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## Introduction

I was assigned a project for a customer to build a normalized relational data model that describes the primary business processes of the **Zozo Company**. The sales department of this company decided to develop a database that contains details of their sales processes. After conducting research within the company's documentation, the company's database team had provided requirements for the desired database. What will be developed are conceptual, logical, and physical diagrams that follow their business rules as well as other important information such as schemas, example tables for entity attributes, and integrity constraints diagrams.

## Project Description and Requirements

The initial entities for the model are REGION, STORE, PRODUCT, CUSTOMER, and VENDOR. With these entities provided, I was also given several business rules to follow that will capture the required data.

- For each **product** being sold: a product ID, product name, and price;
- For each **category** of product: category ID and category name;
- For each **vendor**: vendor ID and vendor name;
- For each **customer**: customer ID, name, and zip code
- For each **store**: store ID and zip code;
- For each **region**: region Id and region name;
- For each sales transaction; transaction ID and date of transaction;
- Each product is supplied by exactly one vendor. Each vendors supplies one or more products
- Each product belongs to exactly one category. Each category contains one or more products
- Each store is located in exactly one region. Each region contains one or more stores
- Each **sales transaction** involves exactly one **customer**. Each **customer** can be involved in one or more transactions
- Each **product** is included in one or more **sales transactions**. Each **sales transaction** includes one or more **products**
- For each **instance** of a product included in a sales transaction, the quantity of that product included (sold) in that transaction is required
- Each customer is shopping in many stores. Each store has many customers.
- Each store contains many products. Each product contained in many stores

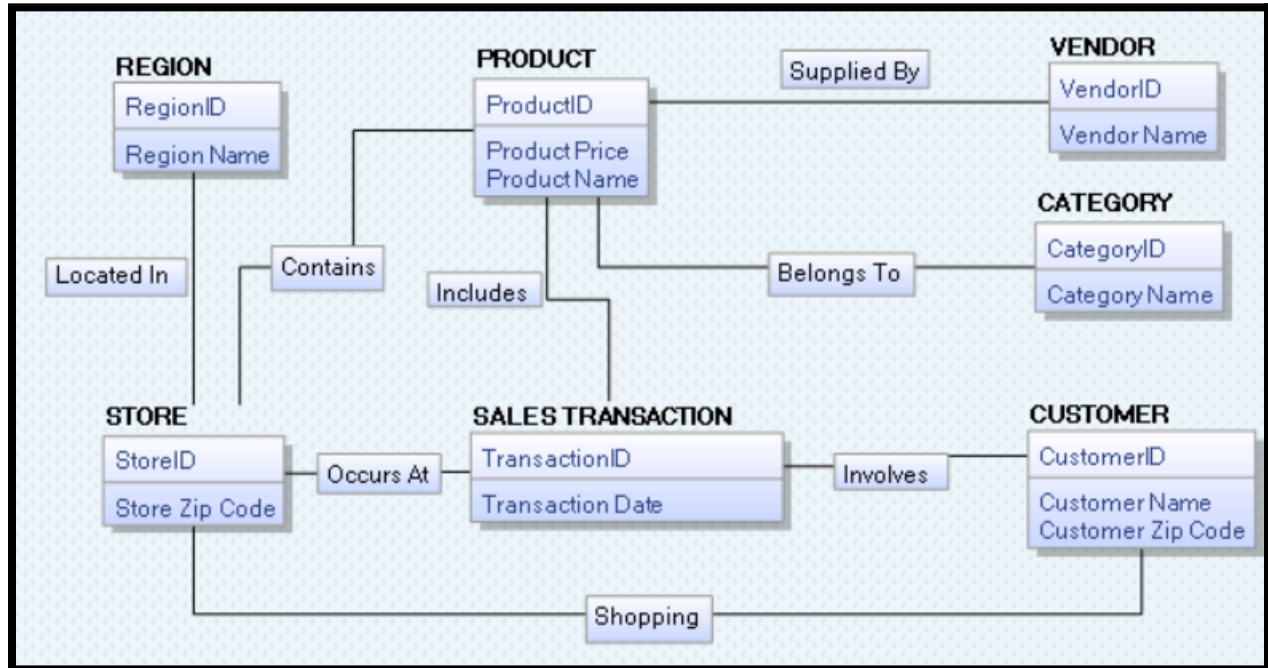
### Attributes, Keys, Null/Not Null, Data type Table

Entity	Key	Attribute	Data Type	Null/Not Null	Example Instance
REGION	Primary Key	Region ID	INTEGER	Not Null	1245
		Region Name	CHAR	Null	Northeast
STORE	Primary Key	Store ID	INTEGER	Not Null	54321
	Foreign Key	Region ID	INTEGER	Not Null	12345
		Store Zip Code	CHAR	Not Null	91711
SALES TRANSACTION	Primary Key	Transaction ID	INTEGER	Not Null	10005
	Foreign Key	Customer ID	INTEGER	Not Null	20001
	Foreign Key	Store ID	INTEGER	Not Null	54321
		Transaction Date	DATE	Not Null	2/29/2024
INCLUDED	Primary Key	Product ID	INTEGER	Not Null	10007
	Primary Key	Transaction ID	INTEGER	Not Null	10005
		Quantity	INTEGER	Not Null	22
PRODUCT	Primary Key	Product ID	INTEGER	Not Null	10007
	Foreign Key	Category ID	INTEGER	Not Null	10101
	Foreign Key	Vendor ID	INTEGER	Not Null	70007
		Product Price	MONEY	Not Null	50.75
		Product Name	CHAR	Null	Hammer
VENDOR	Primary Key	Vendor ID	INTEGER	Not Null	70007
		Vendor Name	CHAR	Null	Poly Depot
CATEGORY	Primary Key	Category ID	INTEGER	Not Null	10101
		Category Name	CHAR	Null	Tools and Hardware
CUSTOMER	Primary Key	Customer ID	INTEGER	Not Null	20001
		Customer Name	CHAR	Null	Dylan Gonzalez
		Customer Zip Code	CHAR	Not Null	91711
CONTAINS	Primary Key	Store ID	INTEGER	Not Null	2001
	Primary Key	Product ID	INTEGER	Not Null	1010
		Supplied	INTEGER	Not Null	30
SHOPPING	Primary Key	Store ID	INTEGER	Not Null	2001
	Primary Key	Customer ID	INTEGER	Not Null	10101
		Amount	INTEGER	Not Null	100

#### Description

This table describes each entity's attributes, key, data type, and whether or not data is required (not null) or optional (null) followed by an example instance.

## Conceptual ERD

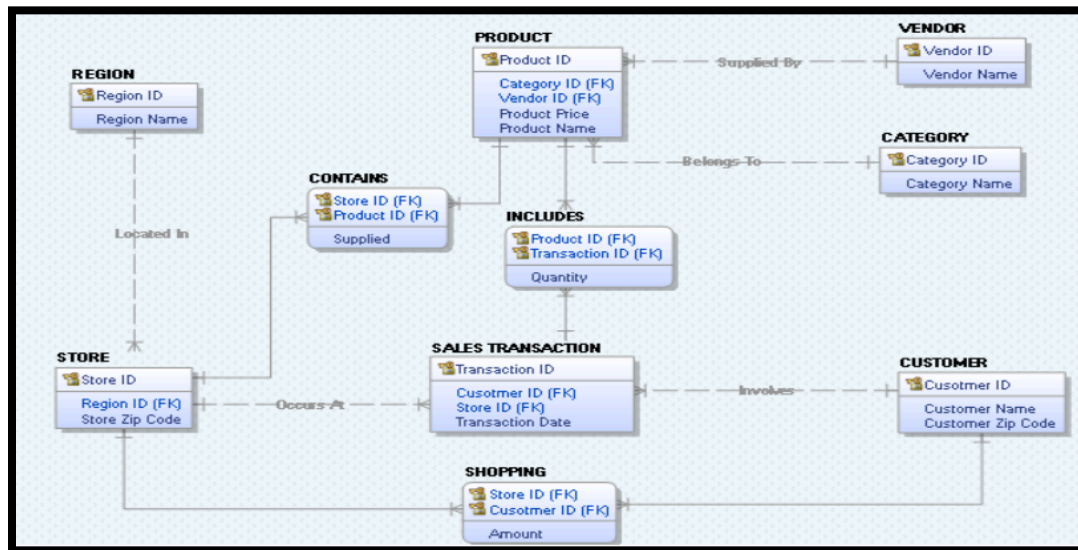


### Description

This conceptual diagram is the basic entity relationship diagram for the company that will be the basis for upcoming models, logical and physical. Each entity has been made according to the company's business rules followed by a connection that describes its relationship.

- Region is located in Store
- Sales Transaction occurs at Store
- Sales Transaction involves Customer
- Sales Transaction includes Product
- Product is supplied by Vendor
- Product belongs to Category
- Customer is Shopping at Store
- Store contains Product

## Logical ERD



### Description

The logical diagram includes the primary keys and foreign keys, if any, for each entity that was created. The primary key for an entity is indicated by the small key and lock image next to each name and each foreign key is denoted as "FK". Each dashed line indicates a non-identifying relationship which describes the relationship of two entities not relying on one another for their identity. This shows that the entities can be independent of each other.

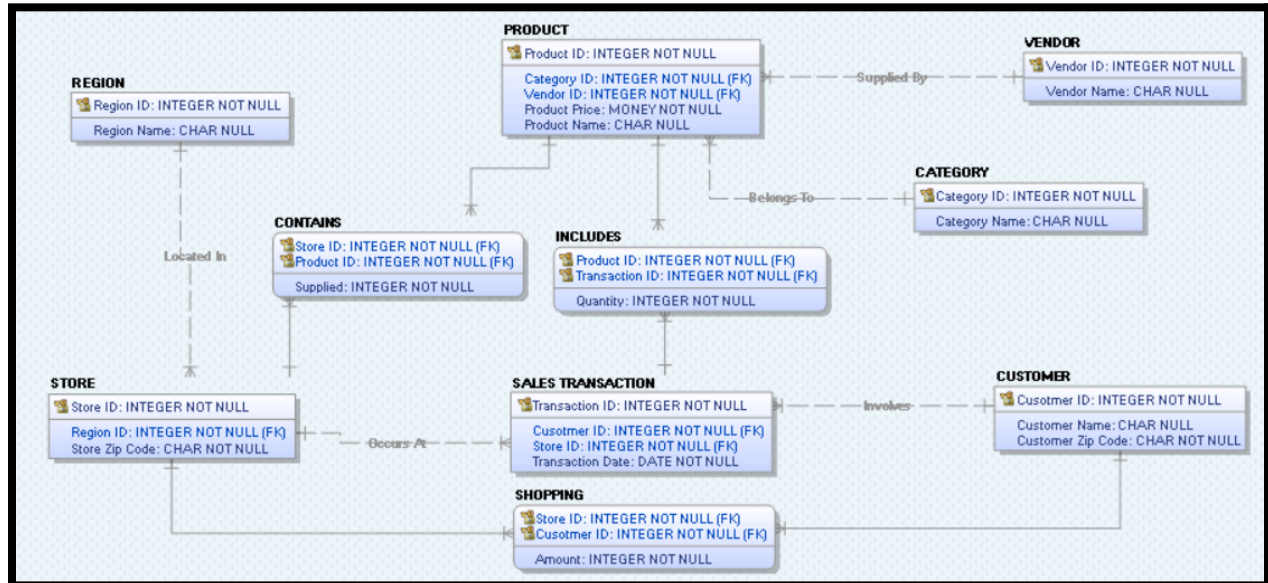
- Store is located in exactly one Region
- Sales Transaction occurs in one Store
- Sales Transaction involves exactly one Customer
- Sales Transaction includes one or more Products
- Product is supplied by exactly one Vendor
- Product belongs to exactly one Category
- Store is supplied by Product
- Customer amount at Store

## **Additional Business Rules**

Additional business rules were added due to the many-to-many relationship between PRODUCT and TRANSACTION entities. These business rules are;

- For each product that is included in a transaction, there are one or more quantities that have been sold. For each quantity(ies) included, there is exactly one product
- For each transaction that is included in the product, there are one or more quantities that have been recorded (sold). For quantity(ies) included, there is exactly one transaction made

## Physical ERD (Erwin)

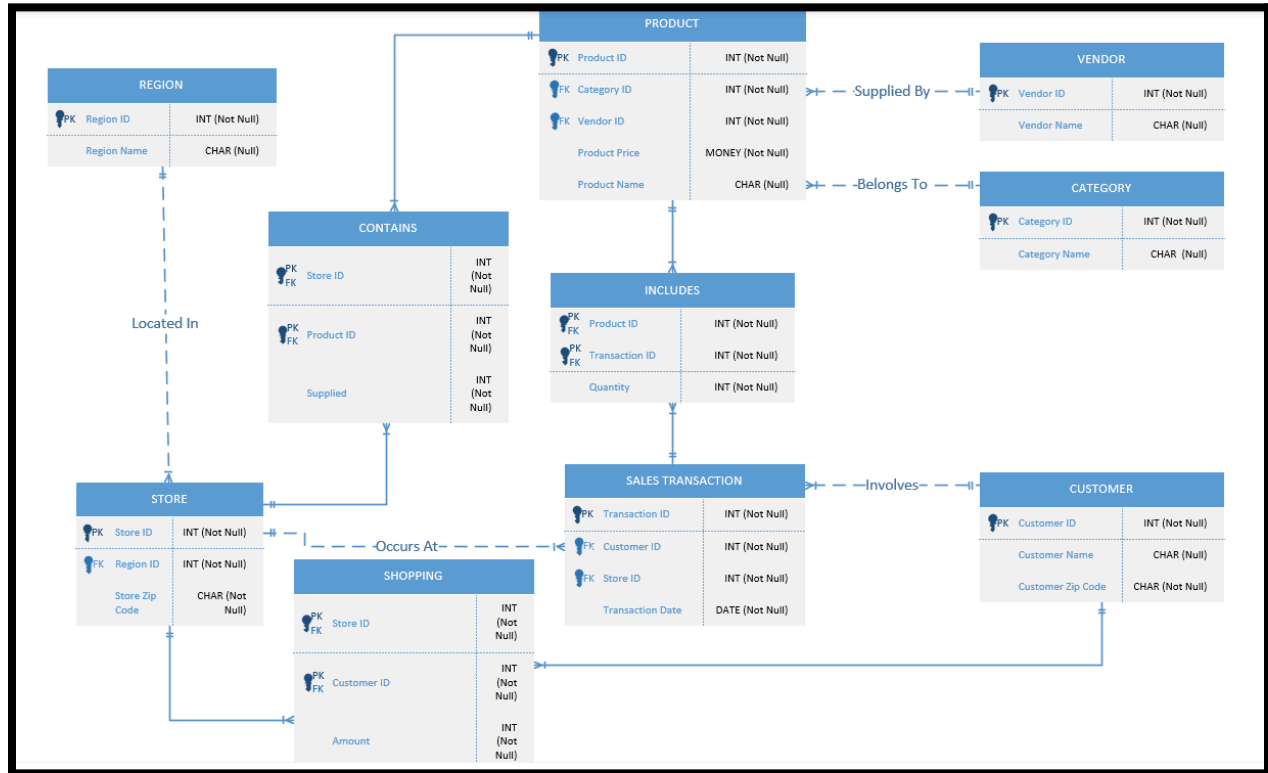


### Description

The physical diagram, modeled in Erwin Data Modeler, displays the data types (CHAR, INTEGER, MONEY, and DATE) and null/ not null types as well. The *null* data type allows the attribute to have data inputted or not while the *not null* data type indicates that the attribute needs data to be inputted.



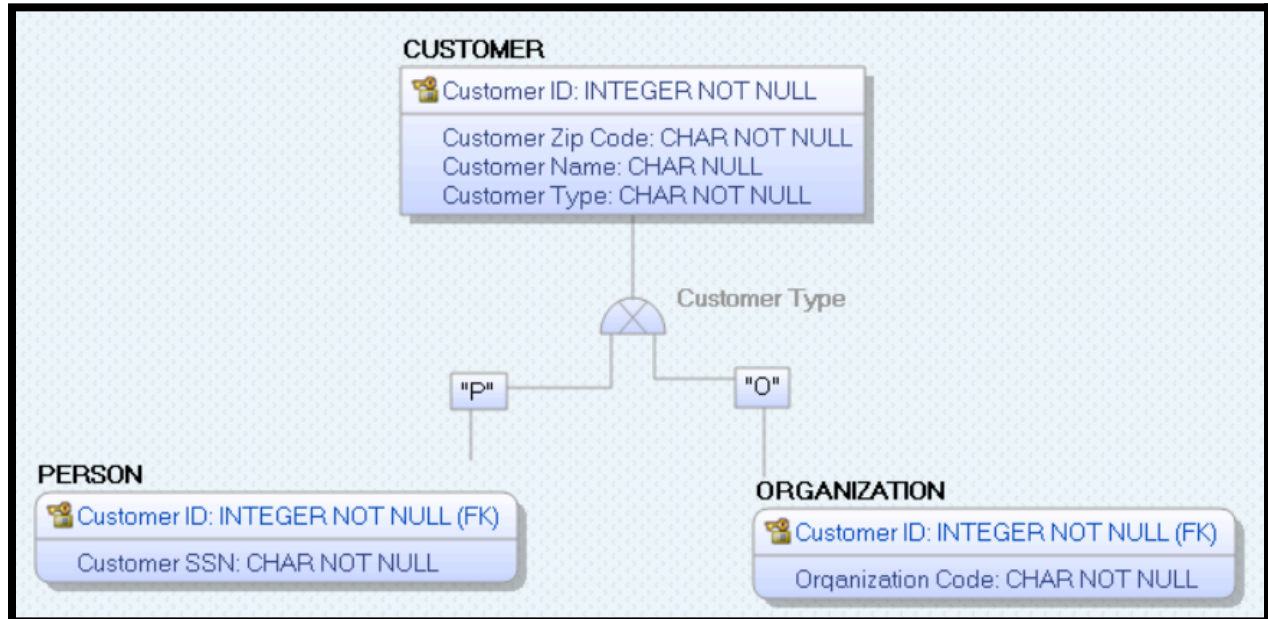
## Physical ERD (Visio)



### Description

The physical diagram, modeled in Microsoft Visio, was made from the Erwin Data model on the previous page. It contains the same entities, attributes along with their data types, and primary or foreign keys. The presentation is a little different from Erwin, but a bit more concise in reading the descriptions for each entity.

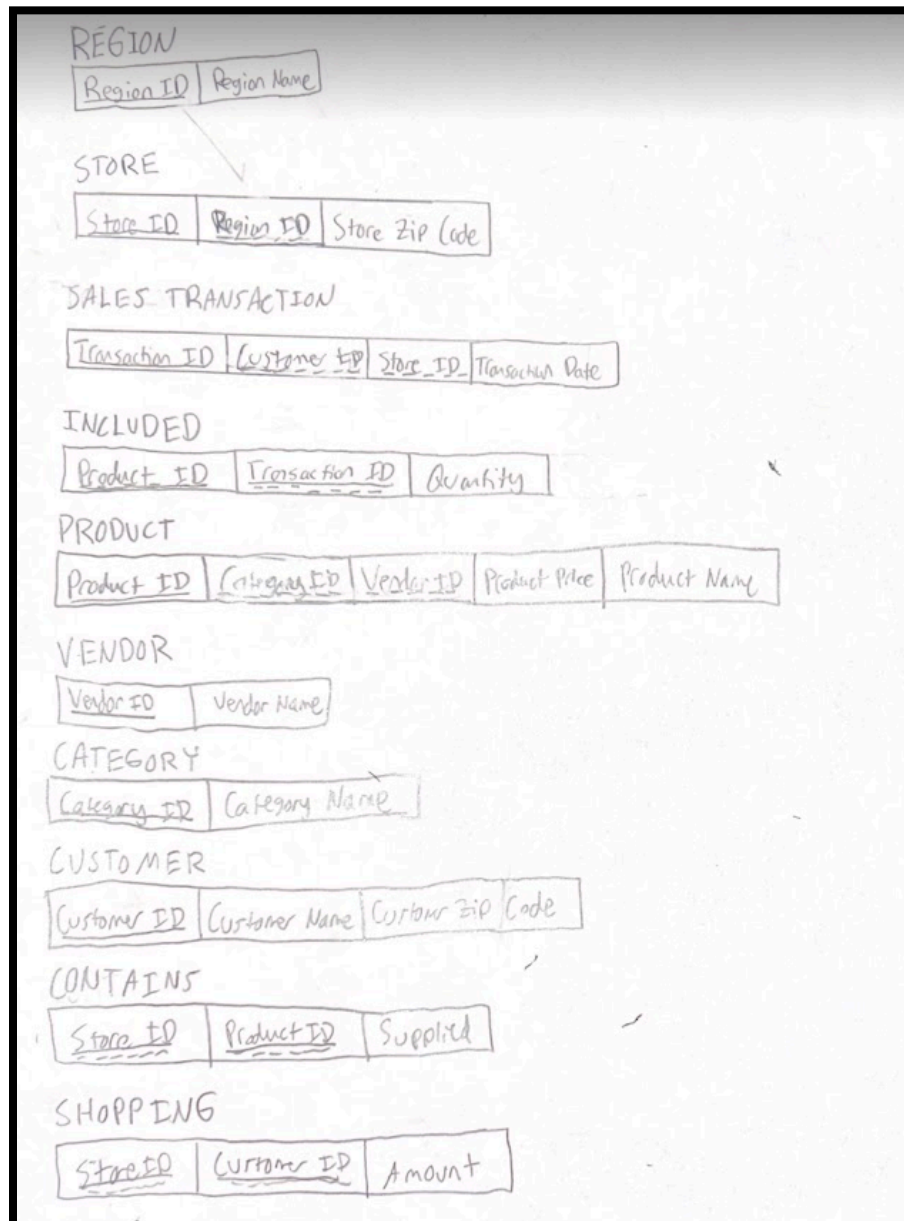
## Supertype Model (Erwin)



### Description

Created one super/subtype entity that describes the type of customer the Zozo Company gets. The customers that the company could get are either a person or an organization. The customer (supertype) has to be one of the subtypes, person ("P") or organization ("O"), which is specialization. The disjoint rule is applied which indicates that the customer can not be both a person and an organization. If the customer is a person, they are required to have a customer social security number (SSN). If the customer is an organization, they are required to have an organization code.

## Schema for All Relations



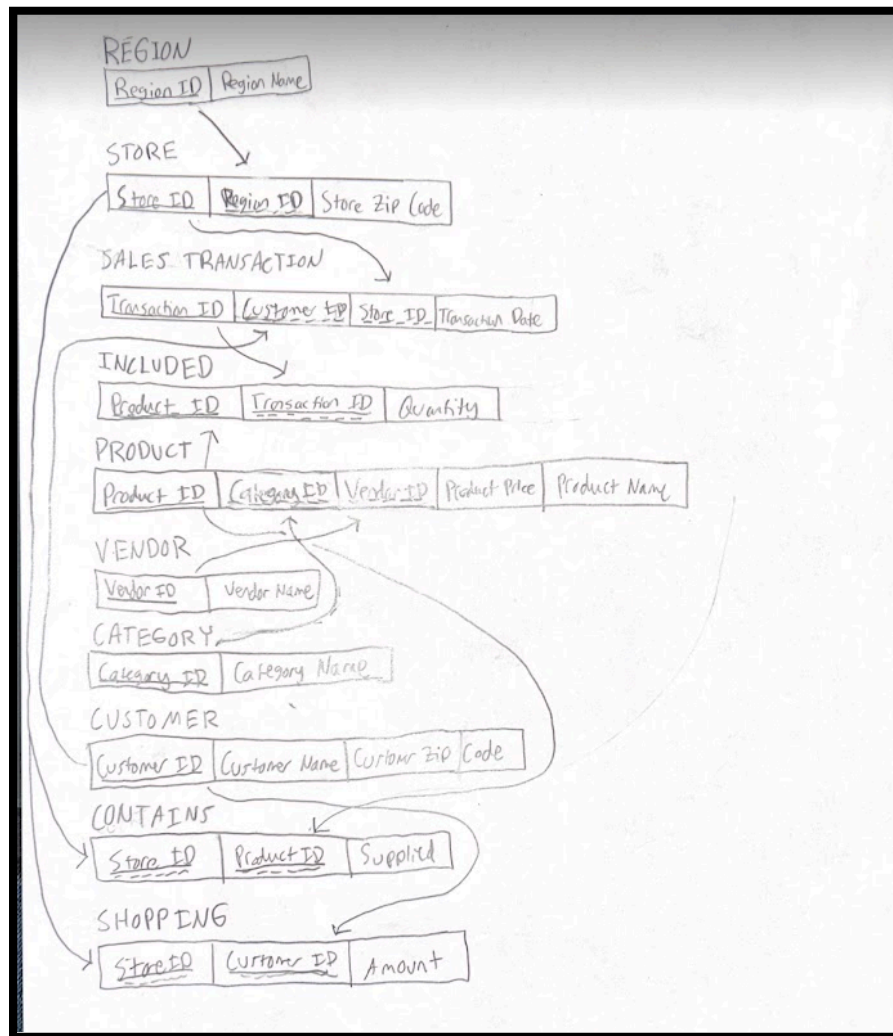
### Description

Here is the diagram of all relations in a schema. If an entity has a solid underline, that is a primary key. If an entity has a dashed-underline, that is a foreign key. If an entity is both dashed and solid underline, then there are both a primary and foreign key within that entity.

\_\_\_\_\_ = Primary Key

----- = Foreign Key

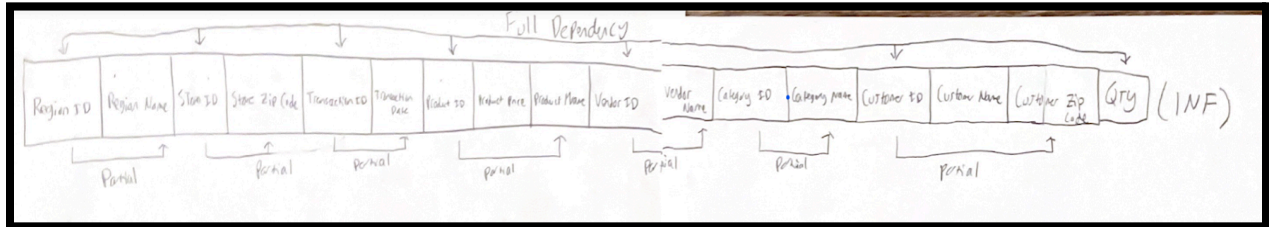
## Referential Integrity Constraints Diagram



### Description

Here is a diagram that has integrity constraints which indicates where each primary key is located.

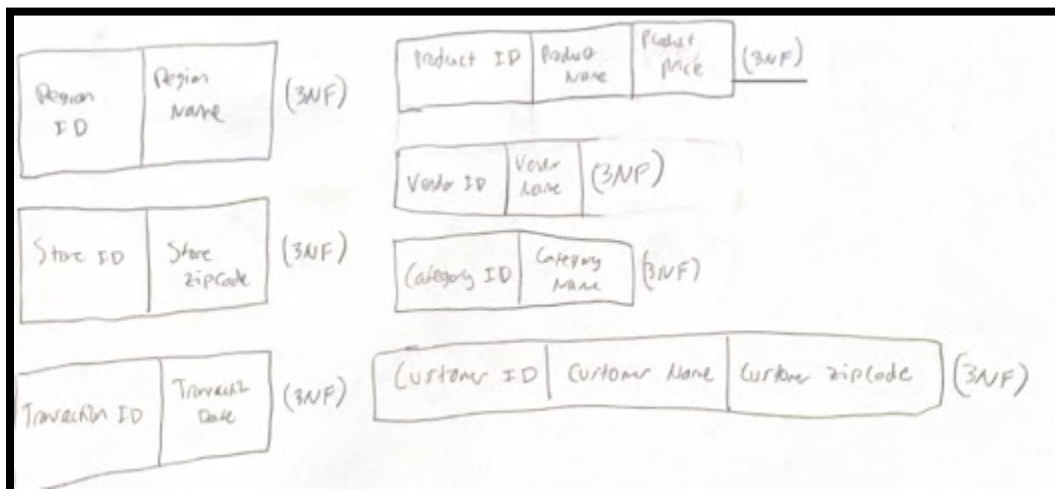
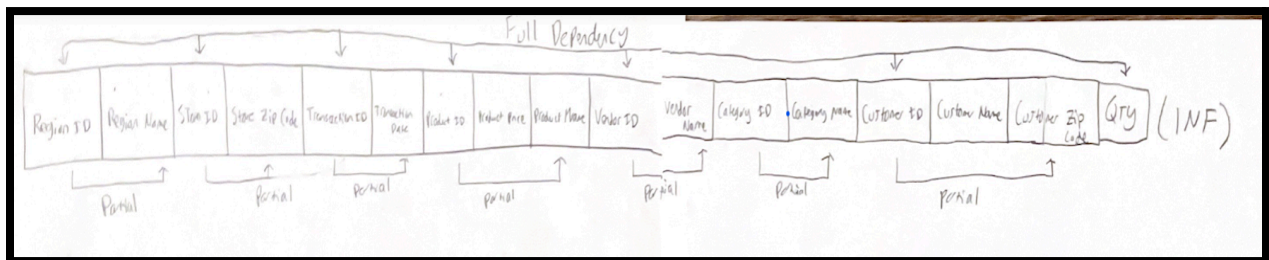
## Functional Dependencies



### Description

The functional dependencies diagram shows what attributes of an entity are functional to determine other attributes. Full dependency means they require that entity to be able to get functional data. Partial dependency is the attribute that requires certain attribute(s) to be functional.

## Normalizations



### Description

All entities are broken down from 1st Normal Form, where attributes have no more than one value for a single instance of an entity, to take on 3rd Normal Form, where entities whose nonprimary-key attributes are not dependent on any other non-primary key attributes.

## References

1. Hoffer, Jeff, et al. Modern Database Management. Available from: VitalSource Bookshelf, (13th Edition). Pearson Education (US), 2018.
2. ERWin Data Modeler Tutorial -  
[https://www.youtube.com/watch?v=XnQ8OKRGOJ0&list=PLdWyZdkgKpTWy\\_24ldyMY0vLEfTS\\_5eYP](https://www.youtube.com/watch?v=XnQ8OKRGOJ0&list=PLdWyZdkgKpTWy_24ldyMY0vLEfTS_5eYP)
3. Microsoft Visio Tutorial for Beginners -  
<https://www.youtube.com/watch?v=b09dKHvu4-4>