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E-Commerce DBMS

Data and Applications

Project Phase – 3

Improvements in ER Model and the System in General

1. Added Component Street Name to Address attribute .
2. Removed Supervisor attribute from Employee relation .
3. Removed Composite attribute Name from Customer and Employee.

ER Model to Relational Model

Step1: Mapping of Regular Entity Types

Customer	
PK	CustomerID
	Email
	FirstName
	LastName
	D.O.B
	Gender
	Age
	Pin
	State
	Country
	Street_Name
	Phone_Number

Product	
PK	Product_ID
	Discount
	Final Price
	Price_Per_Item
	Current_Stock
	Supplier_ID
	Product_Name

SECURITY	
PK	Employee_ID
	Security_Company
	Years_Of_Experience

TECHNICIAN	
PK	Employee_ID
	Project_Name

Department	
PK	Department_Name
	Number_Of_Employee

ORDER	
PK	Customer_ID
	Order_ID
	Product_ID
	Order_Quantity

Delivery Agent	
PK	Agent_ID
	Agent_Name

Employee	
PK	Employee_ID
	Email
	Supervisior
	Salary
	Gender
	FirstName
	LastName
	D.O.B
	Age
	Employement_Status
	Department_Name
	Joining_Date
	Pin
	State
	Country
	Street_Name

SUPPLIER	
PK	Supplier_ID
	Email
	Company_Name
	Contract_Date
	Address
	Phone_Number

For each regular (strong) entity type in the ER schema, we created a relation that includes all the simple attributes of the Entity. For Composite Attributes, only the simple attributes were included. For example: In Customer and Employee Relations Address was converted to Address, Pin Code, State , Country and Street Name .

Step 2: Mapping Of Weak Entity types

Feedback	
PK	**Product_ID**
FK	**Customer_ID**
	Comment
	Rating

Tracking Detail	
PK,FK	**ORDER_ID**
	Agent_ID
	Shipped_From
	Shipped_To
	Estimated_Delievery

For each weak entity type W in the ER schema with owner entity type E, relation R is created which includes all simple attributes (or simple components of composite attributes) of W as attributes of R. Each Relation includes the primary key of owner Entity as a foreign key.

Step 3: Mapping of Binary 1:1 Relationship Types

For ‘MANAGES’ Binary 1:1 Relationship type in the ER schema, the primary key of Employee i.e. Employee_ID was added as a foreign key attribute Manager_ID to the Department.

Employee	
PK	**Employee_ID**
PK	**Email**
FK	**Department_Name**
	Salary Gender FirstName LastName D.O.B Employement_Status Joining_Date Age

Department	
PK	**Department_Name**
FK	**Manager_ID**
	Number_Of_Employee

Step 4: Mapping of Binary 1:N Relationship Types

Relationships:

1. **Supervison** : Primary Key of supervisor (Supervisor_ID) was added to Employee (Supervisee) .

2. **Works_For** : Primary Key of Department (Department_Name) already existed in Employee .

3. **Review** : Since Tracking Detail is weak attribute of Order and so the primary key of Order (Order_ID) is already present in Tracking Detail .

4. **Tracked_By** : Primary Key of Order (Order_ID) was made a foreign key in Tracking_Detail .

Employee	
PK	**Employee_ID**
PK	**Email**
FK	**Supervisor_ID**
FK	**Department_Name**
	Salary
	Gender
	FirstName
	LastName
	D.O.B
	Employement_Status
	Joining_Date
	Age

ORDER	
PK	**Customer_ID**
	Order_ID
	Product_ID
	Order_Quantity

Department	
PK	**Department_Name**
FK	**Manager_ID**
	Number_Of_Employee

Customer	
PK	**CustomerID**
PK	**Email**
	FirstName
	LastName
	D.O.B
	Gender
	Age

Tracking Detail	
PK,FK	**ORDER_ID**
	Agent_ID
	Shipped_From
	Shipped_To
	Estimated_Delivery

Feedback	
PK	**Product_ID**
FK	**Customer_ID**
	Comment
	Rating

Step 5: Mapping of Binary M:N Relationship Types

No Such Relationship Exists in our ER Model.

Step 6: Mapping of Multivalued Attributes

For Multivalued Attributes such as Phone Number and Address, we created new Relations and removed these attributes from the Relations Employee, Customer and Supplier.

Customer_Phone_Number	
FK	**Customer_ID**
PK	**Phone_NO**

Employee_Phone_Number	
FK	**Employee_ID**
PK	**Phone_NO**

Supplier_Phone_Number	
FK	**Supplier_ID**
PK	**Phone_NO**

Customer_Address	
FK	**Customer_ID**
	Pin
	State
	Country
	Street Name

Employee_Address	
FK	**Employee_ID**
	Pin
	State
	Country
	Street Name

Suppler_Address	
FK	**Supplier_ID**
	Address

Step 7: Mapping of N-ary Relationship Types

A new relation Supply is made for Supply 4-ary Relationship which includes the primary key of Customer , Delievery Agent , Supplier and Order .

Supply	
FK	Customer_ID
FK	Order_ID
FK	Agent_ID
FK	Supplier_ID

Step 8 : Mapping Specialization or Generalization

Technician and Security were the disjoint subclasses of Employee and already contained primary key of Employee (Super Class) .

Since all the conditions were satisfied , no changes were made.

SECURITY	
PK	Employee_ID
	Security_Company
	Years_Of_Experience

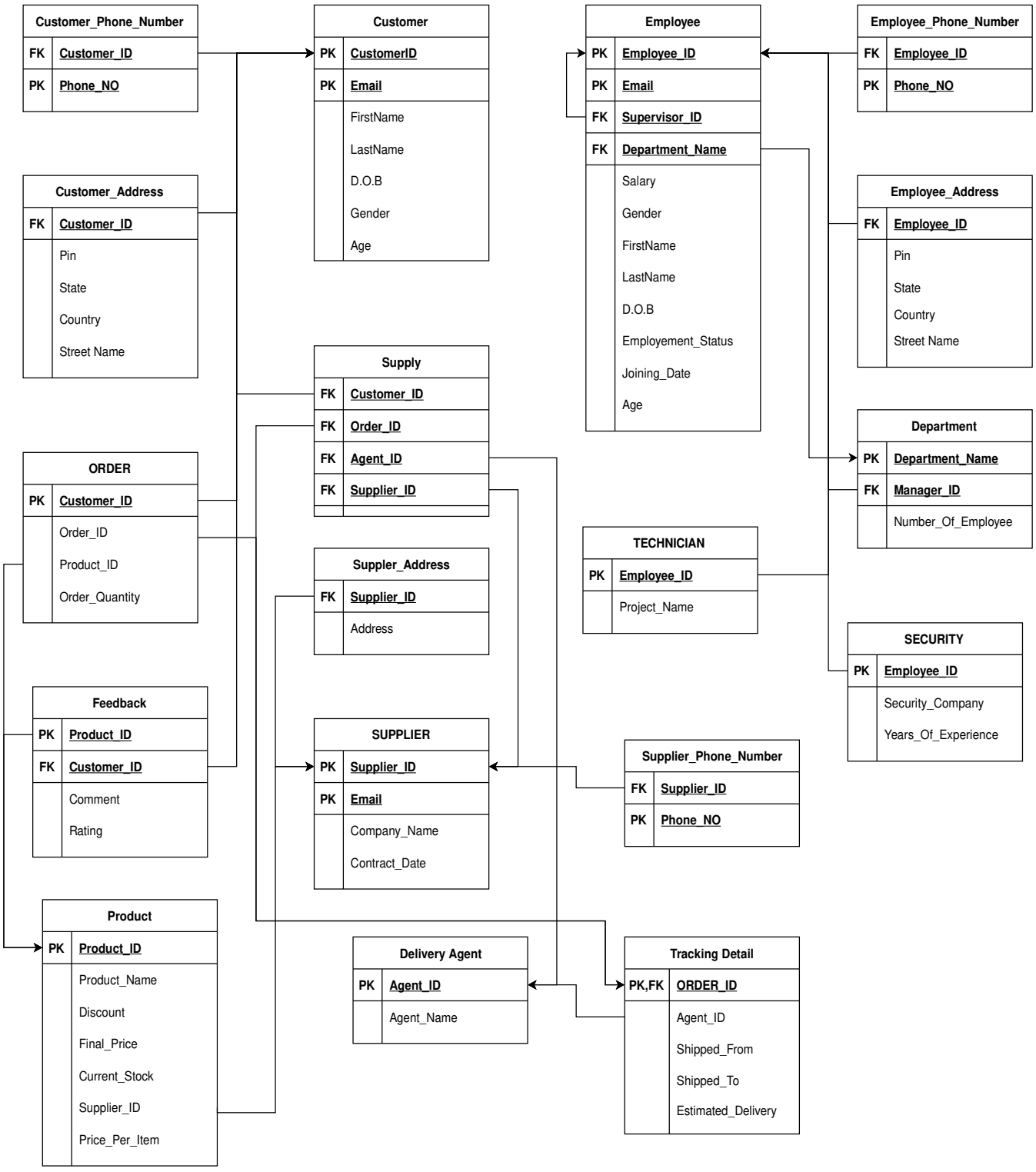
TECHNICIAN	
PK	Employee_ID
	Project_Name

Employee	
PK	Employee_ID
PK	Email
FK	Supervisor_ID
FK	Department_Name
	Salary
	Gender
	FirstName
	LastName
	D.O.B
	Employement_Status
	Joining_Date
	Age

Step 9: Mapping of Union Types (Categories)

No Union Type Existed in our Schema

The Relational Model Obtained from the ER



Conversion of Relational Model to 1NF

Already in 1NF

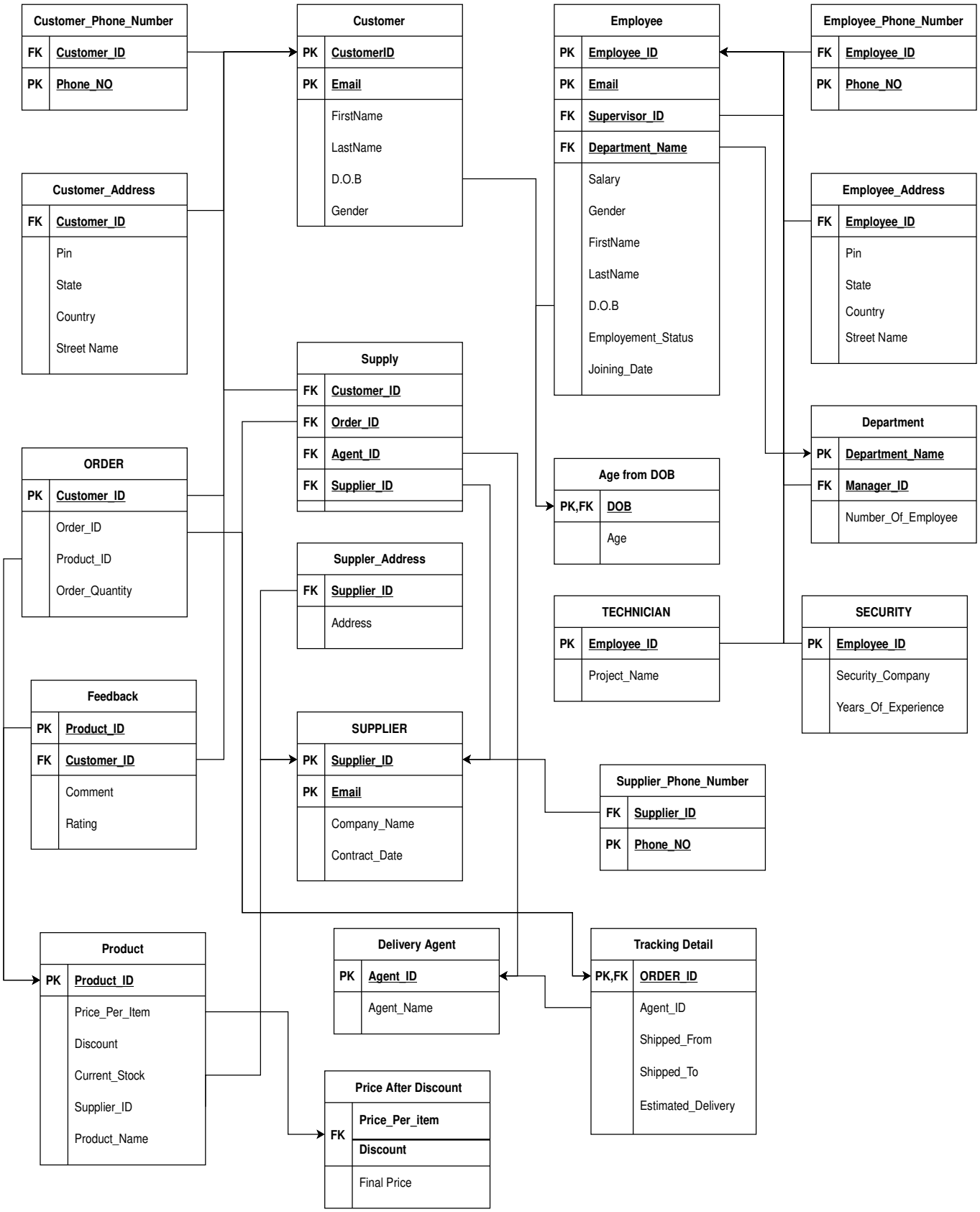
The relational model is already in 1NF as new relations for multivalued attributes were created in Step 6 and Composite attributes were converted to atomic attributes in Step 1.

Conversion of 1NF Relational Model to 2NF

Already in 2NF

The relational model is already in 2NF as all of it’s primary keys have exactly one attribute. Also it does not have any non-prime attribute that is functionally dependent on any proper subset of any candidate key of the relation.

Conversion of 2NF Relational Model to 3NF



Example Tuples for Each Relation to Show a Consistent State of the Final Relational Model

Entity Type	Attribute	Tuple 1	Tuple 2
Customer	Customer_ID	1111111	2222222
	First_Name	Utkarsh	Bhaskar
	Last_Name	Upadhyay	Joshi
	D.O.B	17/07/2001	24/12/2001
	Gender	Male	Male
	Email	utkarsh@gmail.com	bhaskar01@gmail.com
Customer_Address	Customer_ID	1111111	2222222
	Pin	12345	54321
	State	Rajasthan	Rajasthan
	Country	India	India
	Street_Name	B-13,Malviya Nagar	6-F,Vigyan Nagar
Customer_Phone Number	Customer_ID	1111111	2222222
	Phone_Number	9999999999	8888888888
Employee	Employee_ID	3333333	4444444
	First_Name	Ayush	Piyush
	Last_Name	Sharma	Pandey
	Email	ayush00@gmail.com	piyush03@gmail.com
	Supervisor_ID	4960496	NULL
	Department_Name	Cyber Cell	Logistics
	Salary	99999999	9999989
	D.O.B	14/09/2001	12/12/2003
	Employment Status	1	1
	Joining Date	18/08/2016	15/06/2017
	Gender	Male	Male

Employee_ Address	Employee_ID	3333333	4444444
	PIN	11123	12343
	State	Uttar Pradesh	Bihar
	Country	India	India
	Street_Name	Rajiv Nagar	Industrial Area
Employee_Phone Number	Emploee_ID	3333333	4444444
	Phone_NO	7777777777	6666666666
Department	Department Name	Cyber Cell	Logistics
	Manager_ID	4958376	4444444
	No_Of_Employee	10	43
Technician	Employee_ID	1492058	1049375
	Project_Name	Titan	Ancient Dots
Security	Employee_ID	2033024	2019950
	Security_Company	SSS	NSG
	Years_Of_Expertise	3	3.5
Product	Product_ID	9291039	9939853
	Product_Name	Iphone 12	ROG
	Discount	10	5.5
	Current_Stock	695	120
	Supplier_ID	8002002	8003004
	Price_Per_Item	80000	113000
Supplier	Supplier_ID	8002002	8003004
	Email	apple@gmail.com	asus@yahoo.com
	Company_Name	Apple	Asus
	Contract_Date	15/08/2017	01/01/2018

Supplier_Address	Supplier_ID	8002002	8003004
	Address	12/32 Los Angles, California , New Jersey,USA 20021	693-Nazi House, Frankfurt , Germany, 10610
Supplier_Phone Number	Supplier_ID	8002002	8003004
	Phone_No	4445454545	5454545454
Order	Customer_ID	1111111	2222222
	OrderID	3000090	3040035
	Product_ID	9291039	9939853
	Order_Quantity	3	2
Tracking Detail	Order_ID	3000090	3040035
	Agent_ID	6002002	6003004
	Shipped_From	12/32 Los Angles, California , New Jersey,USA 20021	693-Nazi House, Frankfurt , Germany, 10610
	Shipped_To	B-13,Malviya Nagar , Rajasthan , India, 12345	6-F, Vigyan Nagar , Rajasthan, India, 54321
	Estimated_Delivery	7	5
Delivery_Agent	Agent_ID	6002002	6003004
	Agent_Name	Steve Roger	Tony Stark
Feedback	Product_ID	9291039	9939853
	Customer_ID	1111111	2222222
	Comment	Product is Old , Quality not satisfactory	Best Gaming Preformance
	Rating	2	9
Supply	Customer_ID	1111111	2222222
	Order_ID	3000090	3040035
	Agent_ID	6002002	6003004

	Supplier_ID	8002002	8003004
Age_From_DOB	DOB	17/07/2001	24/12/2001
	Age	19	19
Price After Discount	Price_Per_Item	80000	113000
	Discount	10	5.5
	Final_Price	72000	106785