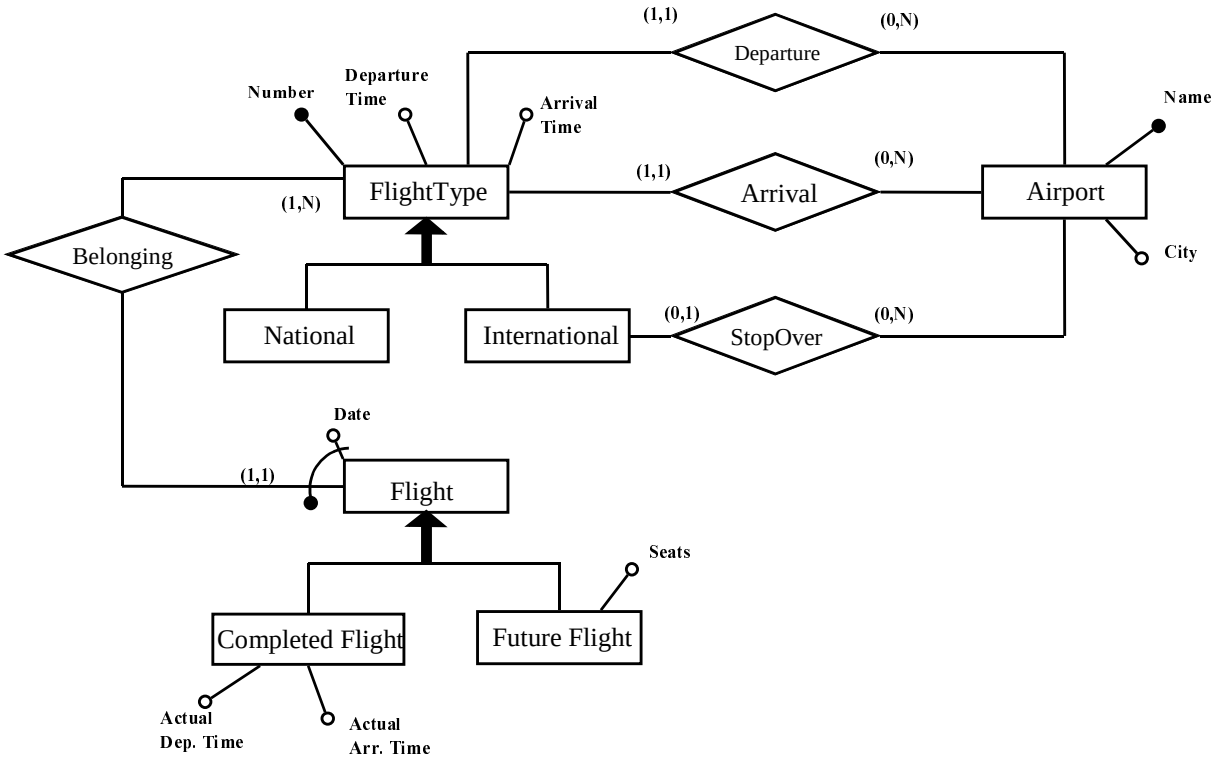
Solution:

All the generalization are exclusive.

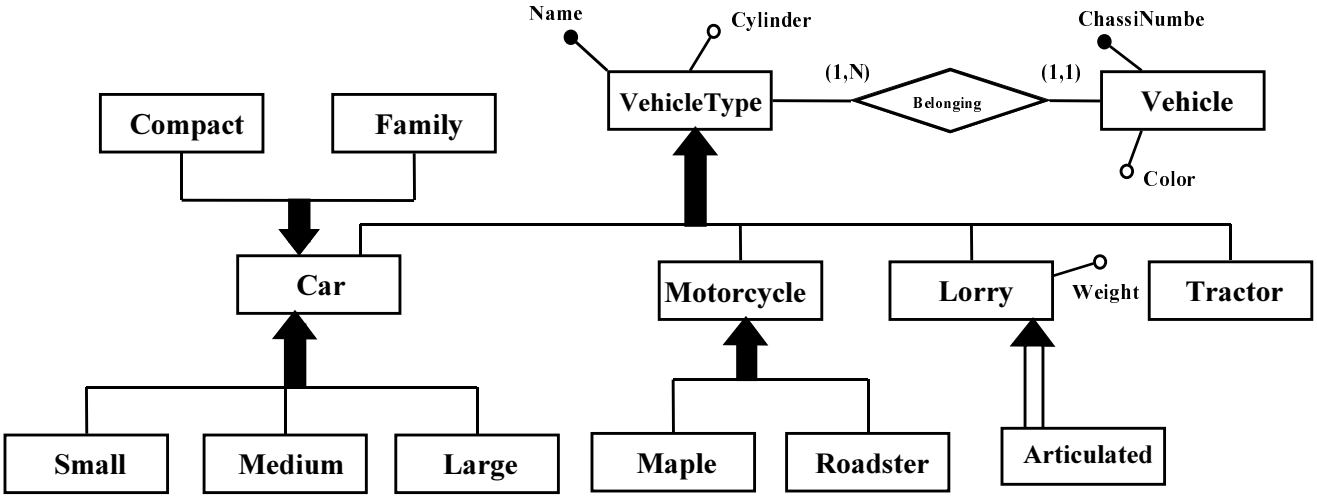
1)



2)


(1,1)
Departure
(0,N)
Number
Departure Time
Arrival Time
Name
FlightType
(1,N)
(1,1)
Arrival
(0,N)
Airport
Belonging
City
National
International
(0,1)
StopOver
(0,N)
Date
(1,1)
Flight
Seats
Completed Flight
Future Flight
Actual Dep. Time
Actual Arr. Time

3)


Name
Cylinder
ChassiNumbe
VehicleType
(1,N)
Belonging
(1,1)
Vehicle
Color
Compact
Family
Car
Motorcycle
Lorry
Weight
Tractor
Small
Medium
Large
Maple
Roadster
Articulated

Exercise 5.6

Consider the Entity-Relationship schema in figure 5.26. Describe in words the information it represents.

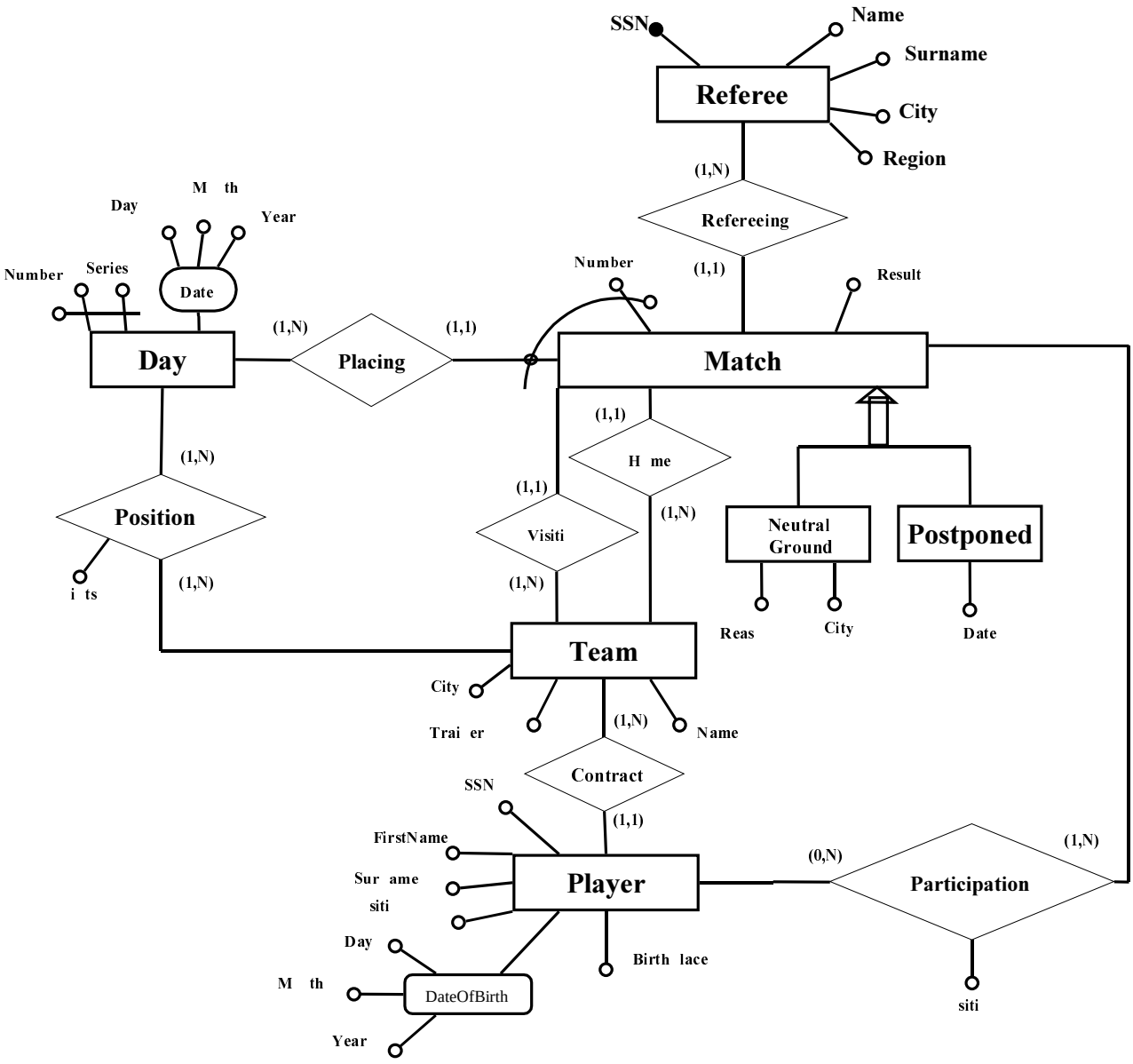


Figure 5.26

Solution:

The schema contains information about a championship (for example a football championship).
The entity TEAM represents all the teams of the championship, indicating, for each of them, its Name, City and trainer's name. The entity PLAYER represents the players of the teams; each player has a contract with only one team, and of course each team has many players.
Players are identified with their Social Security Number (SSN), and for each of them is indicated FirstName, Surname, BirthPlace, Position in the team and date of birth.
The schema contains also information about the matches of the championship, with the entity MATCH. A match is identified with a number (which must be different for all matches in the same day) and with a reference to the day (through the relationship PLACING and the entity DAY).
The relationship HOME and VISITING represent the two teams involved in a match; for each match the result is indicated and the respective referee, with the relationship REFEREEING between MATCH and REFEREE; this entity represents all the referees of the championship, and for each one is given Name, Surname, City and Region. A referee is represented only if he has refereed at least one match.
A match may be played on neutral ground or may be postponed to another date (but these two events together are not admitted in this schema).
The relationship PARTICIPATION represents the fact that a player played in a match, showing his position (may be different from the usually one). The schema does not express the condition that a player who plays in a match must have a contract with one of the two teams.
The entity DAY represents the championship's days. They are identified with Number and Series.
At least, the relationship POSITION gives the points of each team in each Day.

Exercise 5.7

Translate into business rules the following properties of the data in schema in Figure 5.26.

1. There can be no more than five players in a team who play in the same position,
2. A team earns 3 points if it wins, 1 if it draws, zero if it loses
3. If a team plays a match at home, then it is the visiting team in the next match

Produce the complete documentation for such a schema.

Solution:

BR1) The number of players in a team with the same position **MUST BE** greater than five.
BR2) The number of points earned by a team in match **IS OBTAINED BY** subtracting from the points it has in the day of the match the point it had in the previous day.
BR3) The number of points earned by a team in a won match **MUST BE** 3.
BR4) The number of points earned by a team in a drawn match **MUST BE** 1.
BR5) The number of points earned by a team in a lost match **MUST BE** 0.
BR6) The next match of a team **IS OBTAINED BY** searching between all matches in the next day the only one that involve the team.
BR7) The next match of a team that play at home **MUST BE** played at home.

DATA DICTIONARY

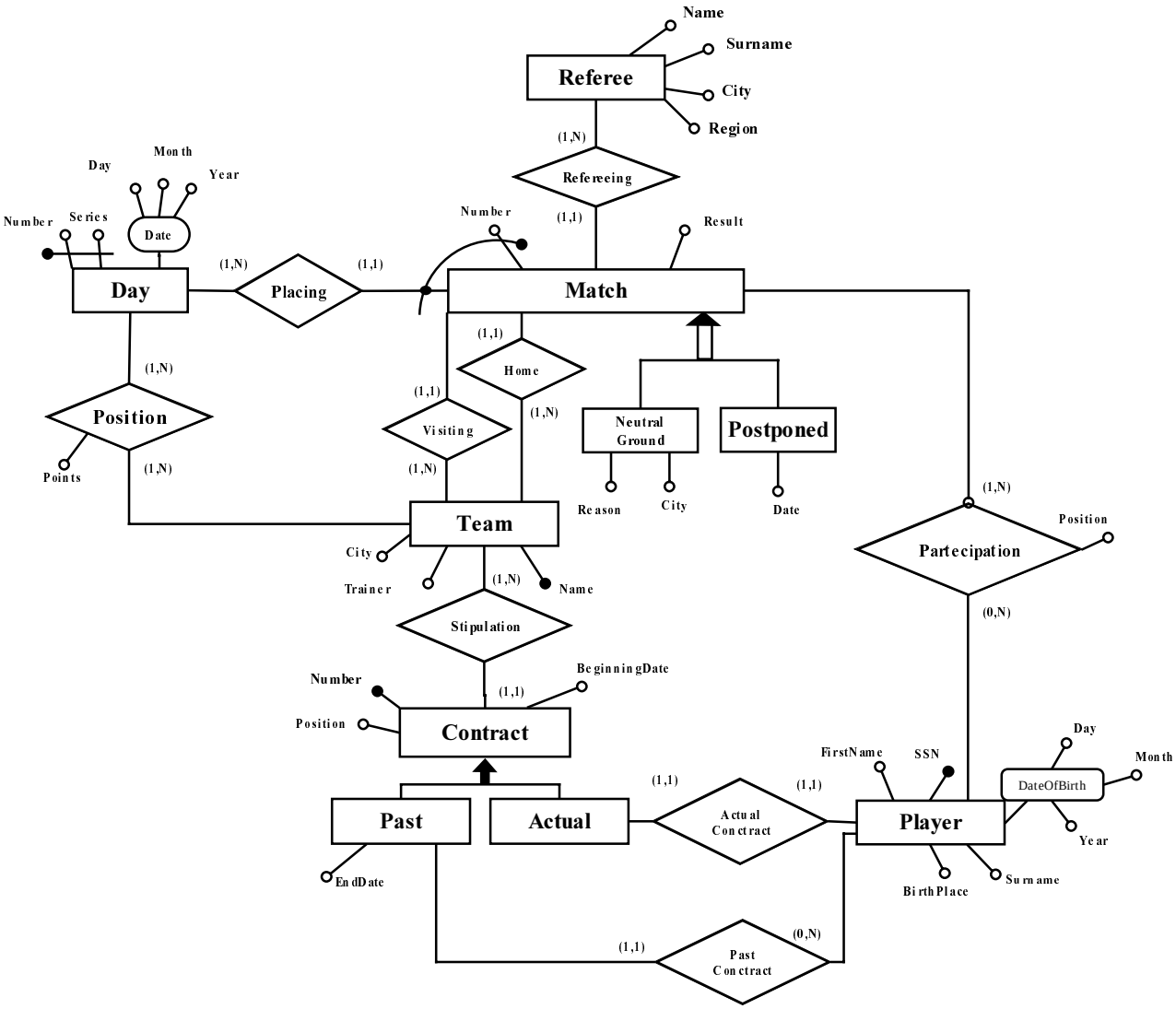
Entity	Description	Attributes	Identifier
Team	A team that plays in the championship.	Name, City, Trainer	Name
Player	Player who plays in a team.	SSN, FirstName, Surname, Position, BirthPlace, DateOfBirth(Day, Month, Year)	
Match	A match played during he championship.	Number, Result	Number + Day(external identifier)
Neutral Ground	A match played in a neutral ground.	Reason, City, Number, Result	Number + Day(external identifier)
Postponed	A match postponed to another date.	Date, Number, Result	Number + Day(external identifier)
Day	Day of the championship	Number, Series, Date (Day, Month, Year)	Number, Series
Referee	A referee of the championship	Name, Surname, City, Region	Name, Surname

Relationship	Description	Entity Involved	Attributes
Refereeing	Associates a Match with a referee.	Referee, Match	
Placing	Associates a Match with the corresponding Championship Day. It's necessary to identify a match.	Match, Day	
Home	Associates a match with a team; it represents the team which played at home in the match.	Match, Team	
Visiting	Associates a match with a team; it represents the team which not played at home in the match.	Match, Team	
Position	Associates a Day with a team; it represents (giving the points), the position of a team after each day.	Day, Team	Points
Contract	Associates a team with a player; it represents the fact that a player actually plays with the team.	Team, Player	
Participation	Associates a player with a match; it represents the fact that the player played in the match. He may have played in a position different from the basic one	Match, Player	Position

Exercise 5.8

Modify the Entity-Relationship schema in Figure 2.26 so as to describe also the past contracts between players and teams with the date of beginning and end of the contracts and the main position played by each player in each team. It is possible that a player can have different contracts with the same team in different periods. For current contracts we wish to know the date of commencement.

Solution:



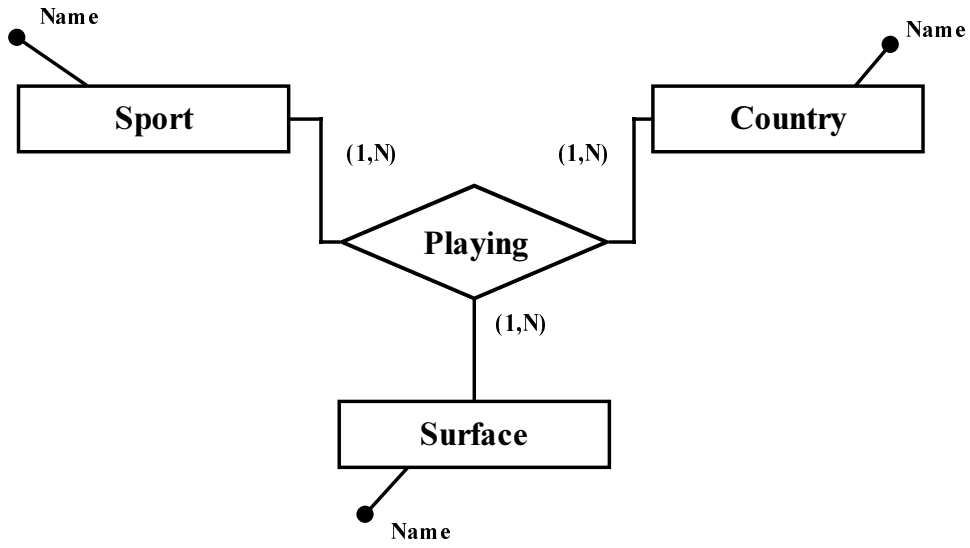
Exercise 5.9

In each of the following cases, reference is made to two ore more entities defined in a Entity-Relationship schema and to a concept that involves them. Specify the schemas, defining the constructs (one ore more relationship and, if necessary, further entities with relatives identifier) necessary to represent the concept, maintaining the entities indicated.

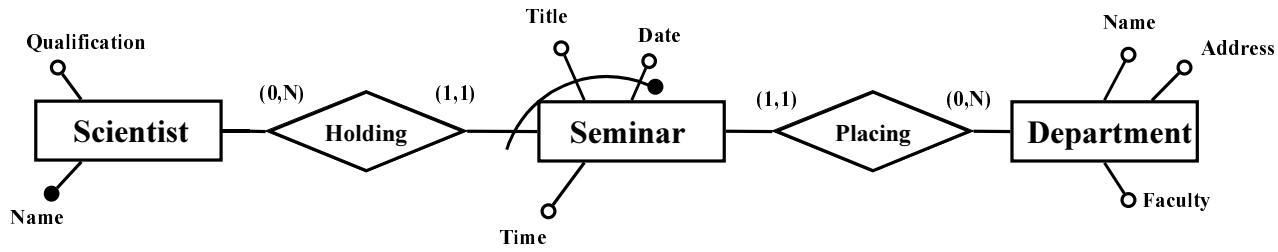
1. Entities: sport, country and surface. Concept: the fact that in one country a sport is praticated on a certain surface (for example, tennis is played on grass in England and in Australia, on red shale in Italy and France, On Astroturf in The USA, Italy and France; soccer on grass in Italy, on grass and Astroturf in the USA, on grass in England).
2. Entities: scientist and department. Concept: the fact that the scientist has held seminars in the department. For every seminar, it is necessary to show the date, time and title, with the constraints that a scientist cannot hold more than a seminar in the same day.
3. Entities: professional and company. Concept: the fact that the professional has been a consultant for the company. It is necessary to show the number of consulting held by the professional for each company, with the total cost.

Solution:

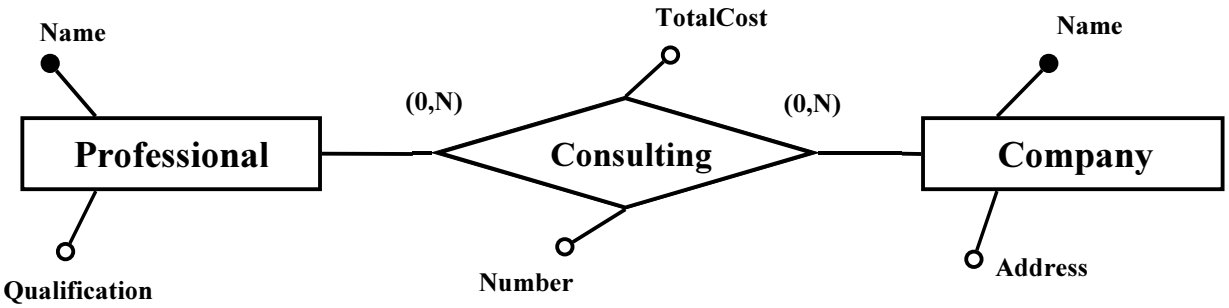
1)



2)



3)


Name
TotalCost
Name
(0,N)
(0,N)
Professional
Consulting
Company
Qualification
Number
Address

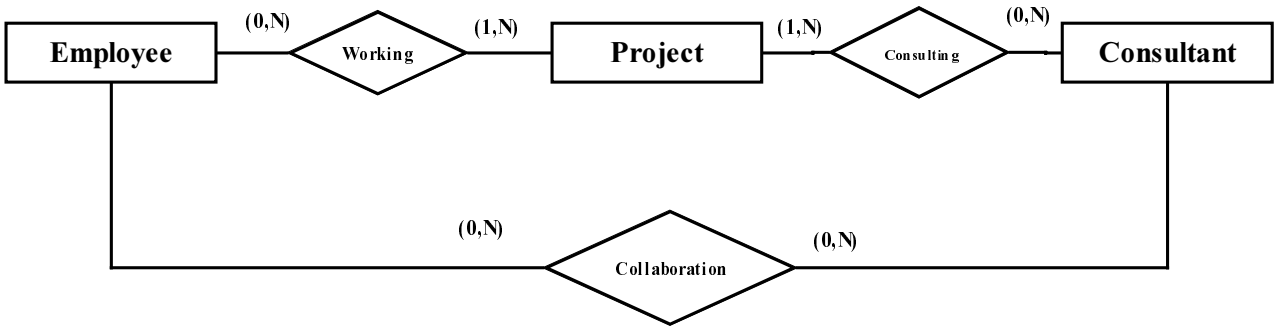
Exercise 5.10

Consider a ternary relationship involving the entities EMPLOYEE, PROJECT and CONSULTANT. Show in which of the following cases it is appropriate to substitute two or three binary relationship for such relationship. In the cases where it is possible, show how it is done.

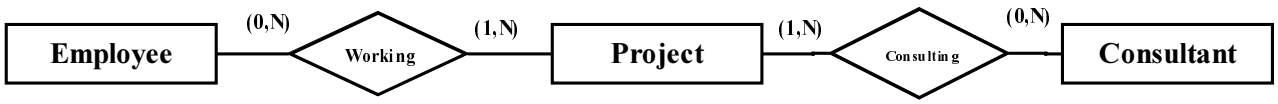
1. Each employee is involved in zero or more project and interacts with zero or more consultant. Each consultant is involved in zero or more project and interacts with zero or more employees. Each project involves one ore more employees and one or more consultant (who need not interact among themselves). An employee and a consultant collaborate in the field of a project if and only if they collaborate between themselves and are both involved in the project.
2. Each employee is involved in zero ore more projects, in each of which they interact with one or more consultant (who can be different from project to project and can in general be a subset of the consultants involved in the project). Each consultant is involved in zero ore more project in each of which he ore she interacts with one or more employees (who can be different from project to project and who can in general be a subset of the employees involved in the projects). Each project involves one ore more employees-consultant pairs
3. Each employee is involved in zero or more projects. Each consultant is involved in zero or more projects. Each project involves one ore more employees and one or more consultants. An employee and a consultant interact if and only if there is a project in which they are both involved.

Solution:

1)



2)



3) The same as point 2.