Solved Problems ERD (Review exercises Chapter 3)

Problem #1 The following is a description of some data requirements for a chain of pharmacies. Draw the appropriate entity-relationship (E-R) diagram. Clearly show all cardinality constraints, cardinality limits, and existence dependencies.

(a) A pharmaceutical company manufactures one or more drugs, and each drug is manufactured and marketed by exactly one pharmaceutical company.

(b) Drugs are sold in pharmacies. Each pharmacy has a unique identification. Every pharmacy sells one or more drugs, but some pharmacies do not sell every drug.

(c) Drug sales must be recorded by prescription, which are kept as a record by the pharmacy. A prescription clearly identifies the drug, physician, and patient, as well as the date it is filled.

(d) Doctors prescribe drugs for patients. A doctor can prescribe one or more drugs for a patient and a patient can get one or more prescriptions, but a prescription is written by only one doctor.

(e) Pharmaceutical companies may have long-term contracts with pharmacies and a pharmacy can contract with zero, one, or more pharmaceutical companies. Each contract is uniquely identified by a contract number.

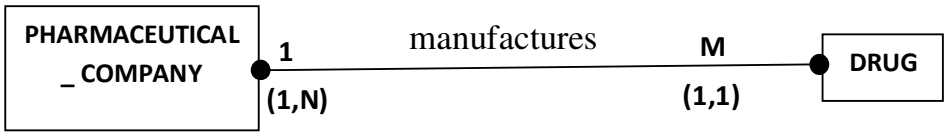
Solution:

Objective: a database that provides data about available drugs, pharmacies, prescriptions written to patients by doctors and prepared by physician, supplying pharmaceutical companies, contracts between companies and pharmacies, etc.

(a) A pharmaceutical company manufactures one or more **drugs**, and each drug is manufactured and marketed by exactly one **pharmaceutical company**.

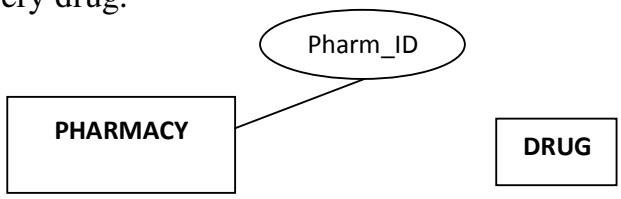
Entities:

Relationship type and cardinality: one to many 1:M between pharmaceutical company and drug

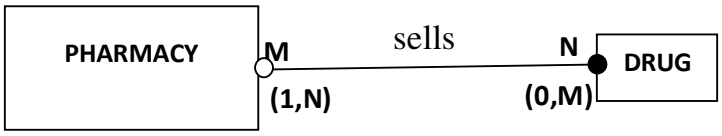


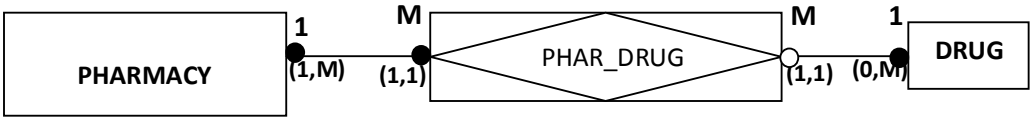
(b) Drugs are sold in pharmacies. Each **pharmacy** has a unique identification. Every pharmacy sells one or more **drugs**, but some pharmacies do not sell every drug.

Entities:



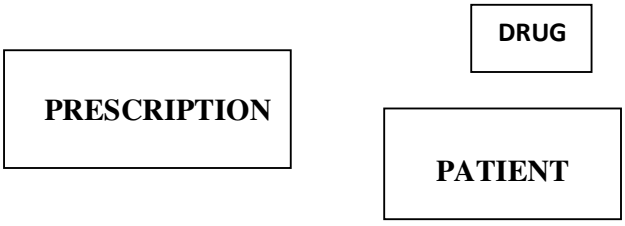
Relationship type and cardinality: many to many M:N between pharmaceutical company and drug



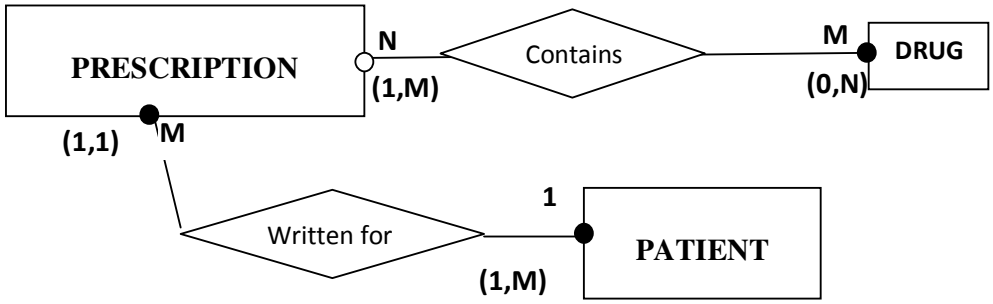


(c) Drug sales must be recorded by **prescription**, which are kept as a record by the pharmacy. A prescription clearly identifies the **drug**, physician, and **patient**, as well as the date it is filled.

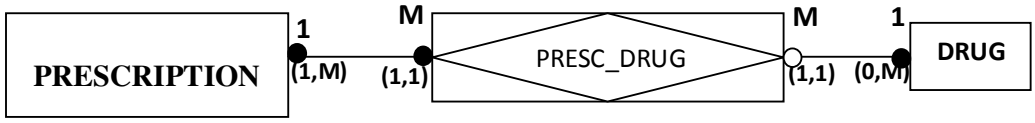
Entities:



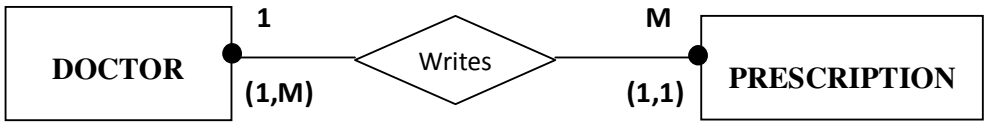
Relationship type and cardinality: many to many M:N between prescription and drug, and 1:M between prescription and patient



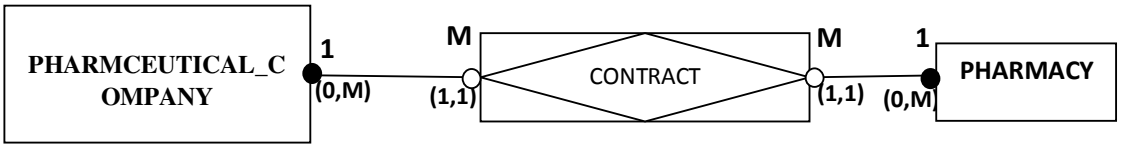
Many to many relationship between prescription and drug must be broken into two one to many through composite entity; say PRESCRIPTION_DRUG



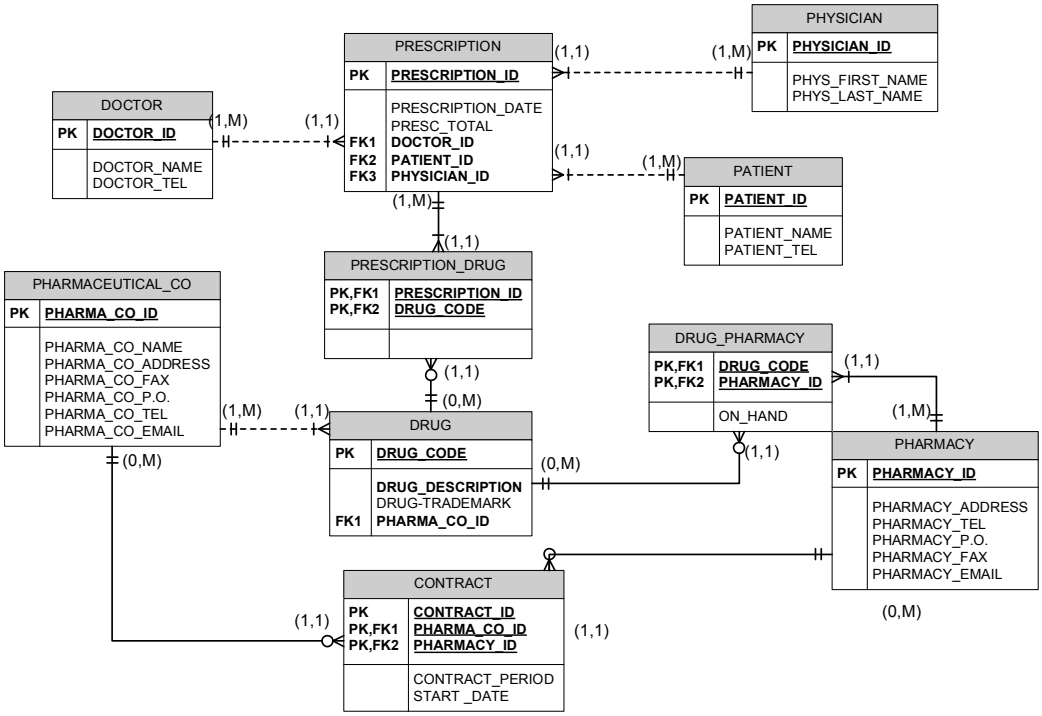
(d) **Doctors** prescribe drugs for patients. A doctor can prescribe one or more **drugs** for a **patient** and a patient can get one or more **prescriptions**, but a prescription is written by only one doctor.



(e) **Pharmaceutical companies** may have long-term contracts with pharmacies and a pharmacy can contract with zero, one, or more pharmaceutical companies. Each **contract** is uniquely identified by a contract number.



Now, the complete ERD with attributes is as follows:



Problem # 2: The ACME Machine Shop is a small job shop that does machining of components for that assembled finished products. The customers give ACME engineering drawings of parts and request production of parts from ACME as needed. The manager of the machine shop has used a database to try to organize some basic information on the customers' parts and their machining requirements as well as scheduling information based on orders. The tables and their design requirements are shown here. The meaning of the tables is as follows:

PART — The parts produced by ACME
PROCESS_PLAN — The operations that must be performed to manufacture the parts
MACHINE — The machines used to manufacture the parts
SCHEDULE — A set of production schedules for part manufacture

MACHINE

MACHINE_ID	MACHINE_DESC
M1	J&L Turret lathe
M2	#5 Milwaukee
M3	#4 Cross Turret
M4	Bridgeport Saw
M5	J&L Profiler
M6	Cincinnati Grinder
M7	Yamaguchi Drill
M8	Bridgeport Mill

PART

PART_NO	PART_DESC	MATERIAL_ID	PROCESS_PLAN_ID	DRAWING_NO
1002	Punch	RM201	PP250	402
1010	Rod	RM302	PP125	467
1011	Cam	RM210	PP101	219
1015	Plate	RM501	PP280	109
1020	Shaft	RM302	PP180	345
1022	Mounting Bracket	RM501	PP105	203

SCHEDULE

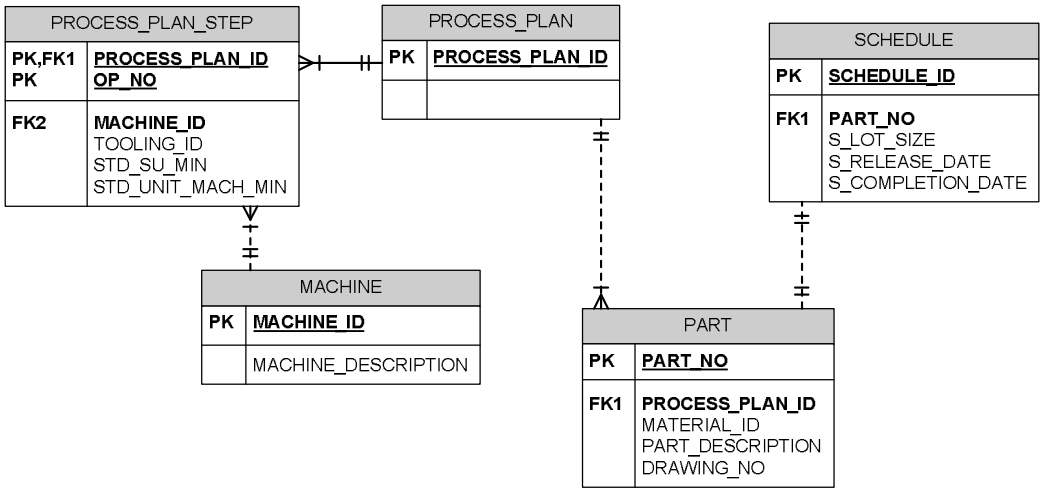
SCHEDULE_ID	PART_NO	S_LOT_SIZE	S_RELEASE_DATE	S_COMPLETION_DATE
S210	1011	20	4/1/06	4/2/06
S211	1002	15	4/1/06	4/3/06
S212	1015	25	4/2/06	4/5/06
S213	1020	10	4/2/06	4/5/06
S214	1022	12	4/2/06	4/6/06

PROCESS_PLAN

PROCESS_PLAN_ID	OP_NO	OP_DESC	MACHINE_ID	TOOLING_ID	STD_SU_MIN	STD_UNIT_MACH_MIN
PP101	1	cut round stock	M4	T210	2	2
PP101	2	profile cam	M5	T50	5	15
PP101	3	drill pin hole	M7	T101	3	2
PP105	1	cut bar stock	M4	T400	2	2
PP105	2	plane slot	M2	T25	5	20
PP105	3	drill mounting	M7	T102	3	2
PP125	1	cut round stock	M4	T210	2	2
PP125	2	turn round stock	M1	T202	10	20
PP125	3	finish grind	M6	T40	8	15
PP180	1	cut round stock	M4	T210	2	2
PP180	2	turn round stock	M1	T215	10	20
PP250	1	cut round stock	M4	T210	2	2
PP250	2	turn stock	M1	T215	10	25
PP250	3	taper angle	M3	T30	12	30
PP250	4	finish grind	M6	T40	8	15
PP280	1	cut plate stock	M4	T250	4	6
PP280	2	mill surface	M8	T602	12	25
PP280	3	drill holes	M7	T101	3	2

Develop a data model using Entity relationship diagram that includes the information about manufacturing elements: parts, process plan, machines, and production schedules

SOLUTION



3.4 Bikes-R-Us sells standard and customized bicycles over the Web. The company buys components from various vendors in its supply chain and assembles the components into bicycles. Standard bicycles are produced to inventory, while custom bicycles are only made to order. Bikes-R-Us wants to develop a database for certain parts of its business. The company needs an E-R diagram to use as a basis for a database design. Develop the E-R diagram from the following statements:

(a) Bikes-R-Us will keep track of materials. The materials are of two kinds: components and bikes.

(b) Materials are related to each other by their bill of material structure. Each bike requires M components. Each component may go into 1 or more bikes.

(c) Components are provided by vendors. A component must be ordered from one or more vendors. A vendor must provide one or more components.

(d) Inventoried material is known as a "material lot." A lot is a grouping of the same material either supplied by the same vendor (components) on a particular shipment or produced in
the same production run (bikes).

(e) A material lot may be provided by a vendor. When a material lot is provided by a vendor, it is associated with one and only one vendor. A vendor may have provided zero, one, or many material lots. Some material lots (e.g., bikes) are not provided by vendors.

(f) A warehouse location is a place where a material lot is stored. A material lot may be stored in more than one location. A warehouse location may have zero, one, or many material lots.

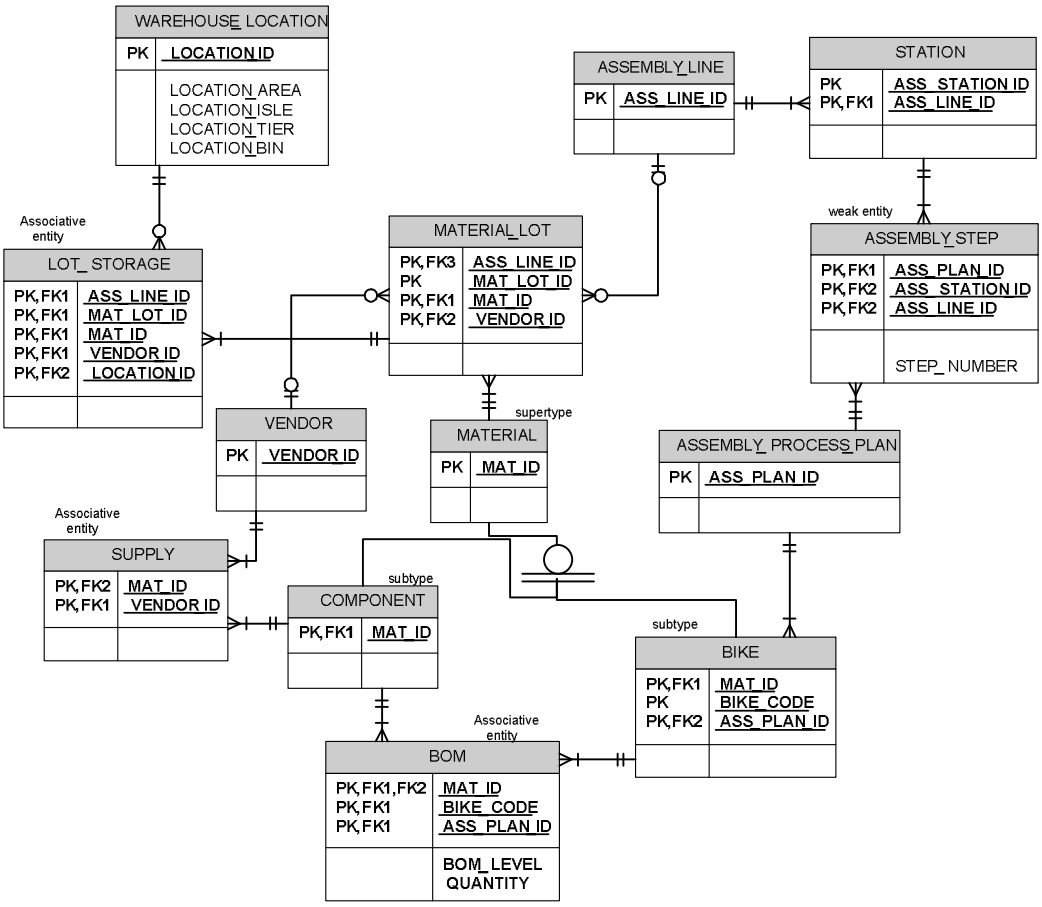
(g) A material lot may be produced on an assembly line. Each assembly line is associated with one or more material lots. Some material lots (e.g., components) are not produced on an assembly line.

(h) An assembly line is composed of stations. Each assembly line has one or more stations, and each station is associated with exactly one assembly line.

(i) An assembly process plan describes the steps by which a bike is assembled. Each bike has one assembly process plan, but the same assembly process plan may be used by more than one bike.

(j) Each assembly process plan has several steps. A step is associated with one process plan.

(k) Each process plan step is associated with a station, where that step is executed. Each step is associated with one and only one station. However, a station may be used in many process plan steps.



Solve the following problem:

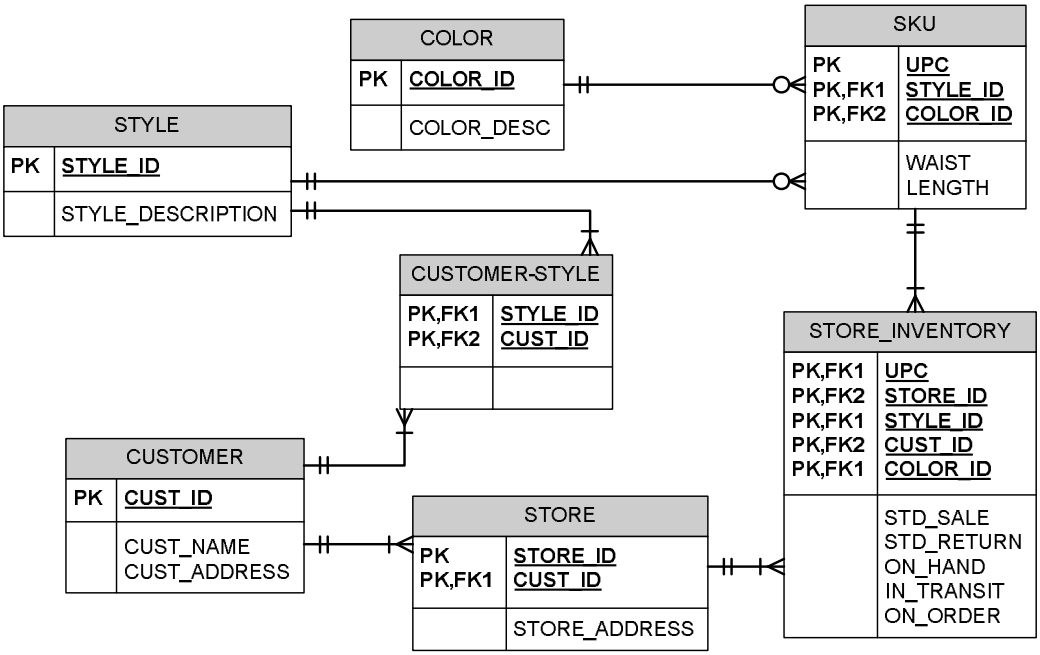
Pants-R-Us is an apparel industry innovator, designer, and producer of high-quality branded and retailer private label pants. It sells its products to major retailers who distribute through their own stores in major cities and shopping malls. The primary product lines feature dress and casual pants for men and women. The products are marketed under widely recognized national brands.

Pants-R-Us is in the process of designing a database system. The following information is provided to design the entity-relationship model for the database.

(a) Develop the entities and relationships that correspond to the following rules:
(1) Pants-R-Us classifies its product line as "Styles." Each style is a design classification for a stock-keeping unit (SKU) where the SKU is the basic style in a particular color, waist, and length. Each style may have zero, one, or many SKUs, but an SKU is a member of only one style category.
(2) Pants-R-Us has created several unique colors for its pants. Each color is uniquely identified by a color_id. A color may be used in zero, one, or more SKUs, but each SKU has only one color. Some colors have been created that have not been assigned to an SKU and may never be used.
(3) The retailers who sell the products are the customers of Pants-R-Us. Customers will contract with Pants-R-Us based on styles it will distribute. A customer may distribute one or more styles for Pants-R-Us, and a particular style may be distributed by more than one customer.
(4) Customers have stores, which is the place where they sell the pants and other products. A customer may have one or more stores. To identify a store in the Pants-R-Us database for shipping purposes, all customers have agreed to provide their store_id to Pants-R-Us.
(5) SKUs are inventoried at the stores of the customers. A store will inventory one or more SKUs and each SKU may be inventoried in zero, one or more stores.

b) The following is a list of attributes. Assign each attribute to the appropriate entities. If a composite entity has to be introduced in order to assign an attribute, name that composite entity. Indicate which attributes are key attributes.
STYLE_ID — A unique identifier of a style of pants
STYLE_DESCRIPTION — A description of a style (e.g., "Loose Fit Denim," or "Pleated Cuffed Pants")
CUST_ID — Unique identifier of a customer of Pants-R-Us
CUST_NAME — The name of the company that is the customer
CUST_ADDRESS — The address of the company that is the customer
STORE_ID — The identifier of the customer's store as provided by the customer
STORE_ADDRESS — The address of the store
COLOR_ID — Unique identifier of a color
COLOR_DESC — Description of a color (e.g., navy, indigo, stone)
UPC — Universal product code, which is a unique identifier of an SKU
WAIST — The waist dimension of an SKU
LENGTH — The length dimension of an SKU
Pants-R-Us will receive actual point-of-sales data by SKU from the customers' stores and keeps track of the stores' inventory positions.
STD_SALES — Customer sales to date from the store location
STD_RETURNS — Cumulative returns to date from the store
ON_HAND — The amount of On_Hand units of inventory of an SKU in a store
IN_TRANSIT — The number of units of inventory of an SKU that has been shipped to a store but not yet received
ON_ORDER — The number of units of an SKU ordered by a store but not yet shipped

SOLUTION


COLOR
PK
COLOR_ID
COLOR_DESC
SKU
PK
PK,FK1
PK,FK2
UPC
STYLE_ID
COLOR_ID
WAIST
LENGTH
STYLE
PK
STYLE_ID
STYLE_DESCRIPTION
CUSTOMER-STYLE
PK,FK1
PK,FK2
STYLE_ID
CUST_ID
STORE_INVENTORY
PK,FK1
PK,FK2
PK,FK1
PK,FK2
PK,FK1
UPC
STORE_ID
STYLE_ID
CUST_ID
COLOR_ID
STD_SALE
STD_RETURN
ON_HAND
IN_TRANSIT
ON_ORDER
CUSTOMER
PK
CUST_ID
CUST_NAME
CUST_ADDRESS
STORE
PK
PK,FK1
STORE_ID
CUST_ID
STORE_ADDRESS