DB 101 Data Management

Case Study – JustBuy Retail Store

JustBuy is a retail store chain that uses a point-of-sale system for grocery store chains. Point-of-sale systems are those systems that record sale transactions at cash counters in computerized stores. Following are the classes identified after discussion with JustBuy.

S. No.	Class Name	Class Description
1.	Store	Contains the information about the store such as the name of the store, address, etc.
2.	Product	Represents information about products available at the store. Contains information such as name of the product, price, and so on. Every product has a unique product identifier called SKU. There is no separate barcode value; the SKU gets printed on the barcode as well. Every product may be classified into one or more categories. Not all products are available in all the stores.
3.	Category	Contains information such as the name of the category and category description.
4.	Stock	Stock information is maintained for every product. The information maintained includes quantity in shelf, quantity in storage, reorder threshold.
5.	Shelf_Location	This class contains information about the hierarchical layout of the store in terms of floors, aisles, and shelves. The floor plan helps the customers and store employees in identifying the exact location of a given product.
6.	Bill	This corresponds to the overall bill of items purchased by a customer. Information about the date of purchase, total bill value, etc. are included as part of the bill information.
7.	Bill_Item	A bill is comprised of several bill items. The information about the product purchased, the quantity purchased and total price are captured as part of this class.
8.	Payment	Customers can settle bills by paying with cash or credit card.

Sample Data

JustBuy retail store chain has 4 stores in Bangalore (e-city, Koramangala, Jayanagar, MG Road). The E-city store is actually a stationery shop that sells pens, pencils, highlighters and printing paper. For some reason, the Jayanagar store sells only tomatoes and onions (perishable category) and hair oil (cosmetics category). Both the Koramangala and MG Road shops sell only bread, biscuits, cheese (bakery category) and jeans and T-shirt (apparel category). Jack and Jake are room mates and decide to do some shopping. Jack buys 2 kgs each of tomatos and onions from Jayanagar store at Rs. 20 per kg. Jake buys a two T-shirts from Koramangala for Rs. 250. Jack pays by cash while Jake uses credit card for the purchase.

Answer the following

A) Draw the complete object-oriented schema for given problem statement using the UML class diagram notation.

Note:
All the classes mentioned above must (mandatory) appear in the final UML schema. You may add additional association classes where needed. Add natural attributes to classes based on the given description for all the classes

B) Map the UML schema to a relational schema. The relational schema should strictly follow the mapping rules discussed in the class. After doing OR mapping, every table in the relational schema should be shown in the following example format:

Table name = EMPLOYEE

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
EMP_ID	Number	PK, Surrogate
Emp_Name	String	NOT NULL
Dept_ID	Number	FK references Department.Dept_ID, NOT NULL

Note:

- *Every table should contain only those columns that are either present in the UML schema or is introduced for the purpose of OR mapping. Do NOT introduce new attributes in the relational schema without a proper reason!*

C) Convert the sample narrative data given in "**Sample Data**" into actual table data as per the relational schema designed in (B) above. For every table, show the sample data in simple tabular form as shown in the following example:

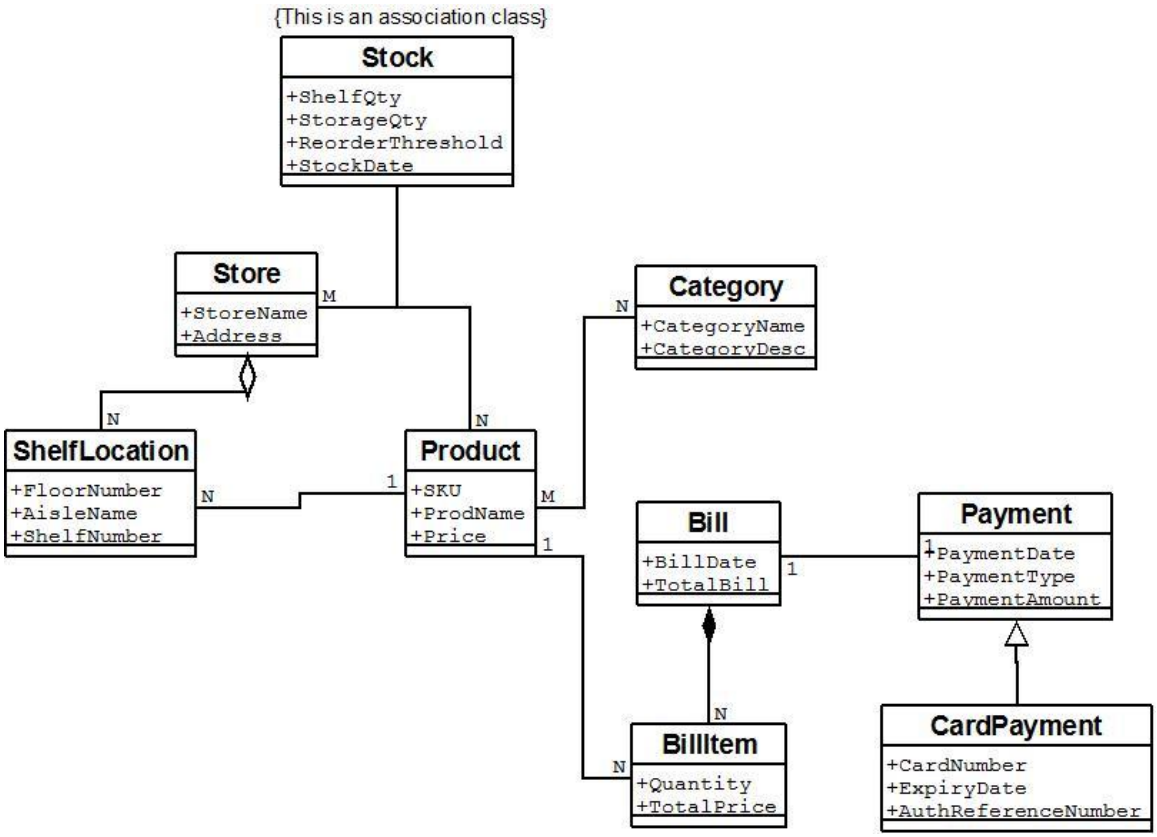
Employee

Employee_Id	Name	Age	Dept_Id
394873	John Doe	34	D01
353636	Jane Doe	35	D01

Note:
*Every piece of information specified under the "**Sample Data**" section must collectively find a place in the relational database you have designed.*

Solution

UML Diagram



Tables:

Table Name: Store

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
Store_ID	Number	PK, Surrogate
StoreName	String	
Address	String	

Table Name: Category

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
Category_ID	Number	PK, Surrogate
CategoryName	String	
CategoryDesc	String	

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Table Name: ShelfLocation

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
ShelfLocation_ID	Number	PK, Surrogate
FloorNumber	String	
AisleNumber	String	
ShelfNumber	String	
Store_ID	Number	FK References Store(Store_ID) NOT NULL
Product_ID	Number	FK References Product(Product_ID) NOT NULL

Table Name: Product

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
Product_ID	Number	PK, Surrogate
SKU	String	
ProdName	String	
Price	Number	

Table Name: Bill

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
Bill_ID	Number	PK, Surrogate
BillDate	Date	
TotalBill	Number	

Table Name: BillItem

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
BillItem_ID	Number	PK, Surrogate
Quantity	Number	

TotalPrice	Number	
Bill_ID	Number	FK References Bill(Bill_ID) NOT NULL ON DELETE CASCADE
Product_ID	Number	FK References Product(Product_ID) NOT NULL

Table Name: Payment

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
Payment_ID	Number	PK, Surrogate
PaymentDate	Date	
PaymentType	String	CHECK ('CASH', 'CARD')
PaymentAmount	Number	
Bill_ID	Number	FK References Bill(Bill_ID) NOT NULL

Table Name: CardPayment

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
Payment_ID	Number	PK FK References Payment(Payment_ID)
CardNumber	Number	
ExpiryDate	Date	
AuthRefNum	String	

Table Name: Stock

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
StoreProduct_ID	Number	PK, Surrogate
Store_ID	Number	FK References Store(Store_ID)
Product_ID	Number	FK References Product(Product_ID)
ShelfQty		
StorageQty		
ReorderThreshold	Number	
StockDate	Date	

Composite key

Table Name: Product_Category

Name of column	Data type	Constraints (PK, FK, Surrogate, UNIQUE, NOT NULL, etc.)
ProductCategory_ID	Number	PK, Surrogate
Product_ID	Number	FK Product(Product_ID) NOT NULL
Category_ID	Number	FK References Category(Category_ID) NOT NULL

Composite key

SAMPLE DATA

JustBuy retail store chain has 4 stores in Bangalore (e-city, Koramangala, Jayanagar, MG Road). The E-city store is actually a stationery shop that sells pens, pencils, highlighters and printing paper. For some reason, the Jayanagar store sells only tomatoes and onions (perishable category) and hair oil (cosmetics category). Both the Koramangala and MG Road shops sell only bread, biscuits, cheese (bakery category) and jeans and T-shirt (apparel category). Jack and Jake are room mates and decide to do some shopping. Jack buys 2 kgs each of tomatos and onions from Jayanagar store at Rs. 20 per kg. Jake buys a two T-shirts from Koramangala for Rs. 250. Jack pays by cash while Jake uses credit card for the purchase.

Sample data
Table Name: Store

Store_ID	StoreName	Address
1	JustBuy	E-city
2	JustBuy	Koramangala
3	JustBuy	Jayanagar
4	JustBuy	MG Road

Table Name: Category

Category_ID	CategoryName	CategoryDesc
1	stationery	pens, pencils, highlighters and printing paper
2	perishable	tomatoes and onions
3	cosmetics	hair oil
4	bakery	bread, biscuits, cheese
5	apparel	jeans and T-shirt

Table Name: ShelfLocation (Floor, aisle and shelf number can be taken randomly)

ShelfLocation_ID	FloorNumber	AisleNumber	ShelfNumber	Store_ID	Product_ID
1	1	201	101	1	1
2	1	202	102	1	2
3	2	201	101	1	3
4	3	201	102	1	4
5	1	101	103	2	8
6	1	102	102	2	9
7	2	201	101	2	10
8	3	201	101	2	11

9	3	201	101	2	12
10	1	201	101	3	5
11	1	201	104	3	6
12	2	101	103	3	7
13	1	101	103	4	8
14	1	102	102	4	9
15	2	201	101	4	10
16	3	201	101	4	11
17	3	201	101	4	12

Table Name: Product (SKU can be taken randomly)

Product_ID	SKU	ProdName	Price (* marked are prices mentioned in question)
1	PD001	pens	10
2	PD002	pencils	2
3	PD003	highlighters	40
4	PD004	printing paper	100
5	PD005	tomatoes	20 *
6	PD006	onions	20 *
7	PD007	hair oil	50
8	PD008	bread	15
9	PD009	biscuits	20
10	PD010	cheese	45
11	PD011	jeans	1000
12	PD012	T-shirt	250 *

Table Name: Bill (Billdate can be taken randomly)

Bill_ID	BillDate	TotalBill
1	10/10/11	80
2	11/11/11	500

Table Name: BillItem

BillItem_ID	Quantity	TotalPrice	Bill_ID	Product_ID
1	2	40	1	5
2	2	40	1	6
3	2	500	2	12

Table Name: Payment (Payemntdate can be taken randomly)

Payment_ID	PaymentDate	PaymentType	PaymentAmount	Bill_ID
1	10/10/11	cash	80	1
2	11/11/11	card	500	2

Table Name: CardPayment (Card number, expiry date, authrefnum can be taken randomly)

Payment_ID	CardNumber	ExpiryDate	AuthRefNum
2	123456789	11/11/18	DF101

Table Name: Stock (Shelfqty,storageqty,reorder threshold, stockdate can be taken randomly)

StoreProduct_ID	Store_ID	Product_ID	ShelfQty	StorageQty	ReorderThreshold	StockDate
1	1	1	5	100		
2	1	2	5	100		
3	1	3	5	100		
4	1	4	5	100		
5	2	8	5	100		
6	2	9	5	100		
7	2	10	5	100		
8	2	11	5	100		
9	2	12	5	100		
10	3	5	5	100		
11	3	6	5	100		
12	3	7	5	100		
13	4	8	5	100		
14	4	9	5	100		
15	4	10	5	100		
16	4	11	5	100		
17	4	12	5	100		

Table Name: Product_Category

ProductCategory_ID	Product_ID	Category_ID
1	1	1
2	2	1
3	3	1

4	4	1
5	5	2
6	6	2
7	7	3
8	8	4
9	9	4
10	10	4
11	11	5
12	12	5