Tutorial 5: Revision

Exercise 1.

Companies, identified by Company ID and described by Company Name and Industry Type, hire consultants, identified by Consultant ID and described by Consultant Name, Consultant Specialty, which is multi-valued. Assume that a consultant can work for only one company at a time, and we need to track only current consulting engagements.

a. Draw an ERD for this situation.

Now, consider a new attribute, Hourly Rate, which is the rate a consultant charges a company for each hour of his or her services. Now, consider that each time a consultant works for a company, a contract is written describing the terms for this consulting engagement. Contract is identified by a composite identifier of Company ID, Consultant ID, and Contract Date.

b. Assuming that a consultant can still work for only one company at a time, redraw the ERR for this new situation.
c. Show the dependency between attributes. Indicate the type of dependencies.
d. Break the EER into 3NF relation.

Exercise 2.

A person may be employed by one or more organizations, and each organization may be the employer of one or more persons. An organization can be an internal organizational unit or an external organization. For persons and organizations, we want to know their ID, name, address, and phone number. For persons, we want to know their birth date, and for organizations, we want to know their budget number. For each employment, we want to know the employment date, termination date, and bonus.

Employment of a person by an organization may result in the person holding many positions over time. For each position, we want to know its title, and each time someone holds that position, we need to know the start date and termination date and salary. An organization is responsible for each position. It is possible for a person to be employed by one organization and hold a position for which another organization is responsible.

a. Draw an EER
b. Break into 3NF

Exercise 3.

Draw an ERD for the following Scenario:

A Laboratory has several chemists who work on one or more projects. Chemists also may use certain kinds of equipment on each project. Attributes of CHEMIST includes EMPLOYEE_ID (identifier), Name, Phone_No. Attribute of PROJECT include Project_ID (identifier), and Start_Date.

Attributes of EQUIPMENT include Serial_No and Cost. The organization wishes to record Assign_Date, which is the date when a given equipment was assigned to a particular chemist

working on a specific project. A chemist must be assigned at least to one project and one equipment item. Any given equipment item need not be assigned, and a given project need not be assigned either a chemist or an equipment item.

Exercise 4.

At a weekend retreat, the entity type PERSON has three subtypes: CAMPER, BIKER, and RUNNER.

PERSON: SSN, Name.

CAMPER: Registration Plate.

BIKER: Serial_No, Type.

RUNNER: Campaign Name

* Draw a separate EER diagram segment for each of the following situations:

a. At a given time, a person must be exactly one of these subtypes.

b. A person may or may not be one of these subtypes. However, a person who is one of these subtypes cannot at the same time be one of the other subtypes.

c. A person may or may not be one of these subtypes. On the other hand, a person may be any two (or even three) of these subtypes at the same time.

d. At a given time, a person must be at least one of these subtypes.

* Break into 3NF

Exercise 5.

The materials manager at Pine Valley Furniture Company maintains a list of suppliers for each of the material items purchased by the company from outside vendors. Table 4-7 shows the essential data required for this application.

TABLE 4-7 Pine Valley Furniture Company Purchasing Data

Attribute Name	Sample Value
Material ID	3792
Material Name	Hinges 3" locking
Unit of Measure	each
Standard Cost	$5.00
Vendor ID	V300
Vendor Name	Apex Hardware
Unit Price	$4.75
Terms Code	1
Terms	COD

a. Draw a dependency diagram for this data. You may assume the following:

• Each material item has one or more suppliers. Each supplier may supply one or more items or may not supply any items.

• The unit price for a material item may vary from one vendor to another.

• The terms code uniquely identifies the terms of the sale (e.g., code 2 means 10 percent net 30 days, etc. At a given time, a supplier applies a term code. The terms for a supplier are the same for all material items ordered from that supplier.

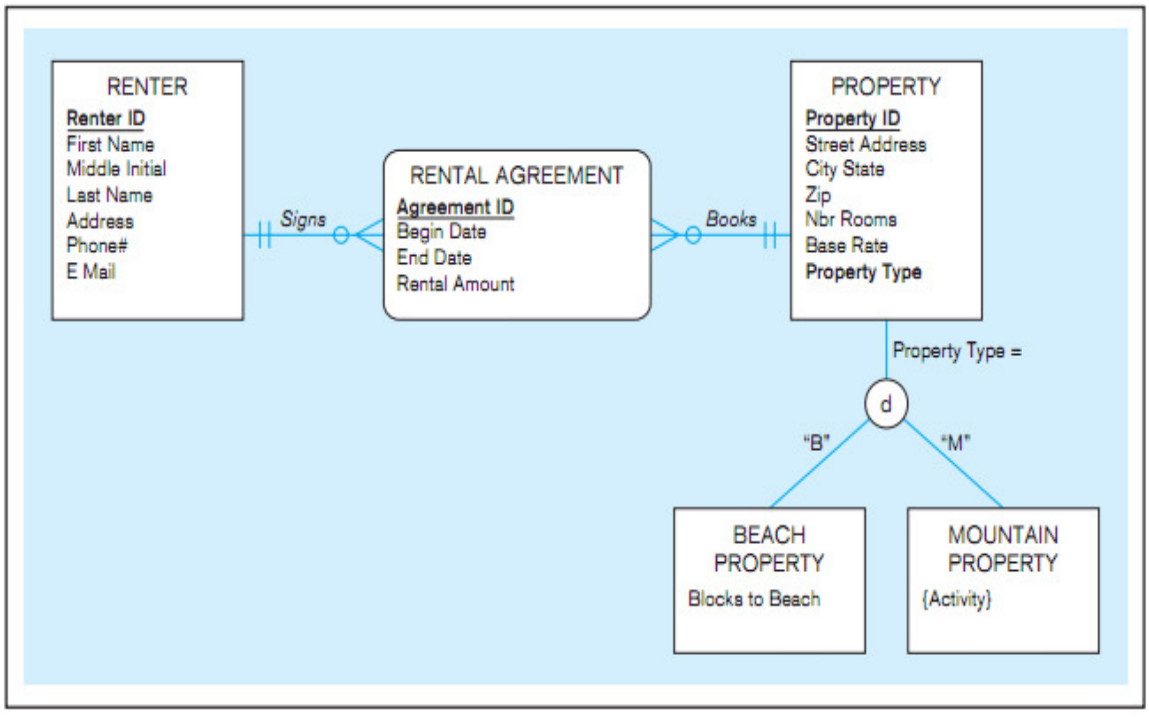
b. Draw an E-R diagram for this situation.
c. Decompose this diagram into a set of diagrams in 3NF.

Exercise 6.

Figure below shows an EER diagram for Vacation Property Rentals. This organization rents preferred properties in several states. As shown in the figure, there are two basic types of properties: beach properties and mountain properties.

a. Diagram the functional dependencies and convert all relations to third normal form

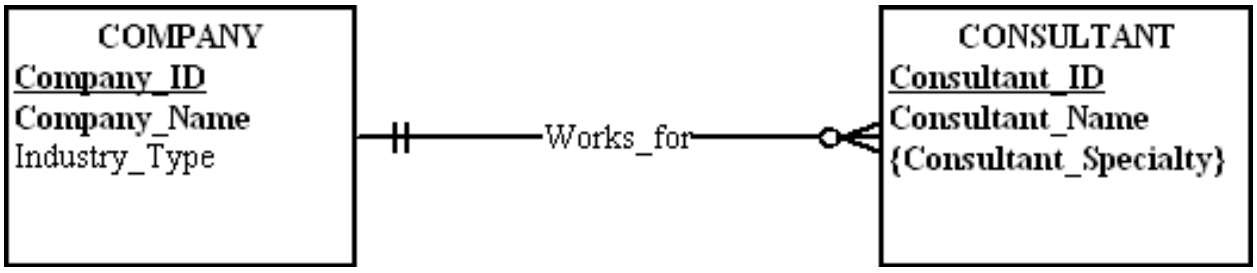
b. Suggest an integrity constraint that would ensure that no property is rented twice during the same time interval.



Solution

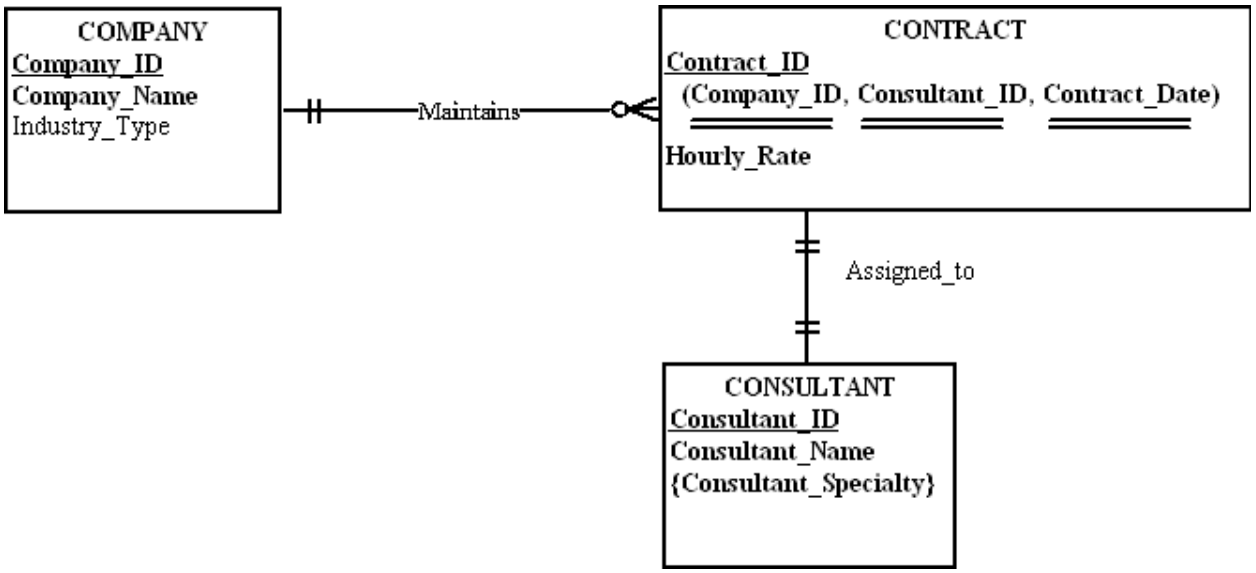
Exercise 1.

a. Draw ERD



b.

*** Solution 1: Use composite primary key



- Dependency for Solution 1:

Company_ID → Company_Name, Industry_Type: full dependency

Company_ID, Consultant_ID, Contract_Date → Hourly_Rate: full dependency

Consultant_ID → Consultant_Name, Consultant_Speciality: full dependency

- Break into 3NF

Because Consutant_Specialty is a mutivalued attribute so it needs to normalize by putting this attribute into a separate relation.

Company_ID	Company_Name	Industry_Type

Hourly_Rate	Contract_Date	Company_ID	Consultant_ID

Consultant_ID	Consultant_Name

Consultant_ID	Speciality

*** Solution 2: Use surrogate key

We want to track historical CONTRACT information. We can create an associative entity for CONTRACT. Contract_ID is used as a surrogate identifier instead of a composite identifier (Company_ID, Consultant_ID, Consultant_Date) for simplicity.

- Dependency for Solution 2:

Company_ID → Company_Name, Industry_Type: full dependency

Contract_ID → Contract_Date, Hourly_Rate: full dependency

Consultant_ID → Consultant_Name, Consultant_Speciality: full dependency

- Break into 3NF

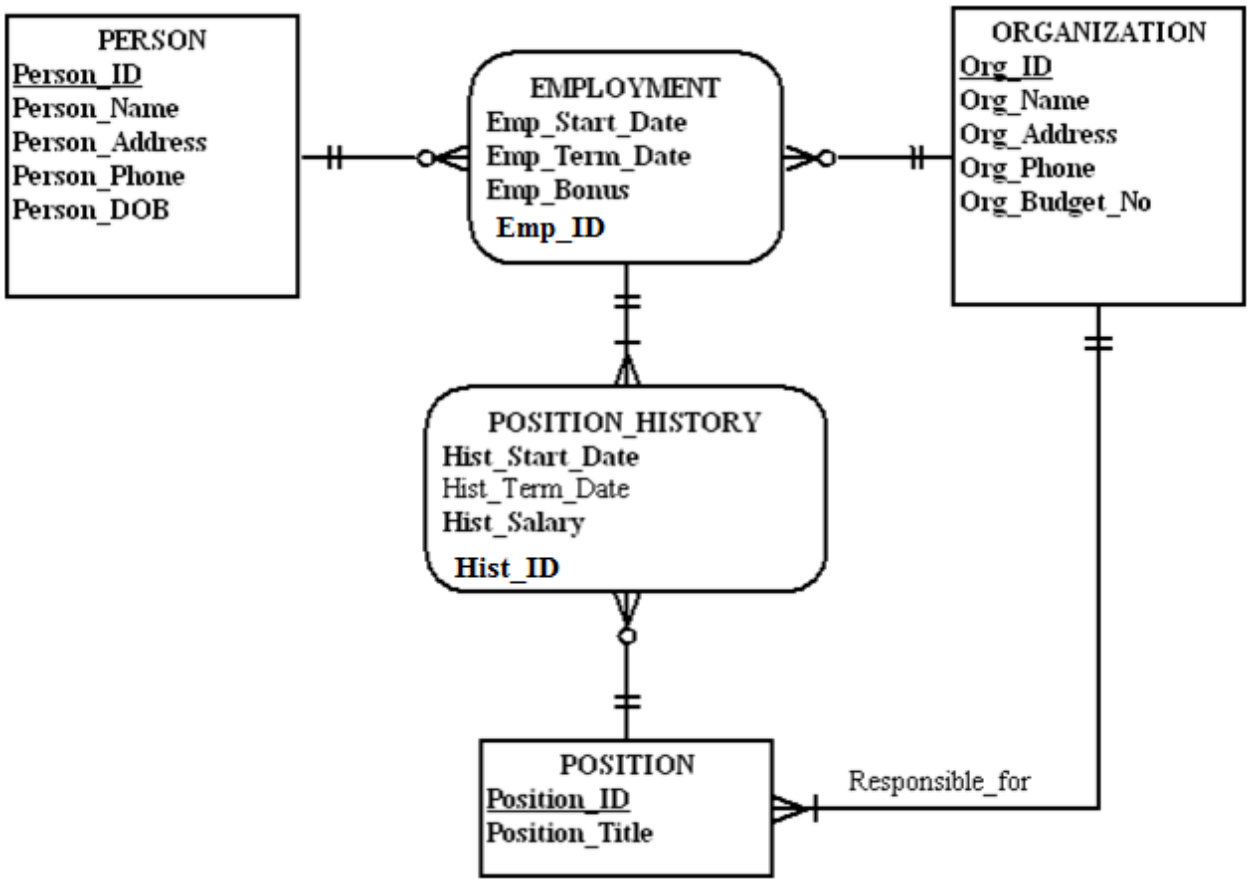
Company_ID	Company_Name	Industry_Type

Contract_ID	Contract_Date	Hourly_Rate	Company_ID	Consultant_ID

Consultant_ID	Consultant_Name

Consultant_ID	Speciality

Exercise 2.



- Break into 3NF

Person_ID	Person_Name	Person_Address	Person_Address	Person_DoB

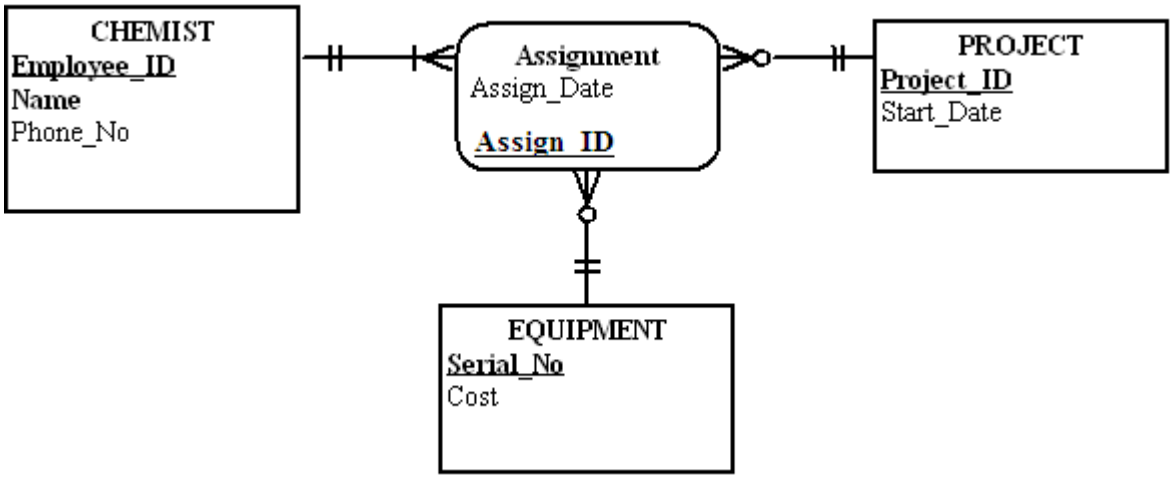
Org_ID	Org_Name	Org_Address	Org_Phone	Org_Budget_No

Emp_ID	Emp_Start_Date	Em_Term_Date	Em_Bonus	Org_ID	Person_ID

Hist_ID	Hist_Start_Date	Hist_Term_Date	Hist_Salary	Emp_ID	Position_ID

Position_ID	Position_Title	Organization_ID

Exercise 3.



- **Break into 3 NF**

Employee_ID	Name	Phone_No

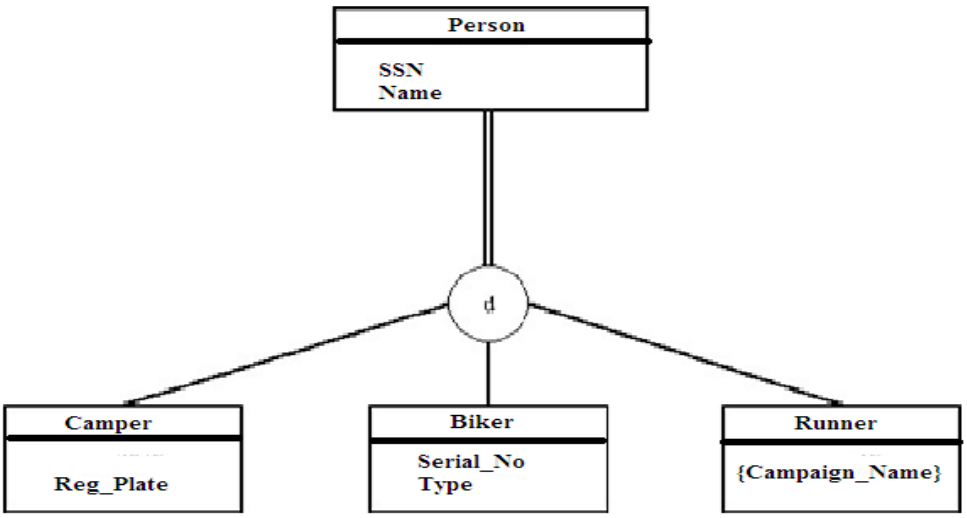
Serial_No	Cost

Project_ID	Start_Date

Assign_ID	Assign_Date	Employee_ID	Project_ID	Serial_No

Exercise 4.

a.



- Break into 3 NF

SSN	Name	Person_Type

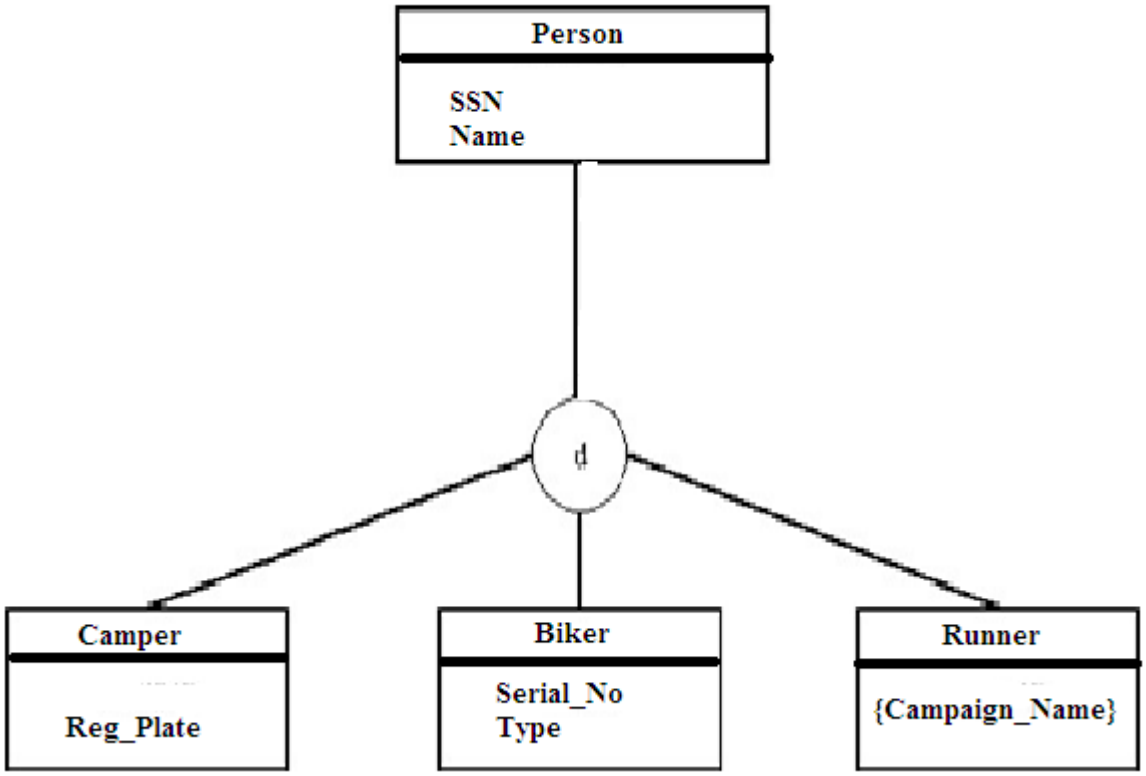
C_SSN	Reg_Plate

B_SSN	Serial_No	Type

R_SSN	CampaignName

- In this case, at a given time, a person must be one of these subtypes. So Person_Type takes 3 values only: 'Camper', 'Biker' and 'Runner'. We can abbreviate them as 'C', 'B' and 'R' for short.

b.



SSN	Name	Person_Type

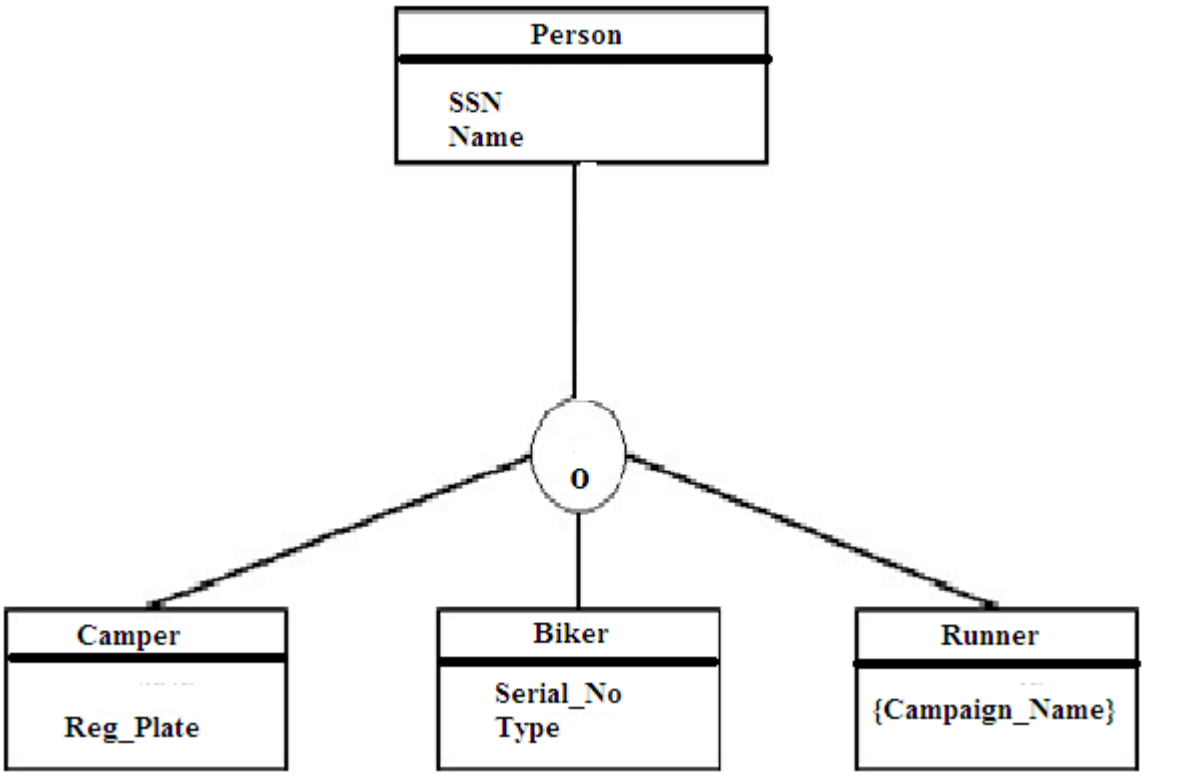
C_SSN	Reg_Plate

B_SSN	Serial_No	Type

R_SSN	CampaignName

- A person may or may not be one of these subtypes. However, a person who is one of these subtypes cannot at the same time be one of the other subtypes. So Person_Type should take 4 values: ‘Camper’, ‘Biker’, ‘Runner’ and ‘Others’. We can abbreviate them as ‘C’, ‘B’,‘R’ and ‘O’ for short.

c.



SSN	Name	Camper?	Biker?	Runner?	Others?

C_SSN	Reg_Plate

B_SSN	Serial_No	Type

R_SSN	CampaignName

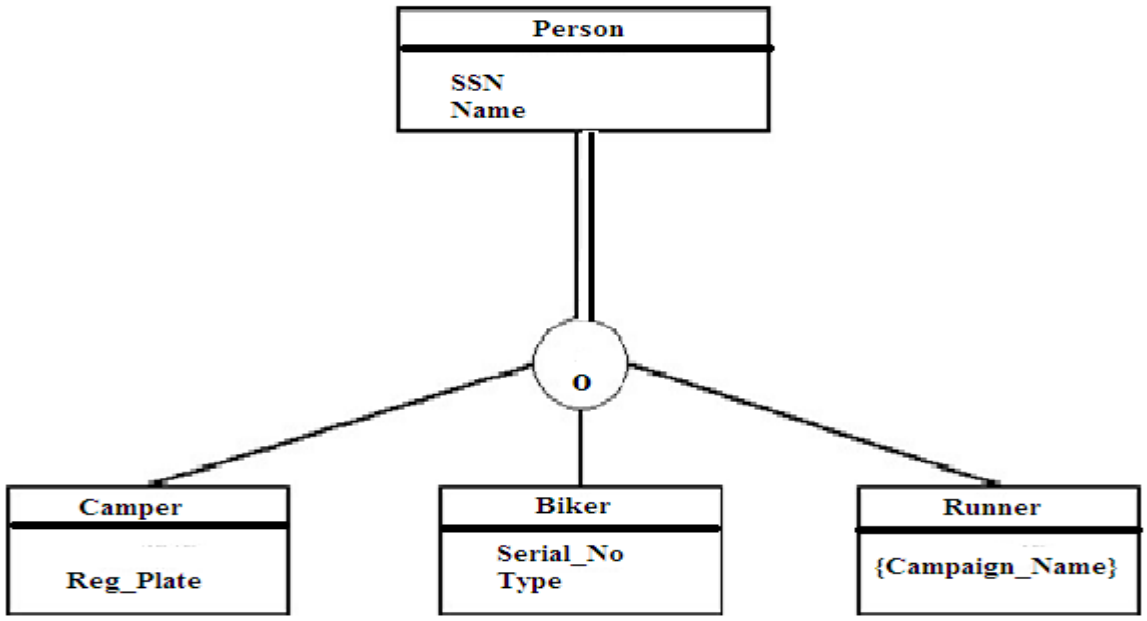
A person may or may not be one of these subtypes. On the other hand, a person may be any two (or even three) of these subtypes at the same time.

So Person_Type is a composite attribute. Then We break it into 4 components: Camper?, Runner?, Biker? And Other? Each of this attribute takes a Boolean value (0 or 1).

For example, if a person at a given time is both biker and runner. This case results an instance as below:

SSN	**Name**	**Camper?**	**Biker?**	**Runner?**	**Others?**
01262345	Trầm Văn Trọng	0	1	1	0

d.



SSN	Name	Camper?	Biker?	Runner?

C_SSN	Reg_Plate

B_SSN	Serial_No	Type

R_SSN	CampaignName

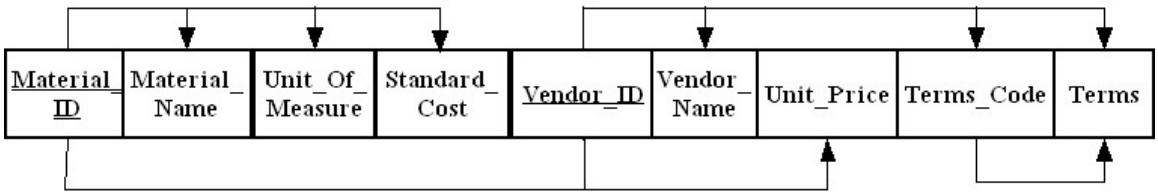
At a given time, a person must be at least one of these subtypes. It also means that Person_type could take only 3 values: Camper, Runner and Biker. Because a person must be at least one of these subtypes so Person_Type is a composite attribute. Then We break it into 3 components: Camper?, Runner?, Biker? Each of this attribute takes a Boolean value (0 or 1).

For example, if a person at a given time is both camper and runner. This case results an instance as below:

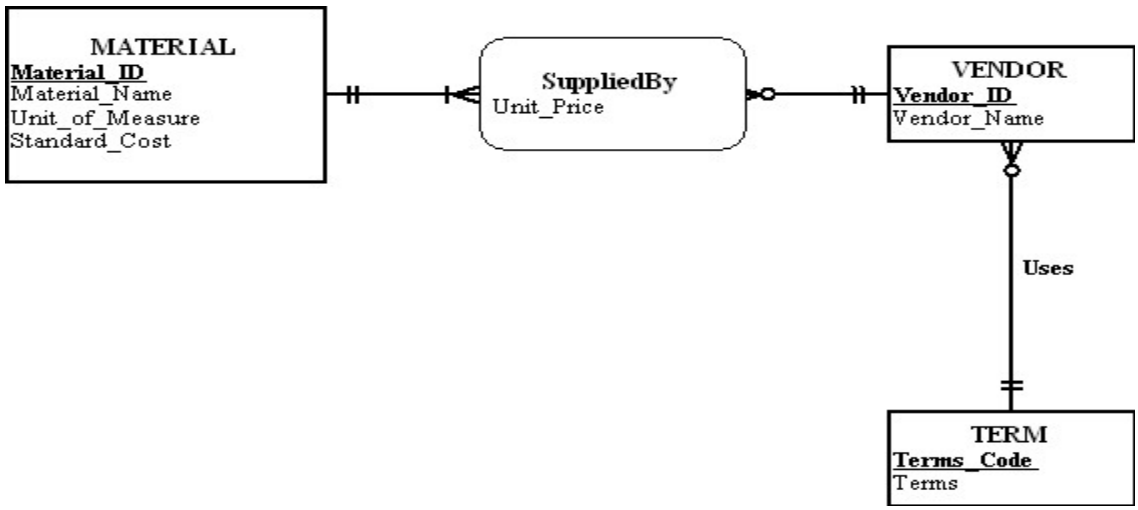
SSN	Name	Camper?	Biker?	Runner?
01262345	Trầm Văn Trọng	1	0	1

Exercise 5.

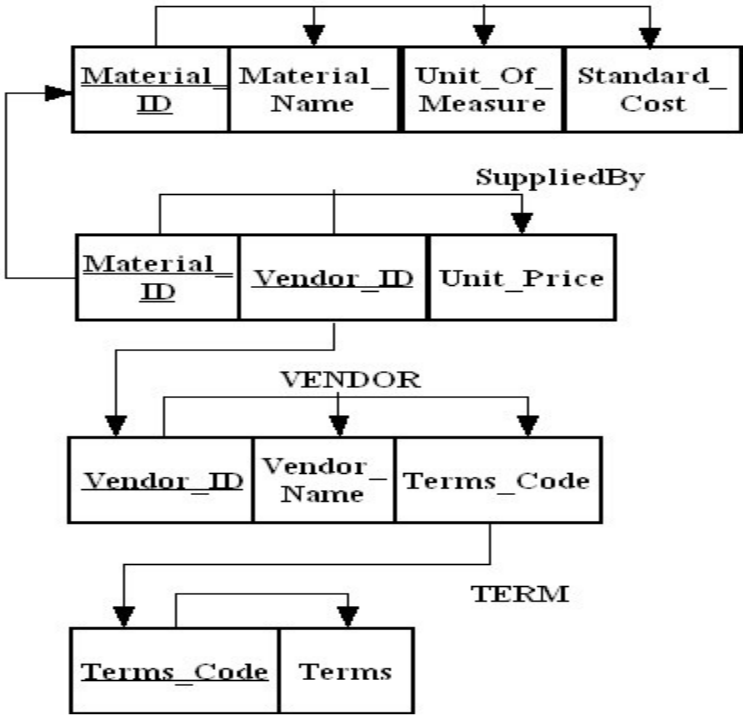
a.



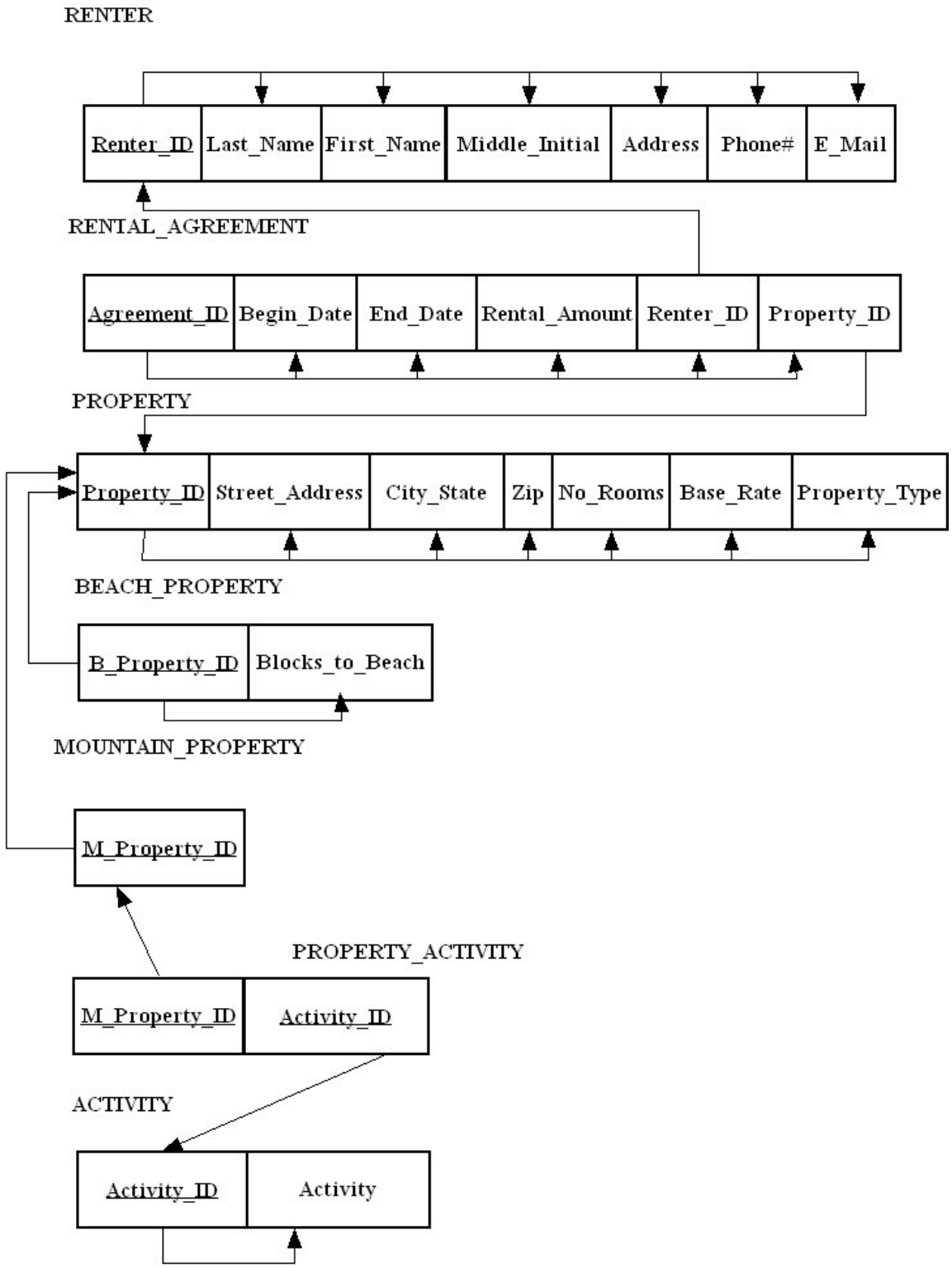
b.



MATERIAL


Material_ID
Material_Name
Unit_Of_Measure
Standard_Cost
SuppliedBy
Material_ID
Vendor_ID
Unit_Price
VENDOR
Vendor_ID
Vendor_Name
Terms_Code
TERM
Terms_Code
Terms

Exercise 6.



c. An action assertion could be used such as:

A property shall have one and only one rental agreement in force at one time, we check Begin_Date and End_Date. Use function SysDate() to check if a given time falls between Begin_Date and End_Date of an Agreement. If yes, it means that the property has been rented, if No, it means that property has not been rented.

Another solution is that:

Add an property “Status” with 2 values “Available” Or “Rented”. Change the status into “Available” when it isn’t rented and ‘Rented” when it is.