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Project on Design of Database for a B2C Company

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We would like to thank Dr. T. Ramakrishnudu for giving us the opportunity to do this project as a part of the Database Management Systems course. Through this project we have gained deeper insight in Database Design, Relational Model, ER Model and Normalization.

We have also gained deeper insight on e-Commerce platforms and their technologies and the design techniques they use for their large databases.

Problem Statement

A B2C, or business-to-consumer, is the type of commerce transaction in which businesses sell products or services to consumers. These days more and more of these companies are selling their products on the internet.

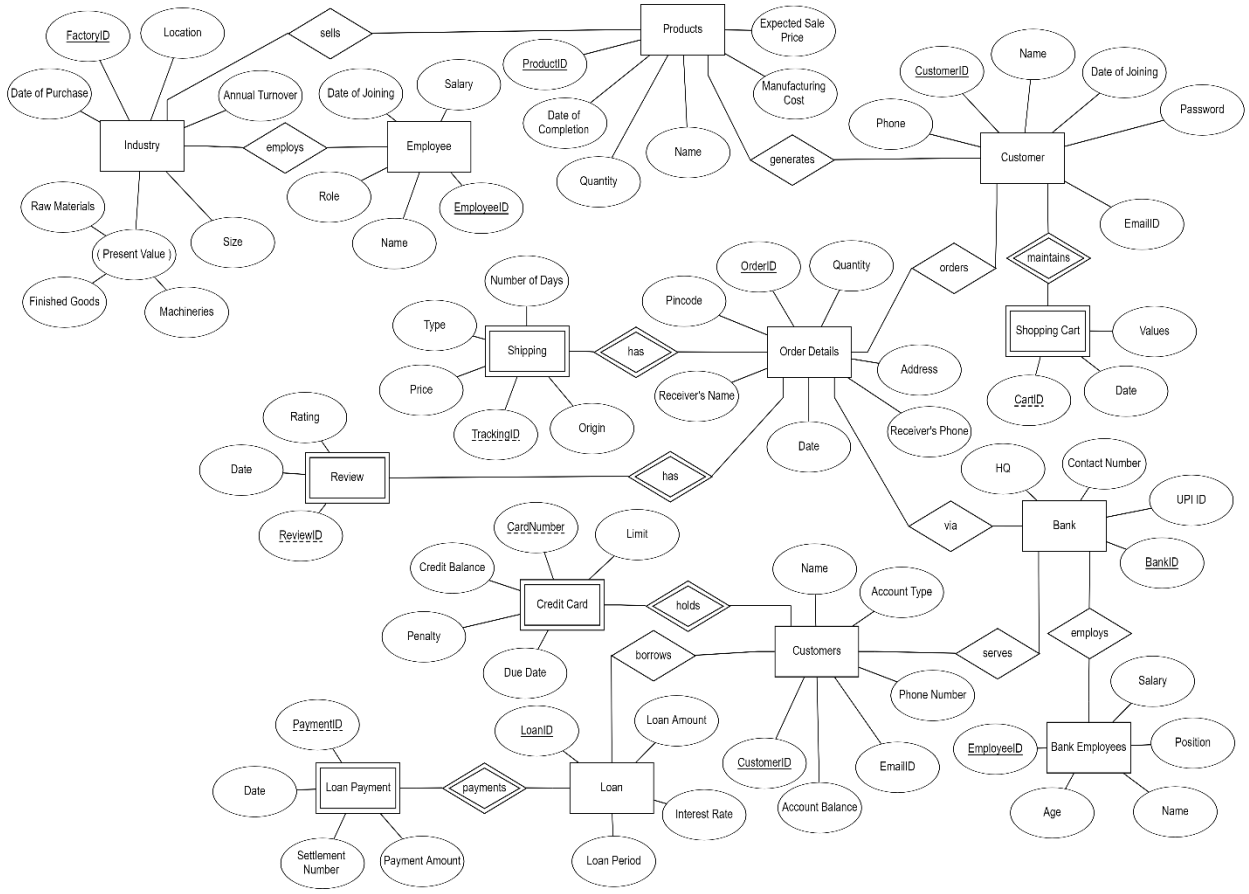
The objective of this project is to develop a general-purpose e-commerce store database where any product can be bought from the internet. Our database comprises of the front end which is made of order details, consumer details, shipping etc. for the online platform and has the back end for the company which includes the employee details, bank and products that are being manufactured.

It is important that the relational database must be designed first. Conceptual can be divided into two parts: The logical data model and the implementation data model. The logical model focuses on what data should be stored in the database while the implementation model deals with how the data is processed. To put this in the context of the relational database, the logical model is used to design the relational tables. The implementation model is used to design the queries that will access and perform operations on those tables. Apart from creating the database we have added functionalities to automate the process of buying and selling of products.

Entity Relationship Model

An entity–relationship model describes interrelated objects of interest in a specific domain of knowledge. A basic ER model is composed of entity types and specifies relationships that can exist between entities.

Below is the ER model of the database that we have designed.

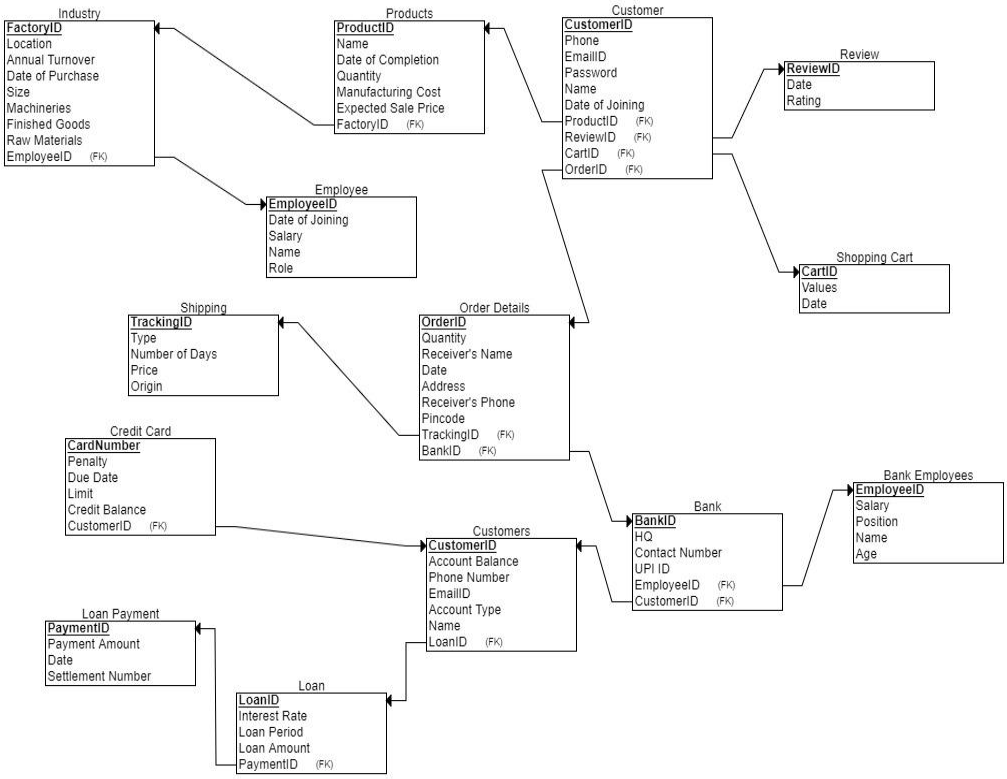


Assumptions

1. A given industry can sell multiple products
2. An industry can employ multiple people
3. Every product can have multiple customers
4. Each Customer has only one Cart
5. Every Customer can have multiple orders
6. Every order has only one TrackingID
7. Each order has only one review
8. Each order can be paid using only one payment gateway
9. Each bank employs multiple individuals
10. Each bank serves multiple customers
11. Each customer can have multiple credit cards
12. Each customer can have multiple loans which in turn can have multiple payments

Relational Schema & Normal Forms

After building the Logical Data Model (here ER Model), the next step is to map it to an Implementation Data Model which is present in most commercially viable databases. For this purpose, we will choose the Relational Model. The Relational Model will consist of multiple Relational Schemas which will better describe our data.



RELATIONAL SCHEMAS

The following relational schemas have been created by mapping our previously created ER Model into the Relational model.

1. **Industry** (FactoryID VARCHAR(20) NOT NULL, Location VARCHAR(20), Annual_Turnover INT, Date_of_Purchase DATE, Factory_Size INT, Machineries INT, Finished_Goods INT, Raw_Materials INT, PRIMARY KEY (FactoryID));

2. **Employee** (Date_of_Joining DATE, Salary INT ,EmployeeID INT NOT NULL,Name VARCHAR(20) ,Role VARCHAR(20) ,FactoryID VARCHAR(20), PRIMARY KEY (EmployeeID), FOREIGN KEY (FactoryID) References Industry(FactoryID));

3. **Products** (Name VARCHAR(20) ,ProductID INT NOT NULL, Date_of_Completion DATE, Quantity INT ,Manufacturing_Cost INT ,Expected_Sale_Price INT ,PRIMARY KEY (ProductID))**;**

4. **Customer** (Phone INT , CustomerID INT NOT NULL ,EmailID VARCHAR(20) , Password VARCHAR(20) , Name VARCHAR(20) ,Date_of_Joining DATE ,PRIMARY KEY (CustomerID));

5. **Shopping_Cart** (CartID INT NOT NULL,Valued INT ,Dated INT ,CustomerID INT, PRIMARY KEY (CartID, CustomerID),FOREIGN KEY (CustomerID) References Customer(CustomerID));

6. **Review** (RevDate DATE,Rating INT ,ReviewID INT NOT NULL,CustomerID INT, PRIMARY KEY (ReviewID, CustomerID),FOREIGN KEY (CustomerID) References Customer(CustomerID));

7. **Order_Details**(Quantity INT ,ReceiverName VARCHAR(20) ,OrderDate DATE, Address VARCHAR(20) ,Pincode INT, ReceiverPhone INT ,OrderID INT NOT NULL,PRIMARY KEY (OrderID));

8. **Shipping** (Type INT , TrackingID INT NOT NULL , Number_of_Days INT, Price INT ,Origin VARCHAR(20),CustomerID INT ,OrderID INT ,PRIMARY KEY (OrderID, TrackingID) , FOREIGN KEY (OrderID) References Order_Details(OrderID));

9. **Bank** (BankID INT NOT NULL,HQ VARCHAR(20) ,Contact_Number INT ,UPI_ID VARCHAR(20) ,PRIMARY KEY (BankID));

10. **Bank_Employees** (EmployeeID INT NOT NULL, Salary INT ,Position VARCHAR(20) ,Name VARCHAR(20) ,Age INT ,BankID INT ,PRIMARY KEY (EmployeeID),FOREIGN KEY (BankID) References Bank(BankID));

11. **Customers** (Account_Balance INT ,Phone_Number INT ,EmailID VARCHAR(20) ,Account_Type VARCHAR(20) ,Name VARCHAR(20) ,CustomerID INT NOT NULL, BankID INT , PRIMARY KEY (CustomerID), FOREIGN KEY (BankID) References Bank(BankID));

12. **Loan** (Interest_Rate INT ,Loan_Period INT ,Loan_Amount INT ,LoanID INT NOT NULL,CustomerID INT ,PRIMARY KEY (LoanID),FOREIGN KEY (CustomerID) References Customers(CustomerID));

13. **Loan_Payment** (PaymentID INT NOT NULL,Payment_Amount INT , Date DATE , Settlement_Number INT ,LoanID INT ,PRIMARY KEY (PaymentID), FOREIGN KEY (LoanID) References Loan(LoanID));

14. **Credit_Card**(CardNumber INT NOT NULL ,,Penalty INT ,Due_Date INT ,Limit INT ,Credit_Balance INT , CustomerID INT ,PRIMARY KEY (CardNumber), FOREIGN KEY (CustomerID) References Customers(CustomerID));

RELATIONS AFTER NORMALIZATION

1. **INDUSTRY** (FactoryID,Locationed,Annual_Turnover,Date_of_Purchase, Factory_Size,Machineries,Finished_Goods,Raw_Materials)

FUNCTIONAL DEPENDENCIES:

FactoryID-> Locationed
FactoryID-> Annual_Turnover
FactoryID-> Date_of_Purchase
FactoryID-> Factory_Size
FactoryID-> Machineries
FactoryID-> Finished_Goods
FactoryID-> Raw_Materials

2. **EMPLOYEE** (EmployeeID,Date_of_Joining,Salary,Name,Role,FactoryID)

FUNCTIONAL DEPENDENCIES:

EmployeeID-> Date_of_Joining
EmployeeID-> Salary
EmployeeID-> Name
EmployeeID-> Role
EmployeeID-> FactoryID

3. **PRODUCTS** (ProductID,Name, Date_of_Completion, Quantity, Manufacturing_Cost, Expected_Sale_Price,FactoryID)

FUNCTIONAL DEPENDENCIES:

ProductID-> Name
ProductID-> Date_of_Completion
ProductID-> Quantity
ProductID-> Manufacturing_Cost
ProductID-> Expected_Sale_Price
ProductID-> FactoryID

4.**CUSTOMER**(
CustomerID,Phone,EmailID,Password,Name,Date_of_Joining,ProductID)

FUNCTIONAL DEPENDENCIES:

CustomerID-> Phone
CustomerID-> EmailID
CustomerID-> Password
CustomerID-> Name
CustomerID-> Date_of_Joining
CustomerID-> ProductID

5.**SHOPPING_CART**(CartID,Valued,Dated,CustomerID)

FUNCTIONAL DEPENDENCIES:

CartID,CustomerID -> Valued
CartID,CustomerID -> Dated

6.**REVIEW(** ReviewID,RevDate,Rating,CustomerID)

FUNCTIONAL DEPENDENCIES:

ReviewID,CustomerID -> Rating
ReviewID,CustomerID -> RevDate

7.**ORDER_DETAILS**(
OrderID,Quantity,OrderDate,Address,Pincode,ReceiverPhone,CustomerID)

FUNCTIONAL DEPENDENCIES:

OrderID-> Quantity
OrderID-> ReceiverName
OrderID-> OrderDate
OrderID-> Address
OrderID-> Pincode
OrderID-> ReceiverPhone
OrderID-> CustomerID

8.**SHIPPING**(OrderID,TrackingID,Type,Number_of_Days,Price,Origin)

FUNCTIONAL DEPENDENCIES:

OrderID,TrackingID -> Type
OrderID,TrackingID -> Number_of_Days
OrderID,TrackingID -> Price
OrderID,TrackingID -> Origin

9.**BANK**(BankID,HQ,Contact_Number,UPI_ID,OrderID)

FUNCTIONAL DEPENDENCIES:

BankID-> HQ
BankID-> Contact_Number
BankID-> UPI_ID
BankID-> OrderID

10.**BANK_EMPLOYEES**(EmployeeID,Salary,Position,Name,Age,BankID)

FUNCTIONAL DEPENDENCIES:

EmployeeID-> Salary
EmployeeID-> Position
EmployeeID-> Name
EmployeeID-> Age
EmployeeID-> BankID

11.**CUSTOMERS**(
CustomerID,Account_Balance,Phone_Number,EmailID,Account_TypeName,BankID
)

FUNCTIONAL DEPENDENCIES:

CustomerID-> Account_Balance
CustomerID-> Phone_Number
CustomerID-> EmailID
CustomerID-> Account_Type
CustomerID-> Name
CustomerID-> BankID

12.**LOAN**(LoanID,Interest_Rate,Loan_Period,Loan_Amount,CustomerID)

FUNCTIONAL DEPENDENCIES:

LoanID-> Interest_Rate
LoanID-> Loan_Period
LoanID-> Loan_Amount
LoanID-> CustomerID

13**.Loan_Payment**(LoanID,PaymentID,Payment_Amount,Date,Settlement_Number)

FUNCTIONAL DEPENDENCIES:

LoanID-> PaymentID
LoanID-> Payment_Amount
LoanID-> Date
LoanID-> Settlement_Number

14.**Credit_Card**(CardNumber,Penalty,Due_Date,Limit,Credit_Balance)

FUNCTIONAL DEPENDENCIES:

CardNumber-> Penalty
CardNumber-> Due_Date
CardNumber-> Limit
CardNumber-> Credit_Balance

ADDITIONAL FEATURE ENHANCEMENTS

1. **Automated Order Confirmation** - Customer is sent an email confirmation with their OrderID and TrackingID.

2. **Automated Feedback Request** - Customers are asked to fill a feedback about their product after they have received it.

3. **Automated Order Placement with the Supplie**r - Supplier is sent an email after the customer places the order

4. **Automated Feedback Receipt** - Supplier is sent the feedback after the customer has filled it in.

5. **Basic Recommender System** – Recommends similar producers to customers based on their previous purchases periodically to increase sales (*beta version*)

DATA INSERTIONS

Go

BANKID	HQ	CONTACT_NUMBER	UPI_ID	ORDERID
1	Bengaluru	1	12345	1
2	Beijing	2	12346	1
3	Bengaluru	3	12376	2
4	Bengaluru	4	85294	3
5	Bengaluru	5	94814	4
6	Bengaluru	6	94210	2
7	Bengaluru	7	38491	1
8	Bengaluru	8	59301	3
9	Bengaluru	9	09134	4

Go

EMPLOYEEID	SALARY	POSITION	NAME	AGE	BANKID
1	10000	Manager	Arun	30	1
2	5000	Junior	Atul	25	2
3	15000	Manager	Aaron	40	3
4	30000	COO	Kumar	50	4
5	25000	Analyst	Ajay	35	5
6	27000	Manager	Mathew	40	6
7	70000	Senior	Manan	55	7

Go

CARDNUMBER	PENALTY	LIMIT	CREDIT_BALANCE	CUSTOMERID	DUE_DATE
221	50	10000	6000	1	19-APR-19
222	500	20000	16000	2	14-APR-19
223	100	10000	8000	3	13-APR-19
224	60	20000	4000	4	12-APR-19
225	50	15000	4000	5	11-APR-19
226	70	10000	6000	6	10-APR-19

Go

PHONE	CUSTOMERID	EMAILID	PASSWORD	NAME	DATE_OF_JOINING	PRODUCTID
123	1	a@abc.com	234z3d@1!	Helas Martin	01-JUN-17	P001
234	2	b@abc.com	424@#$1	Maria Martin	01-JUN-18	P002
314	3	c@abc.com	abs@$!"&^	Melia Martin	01-JUN-16	P003
412	4	d@abc.com	df!dfv@	Amelia Jason	03-MAY-17	P004
712	5	e@abc.com	ddfdfv@	Sam Norman	21-JUN-17	P005
719	6	F@abc.com	ddfg$#@%$^%h	Timothy Geithner	21-JUN-12	P010
993	7	taranathpruthvi@gmail.com	5667578	Pruthvi Taranath	21-JUN-15	P009

FACTORYID	LOCATIONED	ANNUAL_TURNOVER	DATE_OF_PURCHASE	FACTORY_SIZE	MACHINERIES	FINISHED_GOODS	RAW_MATERIALS
F001	BJG	1000000	01-MAR-47	5000	150000	120000	45000
F002	BLR	1900000	01-MAR-47	15000	125000	240000	60000
F003	BJG	1250000	01-JUN-42	5000	150000	190000	42500
F004	BOM	3500000	01-DEC-92	25000	172000	780000	4500
F005	BJG	9570000	01-FEB-03	45000	135000	890000	9500

Go

INTEREST_RATE	LOAN_PERIOD	LOAN_AMOUNT	LOANID	CUSTOMERID
5	3	200000	121	1
6	4	60000	122	2
3	3	100000	123	1
5	5	120000	124	3
5	3	240000	125	4
6	3	290000	126	6
6	5	40000	127	2
10	5	300000	128	5

Go

ACCOUNT_BALANCE	PHONE_NUMBER	EMAILID	ACCOUNT_TYPE	NAME	CUSTOMERID	BANKID
12000	1	c1@gmail.com	borrow	c1	1	1
12500	2	c2@gmail.com	deposit	c2	2	2
13000	3	c3@gmail.com	borrow	c3	3	3
14000	4	c4@gmail.com	deposit	c4	4	4
12700	5	c5@gmail.com	deposit	c5	5	5
13500	6	c6@gmail.com	borrow	c6	6	6
14500	7	c7@gmail.com	borrow	c7	7	7
19000	8	c8@gmail.com	borrow	c8	8	8
12000	9	c9@gmail.com	deposit	c9	9	9

Go

DATE_OF_JOINING	SALARY	EMPLOYEEID	NAME	ROLE	FACTORYID
01-JAN-13	12500	1	Jason	Manager	F001
01-JAN-13	41000	2	Bason	Manager	F002
01-JAN-13	10000	3	Cason	Manager	F003
01-JAN-13	10000	4	Dason	Manager	F004
01-JAN-13	100000	5	Fason	Manager	F005
01-JAN-18	10000	6	Mason	Foreman	F001
01-JAN-19	10000	7	Nason	Technician	F002
01-JAN-18	10000	8	Tason	Engineer	F003
01-JAN-19	10000	9	Rason	Lawyer	F004
01-JAN-14	10000	10	Sason	Attendant	F005

PAYMENTID	PAYMENT_AMOUNT	DUEDATE	SETTLEMENT_NUMBER	LOANID
241	20000	01-JAN-19	111	121
242	24000	02-MAR-19	112	122
243	12000	17-JUN-19	113	123
244	9000	28-OCT-19	114	124
245	10000	04-JAN-19	115	125
246	14000	01-JAN-19	116	126
247	19000	22-JUN-19	117	127
248	28000	07-NOV-19	118	128

Go

QUANTITY	RECEIVERNAME	ORDERDATE	ADDRESS	PINCODE	RECEIVERPHONE	ORDERID	CUSTOMERID
9	Riam	01-MAR-19	IRA	72131	3245	5	6
1	Liam	01-MAR-19	ABC	72131	5783	1	1
2	Siam	01-MAR-19	ABC	72131	3451	2	2
3	Piam	01-MAR-19	DEG	72213	2341	3	4
5	Miam	01-MAR-19	DFG	72214	3455	4	5

NAME	PRODUCTID	DATE_OF_COMPLETION	QUANTITY	MANUFACTURING_COST	EXPECTED_SALE_PRICE	FACTORYID
TV	P001	01-APR-19	123	650	1000	F001
PHONE	P002	01-APR-19	35	250	450	F001
RADIO	P003	01-APR-19	12	50	90	F001
LAPTOP	P004	01-APR-19	95	350	650	F001
PC	P005	01-APR-19	123	250	350	F001
RADIO	P006	01-APR-19	12	20	50	F002
PHONE	P007	01-APR-19	35	150	250	F002
RADIO	P008	01-APR-19	12	20	50	F002
BOOKS	P009	01-APR-19	123	15	30	F003
FOOD	P010	01-APR-19	35	2	2	F004
SOFTWARE	P011	01-APR-19	17	2000	12000	F005

Go

REVDATE	RATING	REVIEWID	ORDERID
01-APR-19	3	1	1
01-APR-19	1	2	2
01-APR-19	4	3	3
01-APR-19	3	4	4
01-APR-19	5	5	5

TYPE	TRACKINGID	NUMBER_OF_DAYS	PRICE	ORIGIN	ORDERID
1	T001	4	42	HYD	1
2	T002	3	123	HYD	2
2	T003	1	75	BOM	3
1	T004	2	35	BLR	4
1	T005	1	824	BLR	5

Go

CARTID	VALUED	DATED	CUSTOMERID
CART001	350	01-JAN-19	1
CART002	250	01-JAN-18	2
CART003	950	01-APR-19	3
CART004	350	01-FEB-19	4
CART005	750	01-MAR-19	5
CART006	193450	01-JAN-19	6