Tutorial 4

1. Define each of the following terms:

   a. determinant   f. composite key

   b. functional dependency   g. relation

   c. transitive dependency   h. normal form

   d. recursive foreign key   i. partial functional dependency

   e. normalization   j. enterprise key

2. Match the following terms to the appropriate definition

   1. well-structured relation
   2. anomaly
   3. functional dependency
   4. determinant
   5. composite key
   6. 1NF
   7. 2NF
   8. 3NF
   9. recursive foreign key
   10. relation
   11. transitive dependency

   a. constraint between two attributes

   b. functional dependency between the primary key and a nonkey attribute via another nonkey attribute

   c. references the primary key in the same relation

   d. multivalued attributes removed

   e. inconsistency or error

   f. contains little redundancy

   g. contains two (or more) attributes

   h. contains no partial functional dependencies

   i. transitive dependencies eliminated

   j. attribute on left side of functional dependency

   k. named two-dimensional table of data

3. Describe how the following components of an E-R diagram are transformed into relations:
   a. regular entity type
   b. relationship (1:M)
   c. relationship (M:N)
   d. supertype/subtype
   e. multivalued attribute
   f. weak entity
   g. composite attribute
   h. derived attribute

4. The figure shows a class list for Millennium College. Convert this user view to a set of 3NF relations using an enterprise key. Draw an EER. Assume the following:

   • An instructor has a unique location.

   • A student has a unique major.

• A course has a unique title.

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MILLENNIUM COLLEGE
CLASS LIST
FALL SEMESTER 201X

COURSE NO.:   IS 460
COURSE TITLE:   DATABASE
INSTRUCTOR NAME:   NORMA L. FORM
INSTRUCTOR LOCATION:   B 104
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STUDENT NO.	STUDENT NAME	MAJOR	GRADE
38214	Bright	IS	A
40875	Cortez	CS	B
51893	Edwards	IS	A

5. Given a piece of data, state the dependencies and draw an EER:

TABLE 4-5   Shipping Manifest

Shipment ID:	00-0001	Shipment Date:	01/10/2010
Origin:	Boston	Expected Arrival:	01/14/2010
Destination:	Brazil		
Ship Number:	39	Captain:	002-15
			Henry Moore

Item Number	Type	Description	Weight	Quantity	TOTALWEIGHT
3223	BM	Concrete Form	500	100	50,000
3297	BM	Steel Beam	87	2,000	174,000
				Shipment Total:	224,000

TABLE 4-6   Parking Tickets at Millennium College

Parking Ticket Table

St ID	L Name	F Name	Phone No	St Lic	Lic No	Ticket #	Date	Code	Fine
38249	Brown	Thomas	111-7804	FL	BRY 123	15634	10/17/10	2	$25
						16017	11/13/10	1	$15
82453	Green	Sally	391-1689	AL	TRE 141	14987	10/05/10	3	$100
						16293	11/18/10	1	$15
						17892	12/13/10	2	$25

6. 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. Decompose this diagram into a set of diagrams in 3NF.

c. Draw an E-R diagram for this situation.

7. 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. Transform the EER diagram to a set of relations and develop a relational schema.

b. Diagram the functional dependencies and determine the normal form for each relation.

c. Convert all relations to third normal form, if necessary, and draw a revised relational schema.

d. Suggest an integrity constraint that would ensure that no property is rented twice during the same time interval.
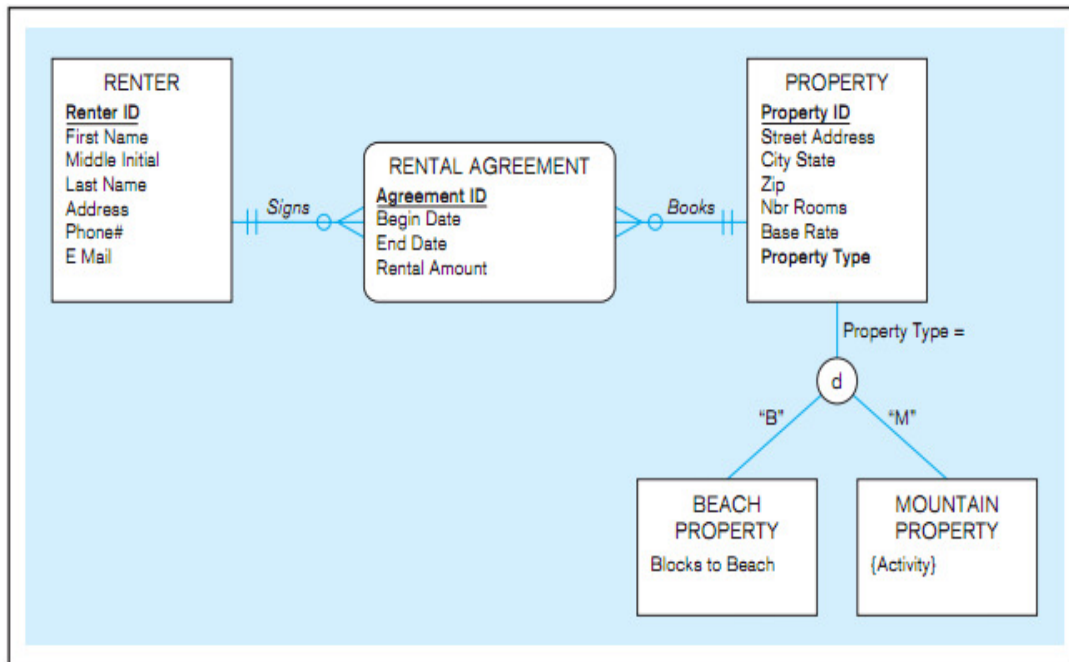
8. Transform the diagram into a relation. In addition, verify that the resulting relations are in 3NF.
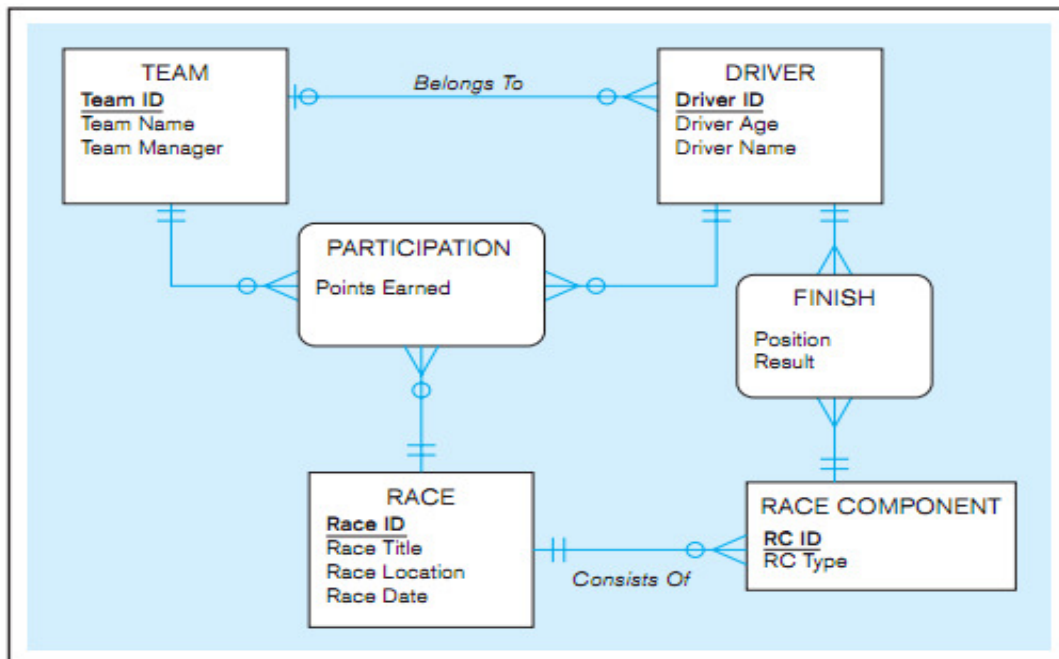
Tut 4 Solution

Exercise 1
Define each of the following terms:

a. *Determinant* The attribute on the left-hand side of the arrow in a functional dependency.

b. *Functional dependency* A constraint between two attributes or two sets of attributes.

c. *Transitive dependency* A functional dependency between two (or more) nonkey attributes.

d. *Recursive foreign key* A foreign key in a relation that references the primary key values of that same relation.

e. *Normalization* The process of decomposing relations with anomalies to produce smaller, well-structured relations.

f. *Composite key* A primary key that consists of more than one attribute.

g. *Relation* A named, two-dimensional table of data.

h. *Normal form* A state of a relation that results from applying simple rules regarding functional dependencies (or relationships between attributes) to that relation.

i. *Partial functional dependency* A functional dependency in which one or more nonkey attributes (such as Name) are functionally dependent on part (but not all) of the primary key.

j. *Enterprise key* A primary key whose value is unique across all relations.

k. Surrogate primary key: A serial number or other system assigned primary key for a relation.

Exercise 2.
f well-structured relation

e anomaly

a functional dependency

j determinant

g composite key

d 1NF

h 2NF

i 3NF

c recursive foreign key

k   relation

b transitive dependency

Exercise 3.

a. *Normal form; normalization* Normal form is a <u>state</u> of a particular relation regarding functional dependencies, while normalization is the <u>process</u> of decomposing relations with anomalies to produce smaller, well-structured relations.

b. *Candidate key; primary key* A primary key is an attribute (or combination of attributes) that uniquely identifies a row in a relation. When a relation has more than one such attribute (or combination of attributes), each is called a candidate key. The primary key is then the one chosen by users to uniquely identify the rows in the relation.

c. *Partial dependency; transitive dependency* A partial functional dependency exists when a nonkey attribute is functionally dependent on part (but not all) of a composite primary key; a transitive dependency is a functional dependency between two or more nonkey attributes.

d. *Composite key; recursive foreign key* A composite key is a primary key that consists of more than one attribute, while a recursive foreign key is a foreign key in a relation that references the primary key values of that same relation.

e. *Determinant; candidate key* A determinant is the attribute on the left-hand side of the arrow in a functional dependency, while a candidate key uniquely identifies a row in a relation.

f. *Foreign key*; *primary key* A primary key uniquely identifies each row in a relation, while a foreign key is a primary key in another table.

g. Enterprise key; surrogate primary key *An enterprise key is a primary key whose value is unique across all relations in the whole database and is likely to hold no business meaning. A surrogate primary key is a primary key whose value is a serial number or other system assigned value and is unique to the relation.*

Exercise 4.

3NF relations for Millennium College are:

OBJECT(<u>OID,</u>Object_Type)

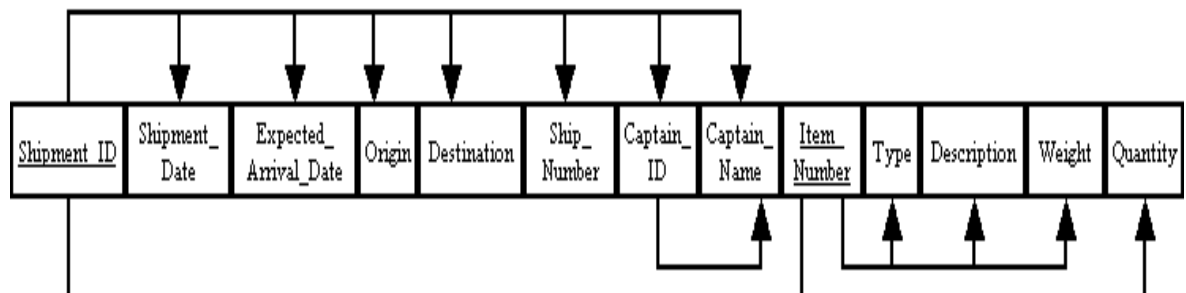INSTRUCTOR (<u>OID,</u> Instructor_Name, Instructor_Location)

COURSE (<u>OID</u>, Course_No, Course_Title, *Instuctor_Name*)
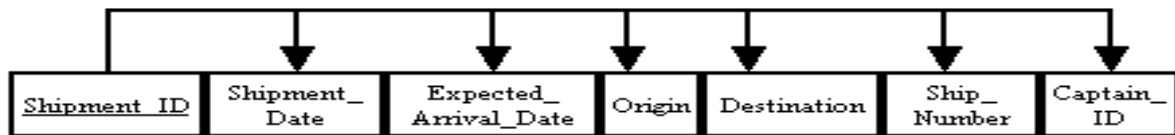
STUDENT (<u>OID,</u> Student_No, Student_Name, Major)

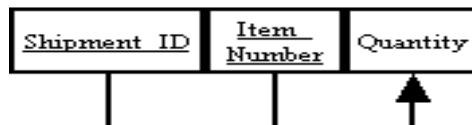OUTCOME (<u>OID</u>, *Student_No*, *Course_No*, Grade)
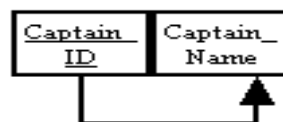
Exercise 5.

a. Shipment Manifest

Shipment_ID	Shipment_Date	Expected_Arrival_Date	Origin	Destination	Ship_Number	Captain_ID	Captain_Name	Item_Number	Type	Description	Weight	Quantity

3rd Norm:

Shipment

Shipment_ID	Shipment_Date	Expected_Arrival_Date	Origin	Destination	Ship_Number	Captain_ID

Shipment_Line

Shipment_ID	Item_Number	Quantity

Item

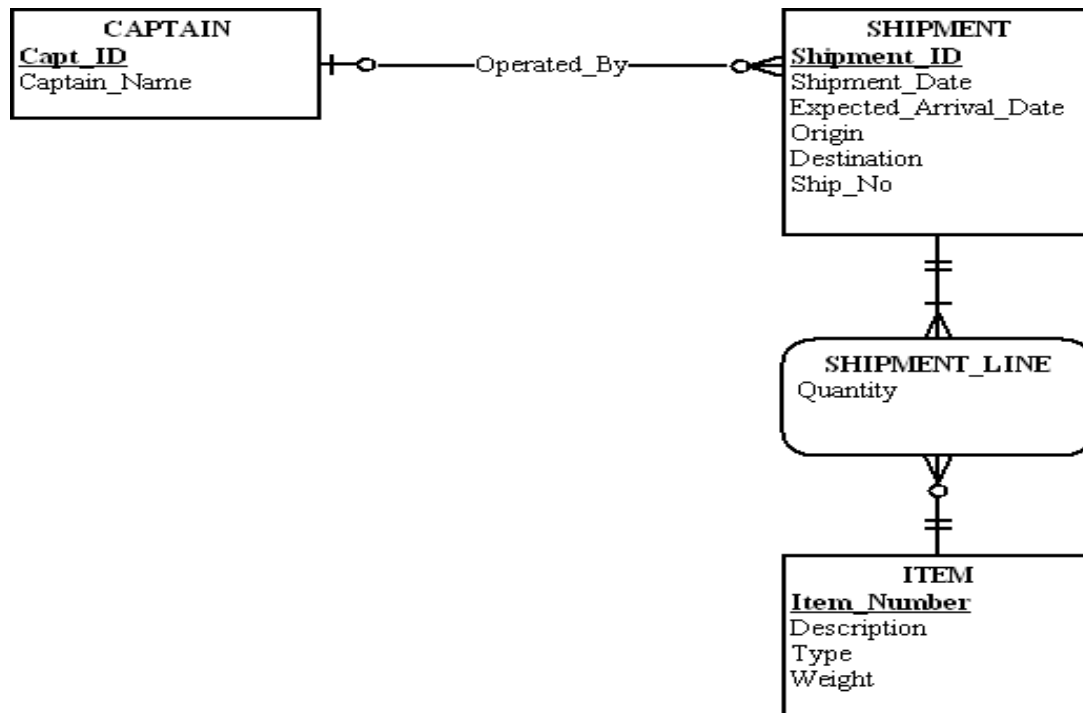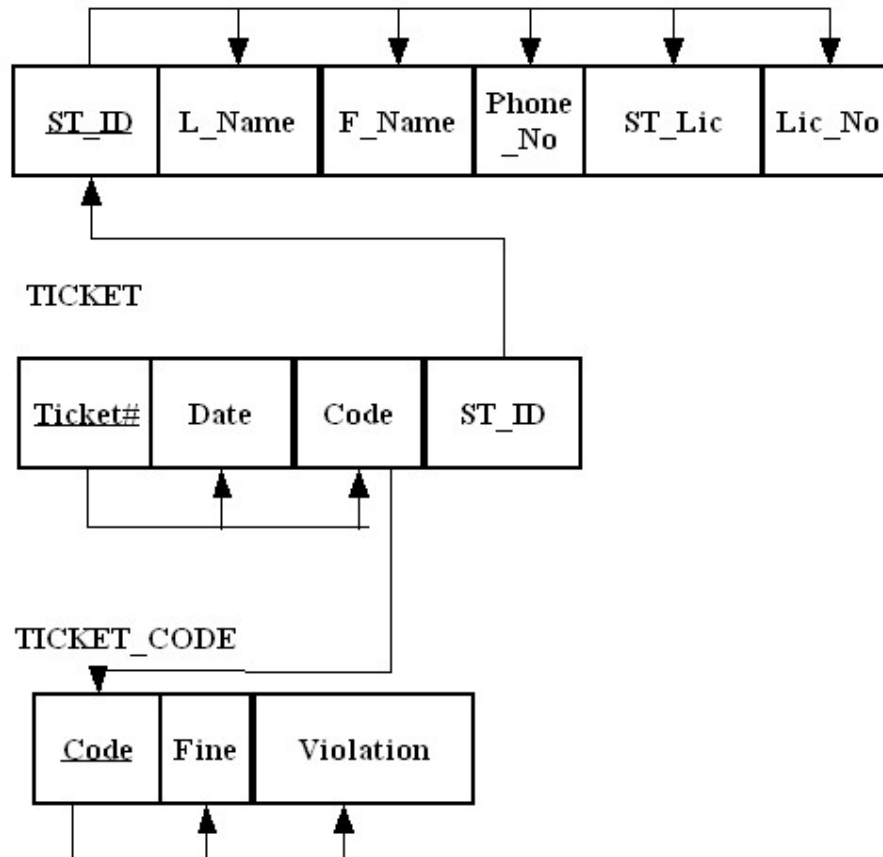| Item_Number	Type	Description	Weight

Captain

Captain_ID	Captain_Name

EER Diagram:

b. License Finement

STUDENT

Exercise 6.

Dependency Diagram

Material_ID	Material_Name	Unit_Of_Measure	Standard_Cost	Vendor_ID	Vendor_Name	Unit_Price	Terms_Code	Terms

3rd Norm:

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

EER:

MATERIAL
Material_ID
Material_Name
Unit_of_Measure
Standard_Cost

SuppliedBy
Unit_Price

VENDOR
Vendor_ID
Vendor_Name

Uses

TERM
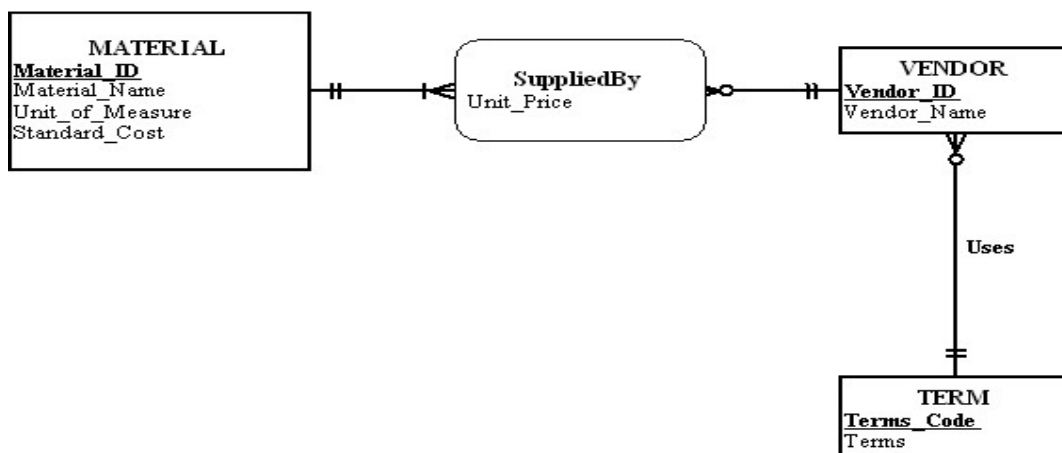**Terms_Code**
Terms

Exercise 7. See Tut 5 Solution

Exercise 8.

Team (**TeamID,** TeamName, Team Manager)

Participation (**RaceID, TeamID, DriverID,** PointsEarned)

Driver(**Driver_ID**,DriverAge,DriverName, TeamID)

Race (**RaceID,** RaceTittle, RaceLocation, RaceDate)

Finish(**DriverID, RC_ID,** Position,Result)

RaceComponent(**RC_ID,** RCType, Race_ID)