COMSATS University Islamabad, Lahore Campus

Database Systems I

Assignment 03 – Project Proposal

Project Title	Grocery Store Management System
Resource Person	Dr. Hamid Turab Mirza
Course Title	Database Systems I
Course Code	CSC 371
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Class/Batch	SP20-BCS
Section	C
Submission Date	27th December 2021

Group Members Information	
Name	**Registration Id**
Ahad Anwar	SP20-BCS-054
Syeda Noor Zehra Naqvi	SP20-BCS-123

1) Abstract

An organized and systemic solution is essential for managing a supermarket. There are many products, different employees, suppliers who supply the product, sales and customers. All the information about the product inventory, sale per day and customer record is kept manually in the record book. So, there is exists a need of automated and centralized system as information form one module is needed by another module. For example, when customer places the order, the quantity of product needs to be updated in stock and if its suppliers need to contact. So, it needs to contact different modules at once.

With that in mind, the old Khataa System is overhauled with the ‘Grocery Store Management System’ with a user-friendly interface that can be used to manage, retrieve and manipulate the data from the database. It will provide ease of managing the data than maintaining it in the record books. The work is useful for saving time, reduces paperwork and human error.

Grocery Store Management System is a windows application written for a Windows Operating System designed to help maintain the transactions of a grocery store. The project is developed in C# and uses MS SQL Server for database management.

2) DOMAIN DESCRIPTION

Business Description:

Samarqand Store is a small-scale family-owned General Store selling everyday grocery and other items to the locality. The business is located in Main Bazar, Nishat, Lahore Cantt and has been operating over 40 years. The store offers 500-1000 products to its customers. The store employs 3 workers, and a cashier (owner) checks out the customer and completed the transaction. The business has two types of customers:

1. Walk In Customer
2. Credit Customer

Credit customers can buy from the shop at any time and have the bill added to their monthly total in the credit book *(Khaata).* The customer holds a separate copy in which the bill is added and signed by the store.

Current Situation:

There is currently no POS system to track the sales at any time. Only the credit sales can be tracked via the credit book but it offers no information on the products/items of each purchase rather just shows the total amount of a purchase on a given date. Sometimes there are clashes between the customer copy and the store credit book due to human error. The credit book offers limited number of pages to each customer which results in 2 problems:

1. Details of Purchase cannot be added due to limited space.
2. If a customer has completed their allotted space in the book, a new credit book is needed. Managing two separate books is a difficult task.

There is no invoicing system and hand-generated invoices take up a lot of time. Managing the inventory becomes a difficult task as the only way to check the availability of a product is to actually go and look in storage.

3)Requirement Specification:

The business is primarily looking to automate the manual process of managing the sales, inventory and payroll. A database management system is required to:

1. Manage and track Sales Activity.
2. Store all Product Data at one place.
3. Manage Inventory.
4. Manage customers.
5. Monitor the number of customers.
6. Keep a digital log of credit customers.

7. Generate Invoices

Functional Requirements:

Id	Function	Entity	Priority
1	Insert/View/Change/Delete Products	Products	High
2	Insert/View/Change/Delete Employees	Employee	Normal
3	Insert/View/Change/Delete Customers	Customers	High
4	Insert/View/Manage Credit Customer Payments	Customers, Credit Customer Payments	High
5	View Orders and their Details	Orders, Customers, Order Details, Products	High
6	Generate Invoices	Customer, Employee, Orders, Payment, Order Details	High
7	Insert/View/Manage Supplier Information	Supplier	Normal
8	View Supplied Products Information	Supplier, Supplied Products	Low
9	View Products Low in Stock	Products	Normal
10	View Product Suppliers	Supplier, Products, Supplied Products	High

Non-Functional Requirements:

- The admin dashboard should be user-friendly and easy to use and navigate.
- Only authorized persons should be able to access the system.
- The system generated reports should be easy to comprehend.
- System should keep a track of which employee is making a particular sale.

4)ASSUMPTIONS

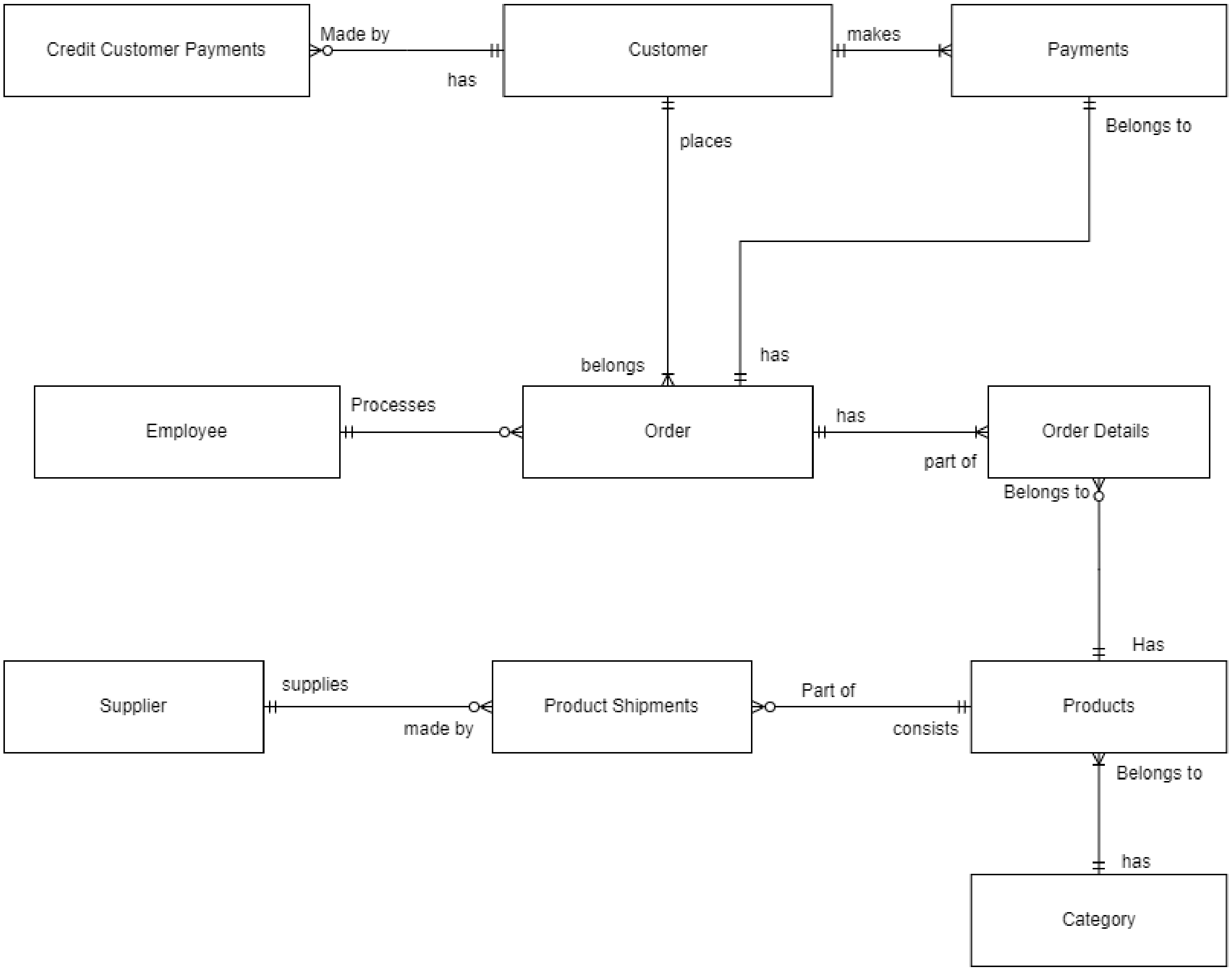
The business currently only accepts Cash as the preferred form of payment; therefore, Bank Payment processing charges are not taken into account in the system.

In accordance to the requirements, we assume that every Walk-In-Customer will pay for their order IN FULL and will not request for credit.

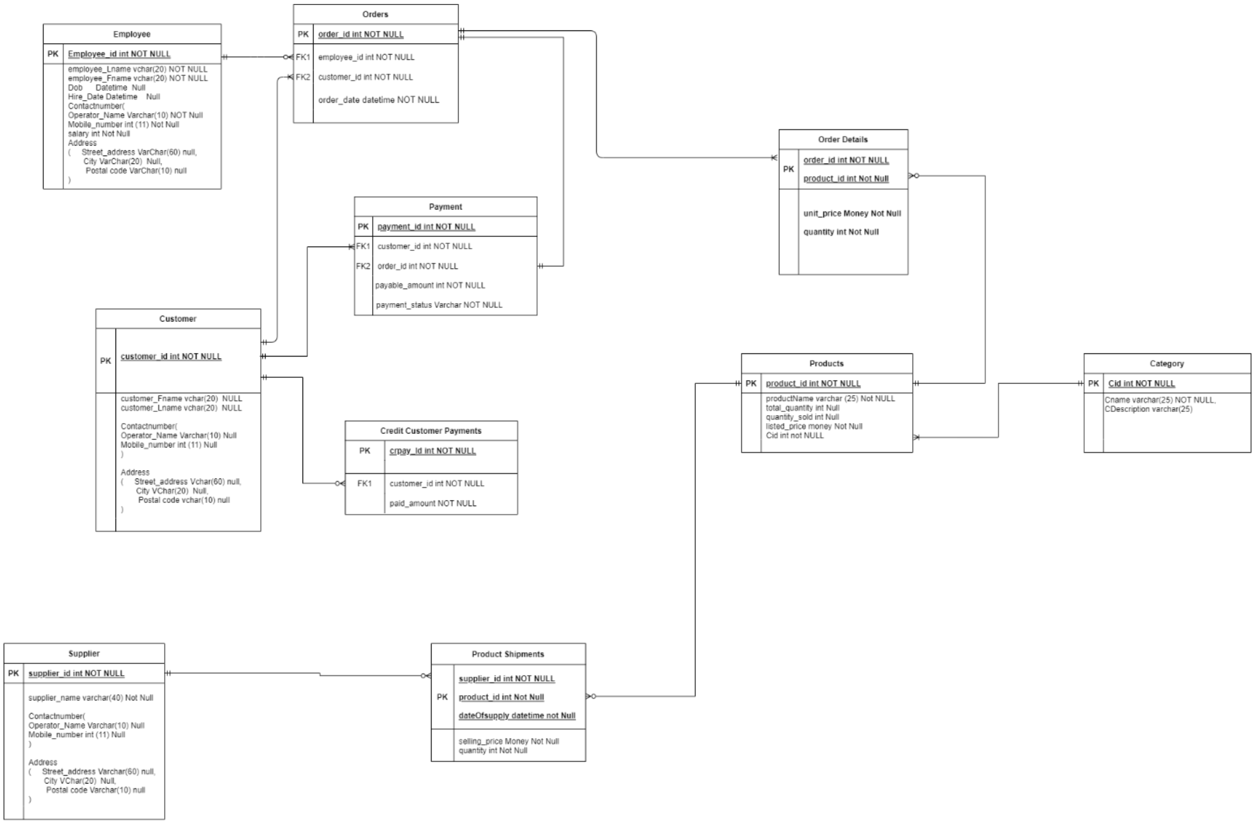
The incoming items from suppliers are stocked the same day. The staff will deal with all problems relating to breakage, item returns and problems related to stock before entering them into the system.

The staff deals with item/order returns and adjusts the quantity in the system manually.

5.1)ENTITY RELATIONSHIP DIAGRAM (Basic)



Detailed ERD with Attributes:



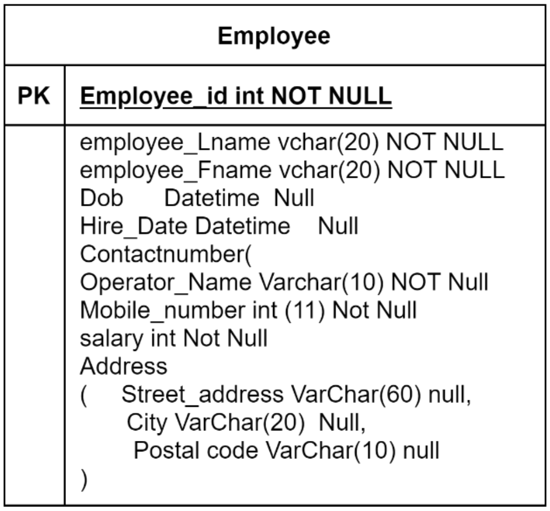
5.2)ENTITIES AND ATTRIBUTES:

Entities & Attributes:

- Customer
- Credit Customer Payments
- Payments
- Order
- Order Details
- Product
- Product Shipments
- Supplier
- Employee
- Category

Employee

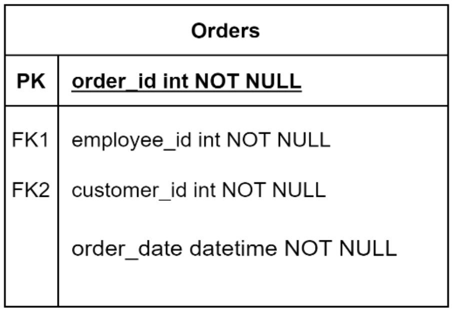
Employee will be the common entity in dash views. It is used to keep detailed information about the employee working in the store. '**employee_id**' is a primary key and will be a unique standard companywide code allocated to a specific employee. '**employee_Lname**' and '**employee_Fname**' will allow to keep information about employees first name and last name. **Dob**' attribute will be used to keep his date of birth. '**salary**' will keep information about monthly salary paid. '**Address**' and '**Contactnumber**' are composite attributes used to save the contact details of the employees in case of emergency. '**Hire_Date**' will be used to keep information about the date of recruitment.



	Employee
PK	**Employee_id int NOT NULL**
	employee_Lname vchar(20) NOT NULL employee_Fname vchar(20) NOT NULL Dob Datetime Null Hire_Date Datetime Null Contactnumber(Operator_Name Varchar(10) NOT Null Mobile_number int (11) Not Null salary int Not Null Address (Street_address VarChar(60) null, City VarChar(20) Null, Postal code VarChar(10) null)

Order

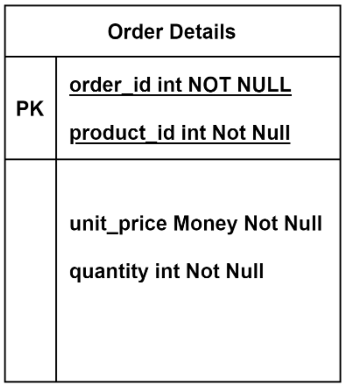
Order will be the common entity in dash views. It is used to keep details about the order placed by customers. ‘**order_id**’ is a primary key and will be unique code allocated each time an order is placed by any customer. ‘**employee_id**’ is a foreign key keeping track of the employee who processed the order. ‘**customer_id’** is a foreign key keeping track of the customer, placing the order. ‘**order_date**’ is an attribute that keeps information about the date the specific order was placed.



	Orders
PK	**order_id int NOT NULL**
FK1	employee_id int NOT NULL
FK2	customer_id int NOT NULL
	order_date datetime NOT NULL

Order Details

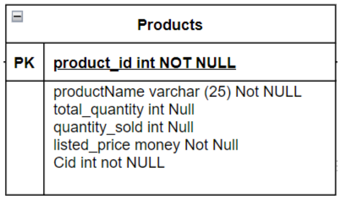
Order-Details will keep detailed information about the orders placed by one customer at a specific time. Both ‘**order_id**’ and ‘**product_id**’ will act as a composite primary key and will be unique. ‘**unit_price**’ is an attribute that is used to keep information about the selling price of a product. It is prone to change depending on the promotions, nearing date of expiry and discounts offered etc. ‘**quantity**’ is the quantity of product ordered by the customer.



	Order Details
PK	**order_id int NOT NULL**
	product_id int Not Null
	unit_price Money Not Null
	quantity int Not Null

Products

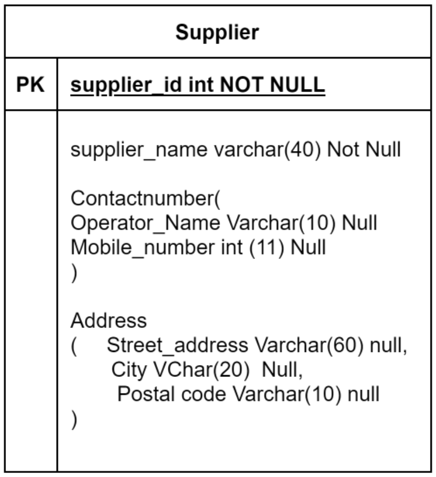
Products keeps information about the products that are available in the store. ‘**product_id**’ is a primary key that is unique standard code allocated to any product. ‘**productName**’ is an attribute to store details about the product’s name. ‘**total_quantity**’ attribute will be used to keep information about the product available in stock, while ‘**quantity_sold**’ will be used to keep track of quantity of the product sold. '**listed_price**' is used to keep information about the price product is intended to be sold at, including GST. '**Cid**' is foreign key that references the category table.



Products	
PK	product_id int NOT NULL
	productName varchar (25) Not NULL total_quantity int Null quantity_sold int Null listed_price money Not Null Cid int not NULL

Supplier

Supplier keeps the general information about the different distributors of various brands who supply products to the store. '**supplier_id**' is a unique primary key assigned to each supplier. '**Address**' is used to store address, '**Contactnumber**' for contact details of the supplier.



Supplier	
PK	supplier_id int NOT NULL
	supplier_name varchar(40) Not Null Contactnumber(Operator_Name Varchar(10) Null Mobile_number int (11) Null) Address (Street_address Varchar(60) null, City VChar(20) Null, Postal code Varchar(10) null)

Product Shipments

Supplied-Products keeps detailed information about the products supplied by suppliers. As same supplier can supply different products and same products can be supplied by different suppliers at different rate, it is necessary to keep detailed information about the supplied products. '**supplier_id**', '**product_id**' and '**dateofsupply**' are the composite primary key . '**selling_price**' attribute track of the rate product is bought at per piece. It can be used to make comparisons between the different suppliers and calculate profits by comparing it with the attribute of ‘**listed_price**’ in products entity. Quantity attributes stores the information about the quantity of product ordered, so that it can be updated in stock.

Product Shipments	
PK	supplier_id int NOT NULL product_id int Not Null dateOfsupply datetime not Null
	selling_price Money Not Null quantity int Not Null

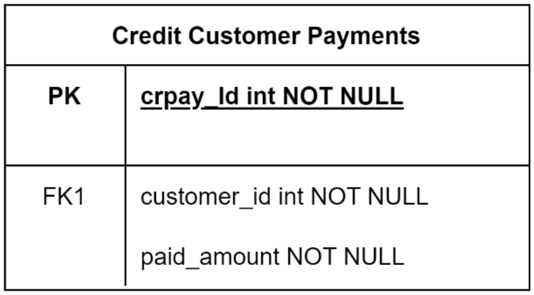
Customers

Customer keeps general details about the customers. There are two types of customers, walk-in and credit customers. ‘**customer_id**’ is the primary key that is unique for every credit customer, walk in customer share a same default id.

Customer	
PK	customer_id int NOT NULL
	customer_Fname vchar(20) NULL customer_Lname vchar(20) NULL Contactnumber(Operator_Name Varchar(10) Null Mobile_number int (11) Null) Address (Street_address Vchar(60) null, City VChar(20) Null, Postal code vchar(10) null)

Credit-Customer-Payments

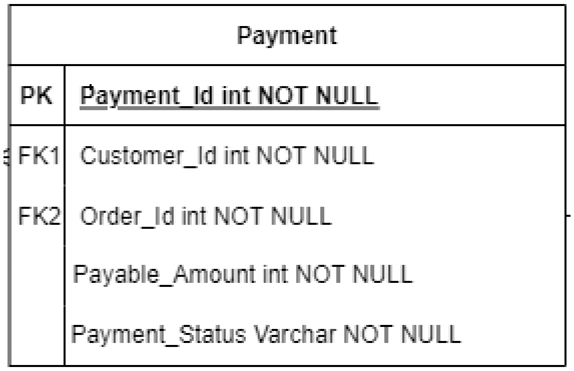
Credit-Customer-Payments keeps tracks of the payments made and dues of the credit customers. ‘**crpay_id**’ is the unique primary key that is issued every credit customers make payments. ‘**customer_id**’ is the foreign key to the customer table, who is making the payment. ‘**paid_amount**’ is the amount paid by credit customer to clear the dues.



Credit Customer Payments	
PK	crpay_Id int NOT NULL
FK1	customer_id int NOT NULL
	paid_amount NOT NULL

Payment

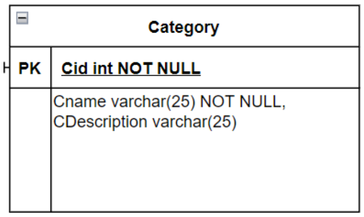
Payments stores the information about the payments made to the store and the payments that are pending.’**payment_id**’ is the unique primary key that is generated everytime orders are placed and processed. ‘**customer_id**’ is the foreign key, keeping track of the customer who needs to pay. ‘**order_id**’ is another foreign key that links the payments entity to the order table against which payments are to be received. ‘**payable_amount**’ is the attribute that keeps track of amount that is to be paid. ‘**payment_status**’ is the attribute that tells whether the dues were cleared or not.



Payment	
PK	Payment_Id int NOT NULL
FK1	Customer_Id int NOT NULL
FK2	Order_Id int NOT NULL
	Payable_Amount int NOT NULL
	Payment_Status Varchar NOT NULL

Category

Category Table stores information about the category of product i.e snack, diary etc. ’**Cid**’ is the unique primary key that is generated every time a new category is added. ‘**Cname**’ and ‘**CDescription**’ are used to store information about the category.



	Category
PK	Cid int NOT NULL
	Cname varchar(25) NOT NULL, CDescription varchar(25)

5.3)RELATIONSHIPS AND LABELS:

Order

- One or many orders can be placed by a customer
- An order has at least one Order Details.
- An order must be processed by only one employee
- One order has only one Payment.

Payment

- A Payment belongs to only one order.
- A payment must be made by a customer.

Order Details

- An order detail must belong-to a product.
- An order detail is a part of Order.
- An order detail must be a part of one and only order.

Employee

- An employee can process zero or more orders.

Customer

- A customer must make a payment.
- A customer has to make atleast one payment.
- A customer can make zero or many credit payments.
- A customer must place an order.
- A customer can place more than one orders.

Product

- A product can be a part of one or many order details.

- A product consists of zero or many supplied products.
- A product can be supplied by more than one supplier.
- A product can belong to one and one category.

Credit Customer Payment

- Credit Customer Payment must belong to only one customer.

Supplier

- A supplier can supply zero or more product shipments.
- A supplier can supply more than one product.

Product Shipments

- Product shipments consist of product.
- A product shipment consists of one and only one product.
- A product shipment must be made by one and only one supplier.

5.3)VALIDATION

It can be clearly seen from above ER Diagram, its description and their relationships that the model captures all information that is of interest to the business and completes the specified business and functional requirements.

All M:N Relationships are resolved by the inclusion of a third entity in between them to ensure referential integrity. Since all such relations are resolved at this level and the shape of the records is in a natural form. Primary Keys are carefully set so that uniqueness remains in each record and foreign keys help us connect the entities together. Presence of data in essential fields such as Customer Name, Product Price etc., is ensured by making those columns NOT NULL.

Data in specific fields such as Listed Price in Products, Payable Amount in Payment and others are restricted to always be positive, therefore range restriction applies. This eliminates any possible errors in calculation of bills and generating invoices.

All incoming data into the system is also validated against its data type to make sure that the entered data makes sense. For example: Price should either be an integer or float, inclusion of Alphabets in price does not make sense and can result in wrong calculations ahead.

5.4)DESCRIPTION

Entity Relationship Diagram illustrates the structure of the Billing section of the proposed system. It can be observed from the diagram that Samarqand’s managing department is performing three main functions. Those are of purchasing stock from different suppliers that is stored appropriately, then selling them and keeping track of sales and the customers who are on credit.

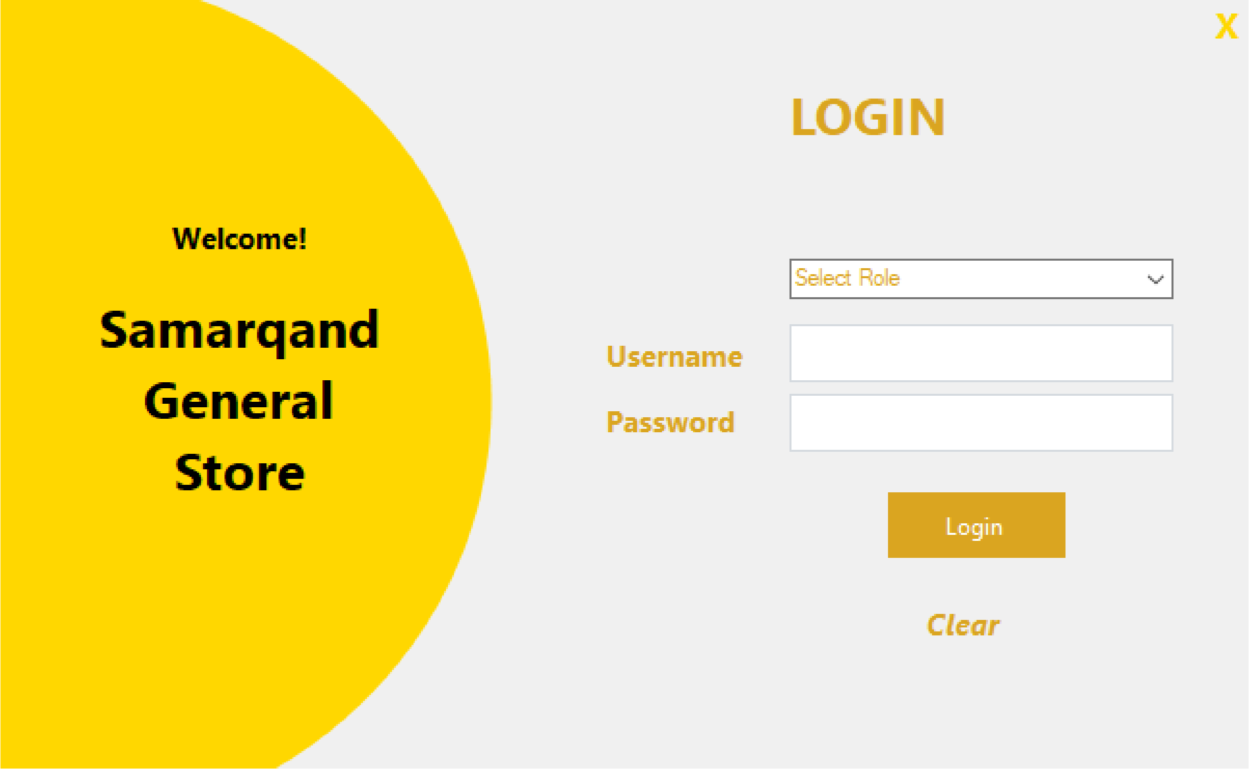
On Order-Receipt it is a must requirement to record the type of customer placing that order and who is processing the order. Since any customer can have place many orders and there could be many products on any one Order Receipt; therefore to resolve this M:N relationship an Order Detail link entity is used. Once the order is placed and processed, the customer makes payment depending on the type of customer he is.

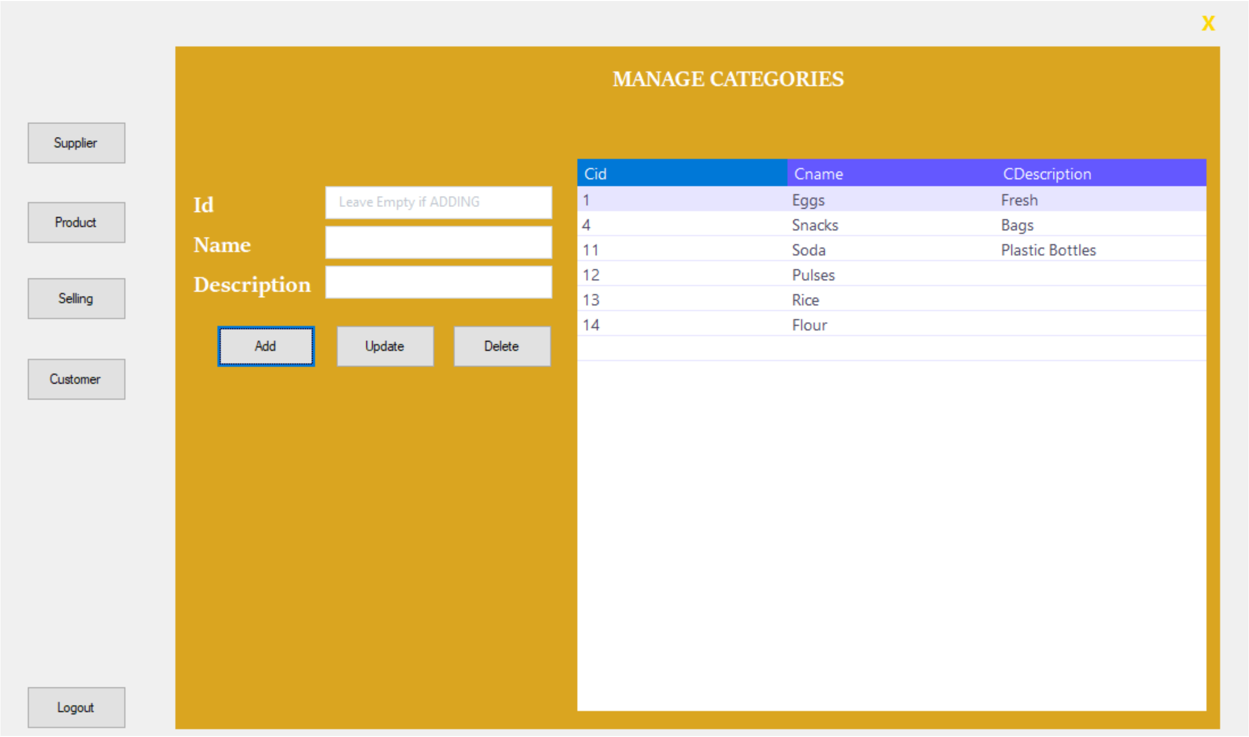
If the customer is walk in customer, the cash is received against that order and the information is stored in the Payment entity. If the customer is credit customer, the order details and the customer details are saved along in the database along with the amount that is due. In case the credit customer decides to pay, payment is received and the log of the due clearance is kept in Credit Customer Payments.

The store orders products from different suppliers depending on their convenience. One supplier can supplier more than more product and one product can be supplied by many different suppliers. Hence to resolve this M:N relation a Supplier Products link entity is used.

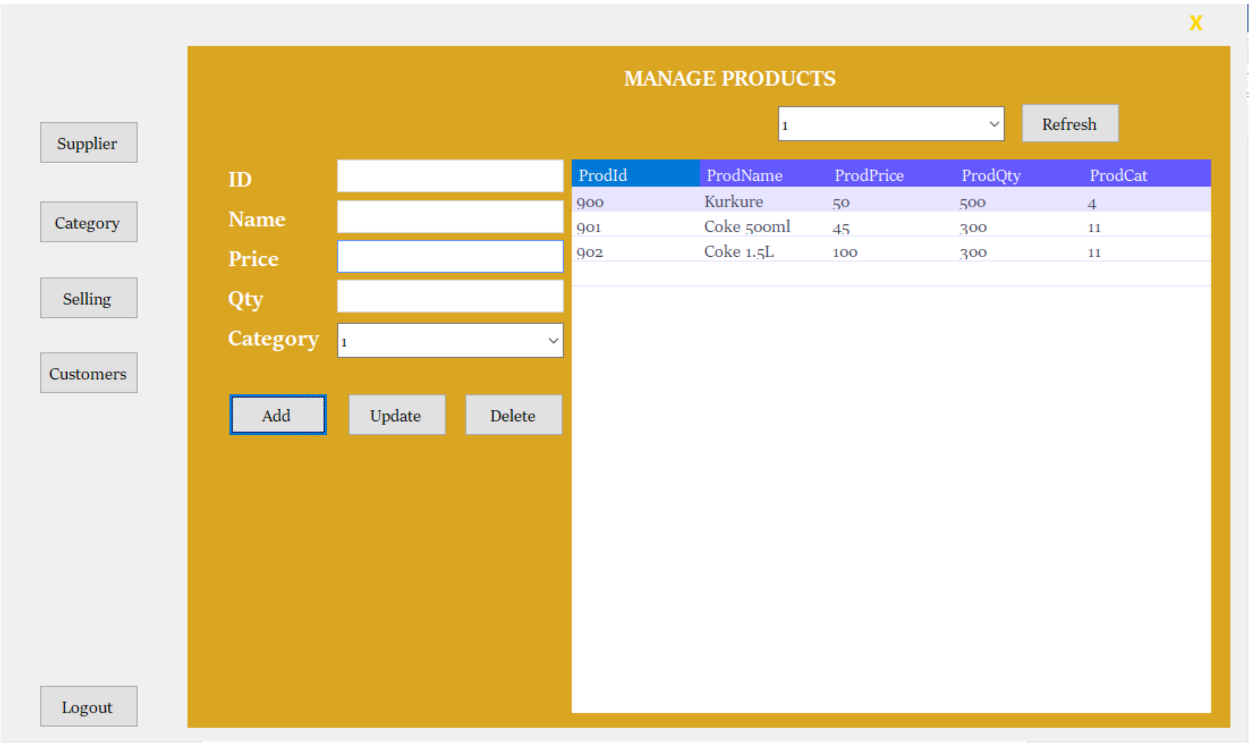
Also, as there is no requirement of keeping the log of “when the stock was ordered” or ‘where the ordered stock is kept’ it is assumed that the delivery was made and the products were racked/stored on the same day, therefore the design allows to update the quantities of stored products.

6) Screen Shots of the developed frontend / GUI





Cid	Cname	CDescription
1	Eggs	Fresh
4	Snacks	Bags
11	Soda	Plastic Bottles
12	Pulses	
13	Rice	
14	Flour	



MANAGE PRODUCTS

ID

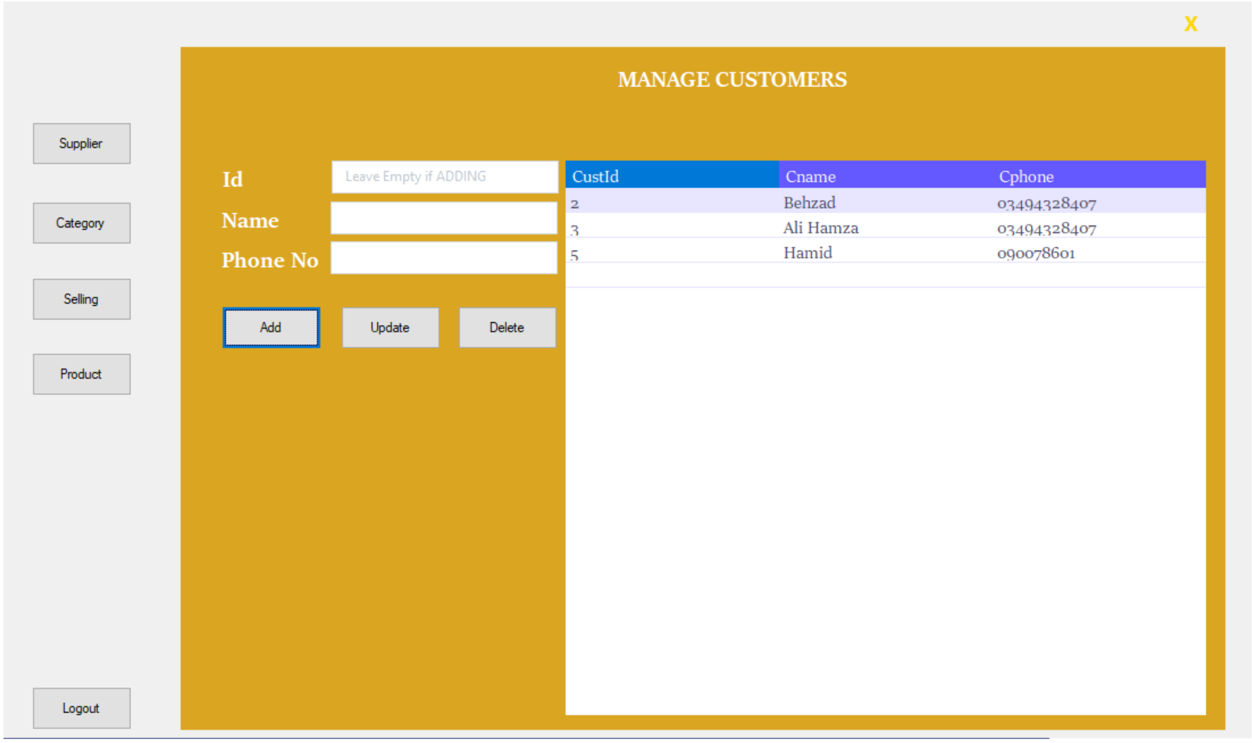
Name

Price

Qty

Category: 1

ProdId	ProdName	ProdPrice	ProdQty	ProdCat
900	Kurkure	50	500	4
901	Coke 500ml	45	300	11
902	Coke 1.5L	100	300	11



MANAGE CUSTOMERS

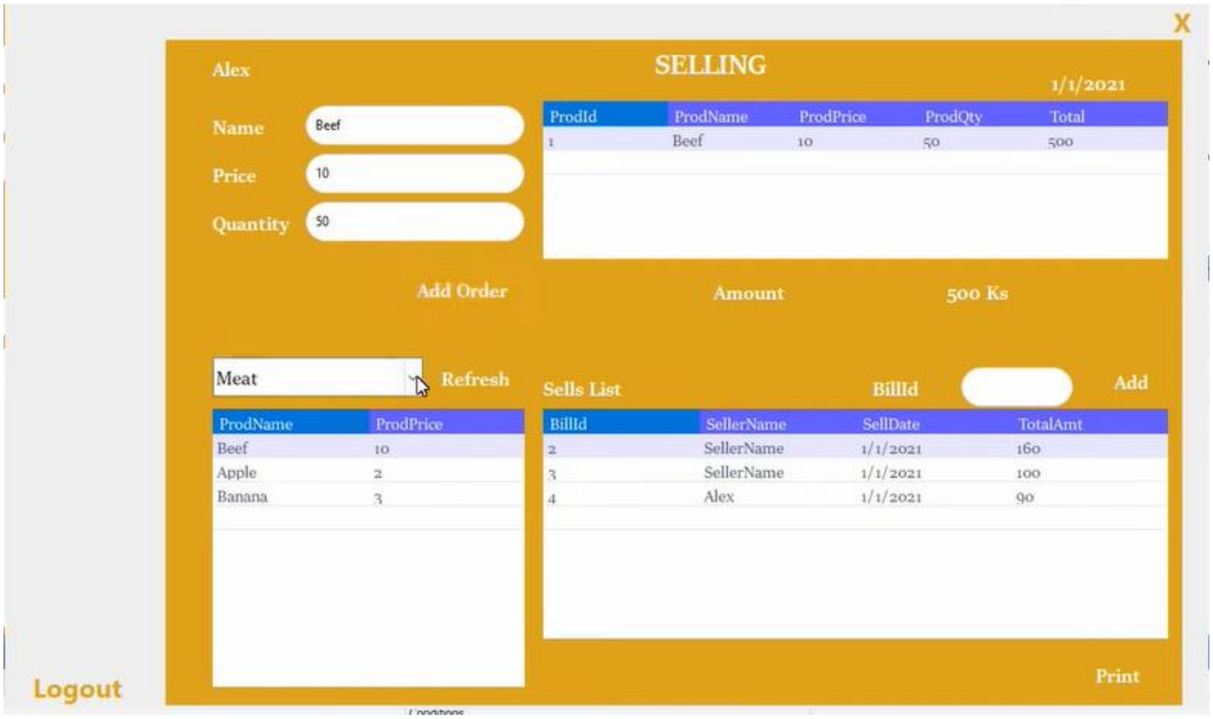
Id: Leave Empty if ADDING

Name

Phone No

CustId	Cname	Cphone
2	Behzad	03494328407
3	Ali Hamza	03494328407
5	Hamid	090078601

7) Screen Shots of the developed report



Alex

SELLING

1/1/2021

Name: Beef

Price: 10

Quantity: 50

ProdId	ProdName	ProdPrice	ProdQty	Total
1	Beef	10	50	500

Amount 500 Ks

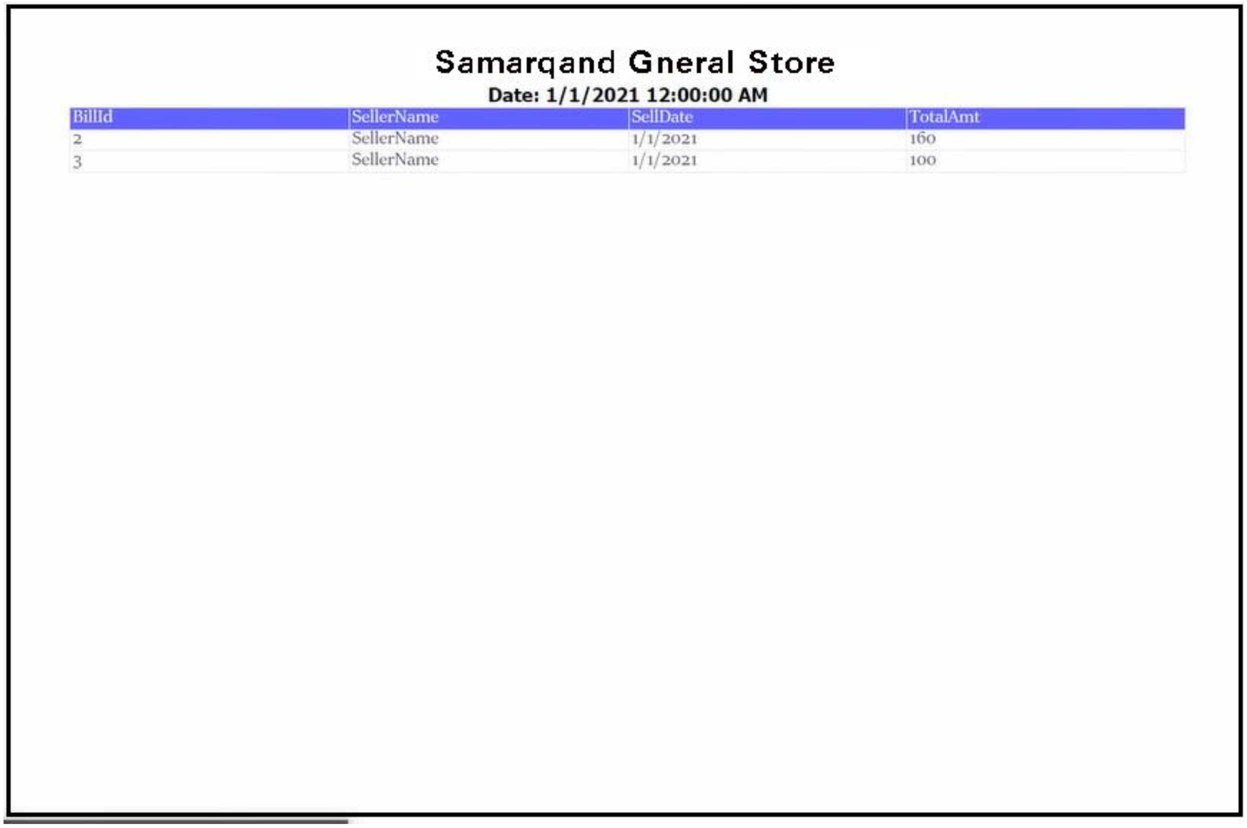
Meat

ProdName	ProdPrice
Beef	10
Apple	2
Banana	3

Sells List

BillId

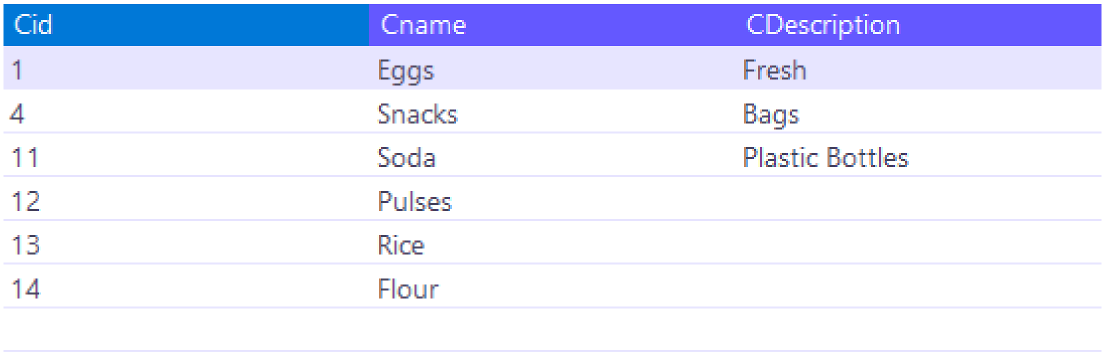
BillId	SellerName	SellDate	TotalAmt
2	SellerName	1/1/2021	160
3	SellerName	1/1/2021	100
4	Alex	1/1/2021	90



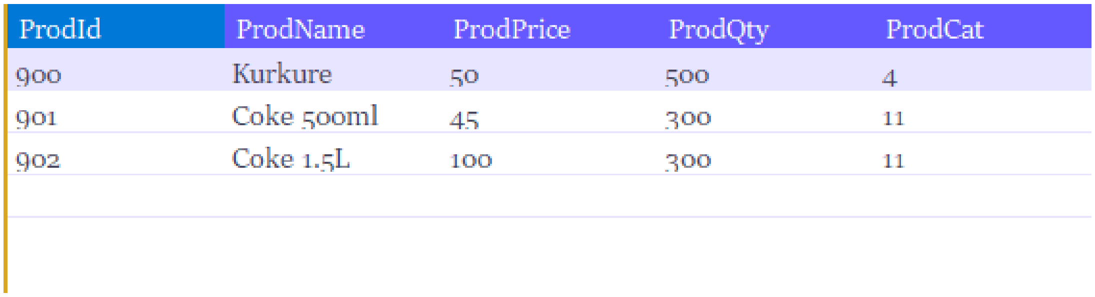
Samarqand Gneral Store

Date: 1/1/2021 12:00:00 AM

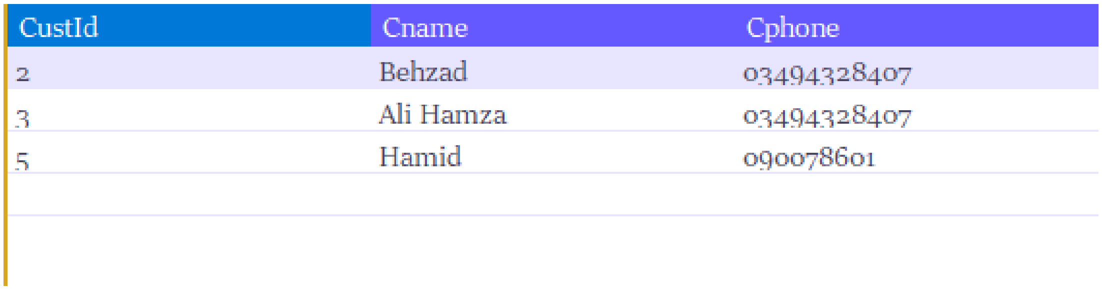
BillId	SellerName	SellDate	TotalAmt
2	SellerName	1/1/2021	160
3	SellerName	1/1/2021	100



Cid	Cname	CDescription
1	Eggs	Fresh
4	Snacks	Bags
11	Soda	Plastic Bottles
12	Pulses	
13	Rice	
14	Flour	



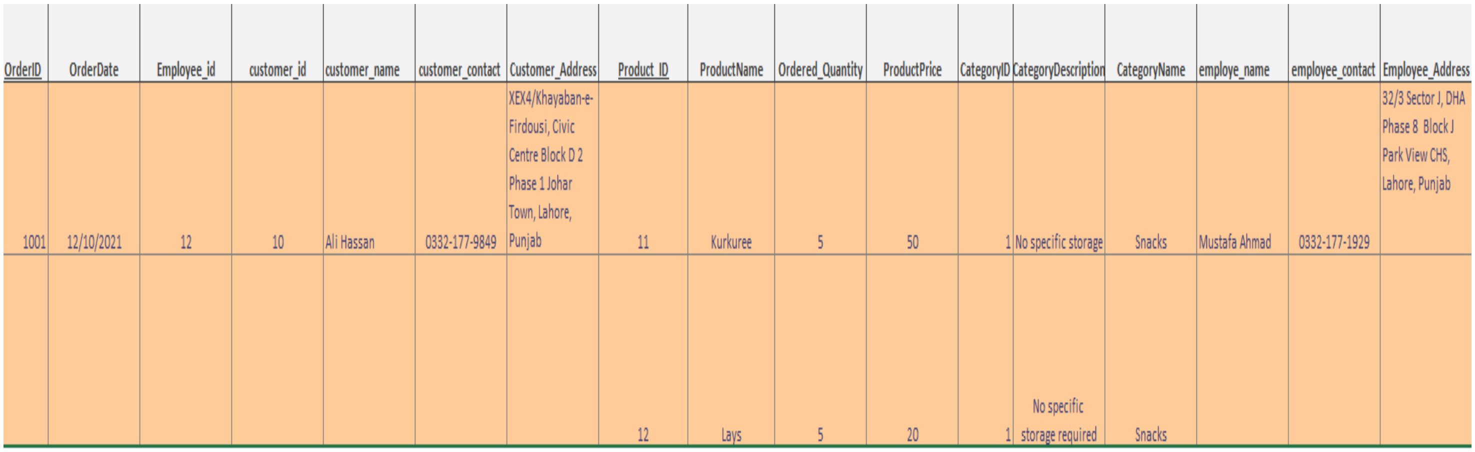
ProdId	ProdName	ProdPrice	ProdQty	ProdCat
900	Kurkure	50	500	4
901	Coke 500ml	45	300	11
902	Coke 1.5L	100	300	11



CustId	Cname	Cphone
2	Behzad	03494328407
3	Ali Hamza	03494328407
5	Hamid	090078601

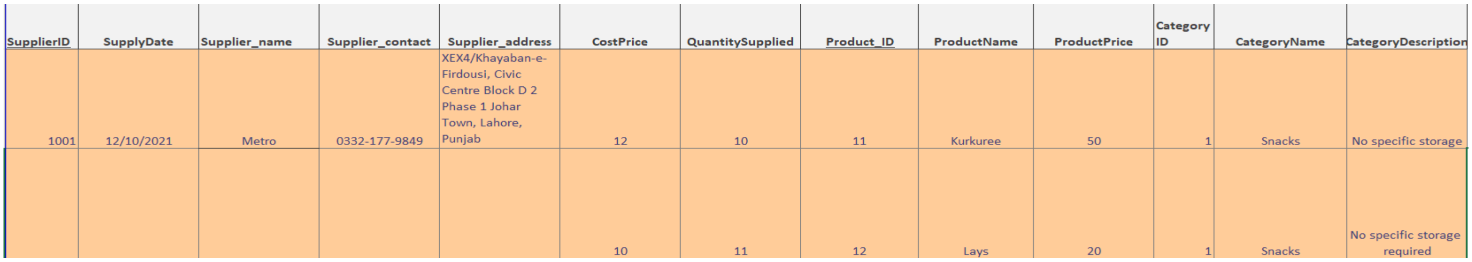
8)NORMALIZATION TO 3rd NF

INVOICE DATA initially contains product details, customer details, employee who is managing the order details and the order details.



OrderID	OrderDate	Employee_id	customer_id	customer_name	customer_contact	Customer_Address	Product_ID	ProductName	Ordered_Quantity	ProductPrice	CategoryID	CategoryDescription	CategoryName	employe_name	employee_contact	Employee_Address
1001	12/10/2021	12	10	Ali Hassan	0332-177-9849	XEX4/Khayaban-e-Firdousi, Civic Centre Block D 2 Phase 1 Johar Town, Lahore, Punjab	11	Kurkuree	5	50	1	No specific storage	Snacks	Mustafa Ahmad	0332-177-1929	32/3 Sector J, DHA Phase 8 Block J Park View CHS, Lahore, Punjab
							12	Lays	5	20	1	No specific storage required	Snacks			

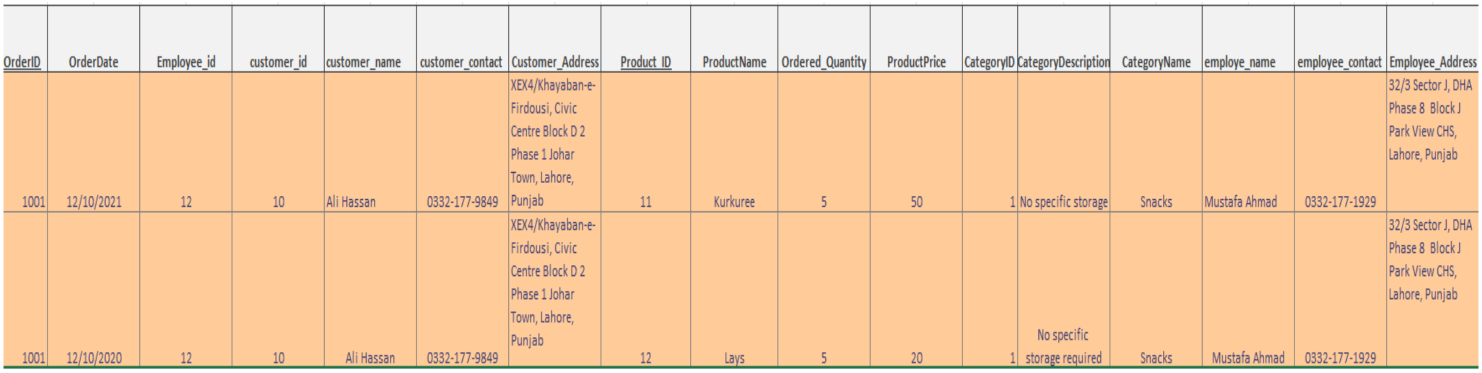
Supply receipt



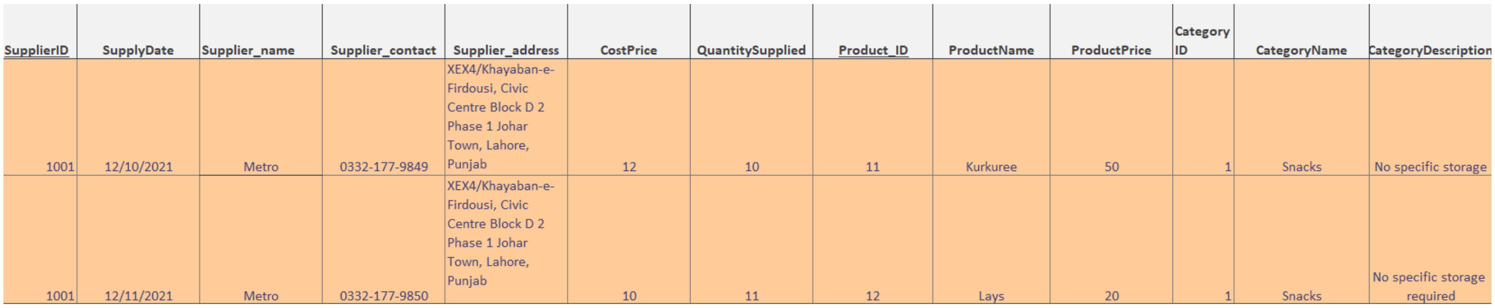
SupplierID	SupplyDate	Supplier_name	Supplier_contact	Supplier_address	CostPrice	QuantitySupplied	Product_ID	ProductName	ProductPrice	Category ID	CategoryName	CategoryDescription
1001	12/10/2021	Metro	0332-177-9849	XEX4/Khayaban-e-Firdousi, Civic Centre Block D 2 Phase 1 Johar Town, Lahore, Punjab	12	10	11	Kurkuree	50	1	Snacks	No specific storage
					10	11	12	Lays	20	1	Snacks	No specific storage required

This is not a table. To convert into a table into 1st NF we will remove the multivalued attributes.

1st NF

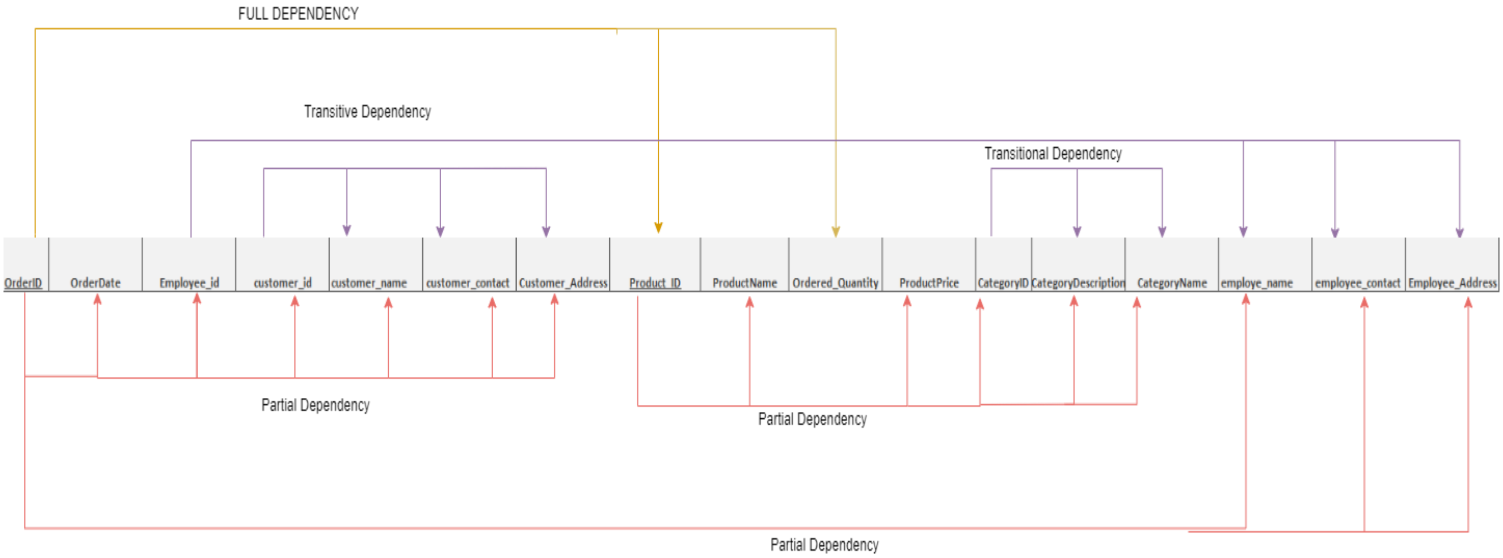


OrderID	OrderDate	Employee_id	customer_id	customer_name	customer_contact	Customer_Address	Product_ID	ProductName	Ordered_Quantity	ProductPrice	CategoryID	CategoryDescription	CategoryName	employe_name	employee_contact	Employee_Address
1001	12/10/2021	12	10	Ali Hassan	0332-177-9849	XEX4/Khayaban-e-Firdousi, Civic Centre Block D 2 Phase 1 Johar Town, Lahore, Punjab	11	Kurkuree	5	50	1	No specific storage	Snacks	Mustafa Ahmad	0332-177-1929	32/3 Sector J, DHA Phase 8 Block J Park View CHS, Lahore, Punjab
1001	12/10/2020	12	10	Ali Hassan	0332-177-9849	XEX4/Khayaban-e-Firdousi, Civic Centre Block D 2 Phase 1 Johar Town, Punjab	12	Lays	5	20	1	No specific storage required	Snacks	Mustafa Ahmad	0332-177-1929	32/3 Sector J, DHA Phase 8 Block J Park View CHS, Lahore, Punjab



SupplierID	SupplyDate	Supplier_name	Supplier_contact	Supplier_address	CostPrice	QuantitySupplied	Product_ID	ProductName	ProductPrice	Category ID	CategoryName	CategoryDescription
1001	12/10/2021	Metro	0332-177-9849	XEX4/Khayaban-e-Firdousi, Civic Centre Block D 2 Phase 1 Johar Town, Lahore, Punjab	12	10	11	Kurkuree	50	1	Snacks	No specific storage
1001	12/11/2021	Metro	0332-177-9850	XEX4/Khayaban-e-Firdousi, Civic Centre Block D 2 Phase 1 Johar Town, Lahore, Punjab	10	11	12	Lays	20	1	Snacks	No specific storage required

2nd NF



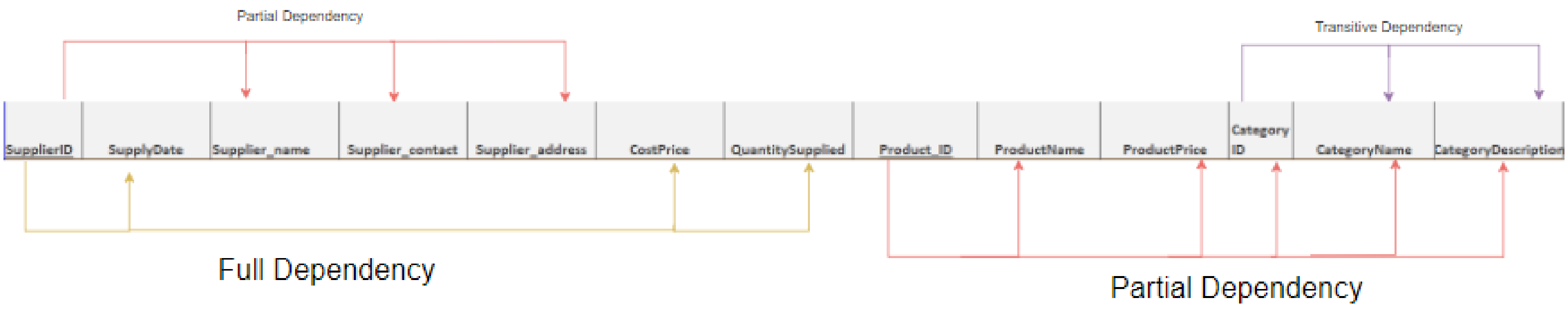
- OrderID-> OrderDate,customer_id,customer_name, Customer_Address ,Employee_id,employee_name,employee_contact,Employee_Address

- customer_id->customer_name,customer_contact,Customer_Address

- Employee_id-> employee_name,employee_contact,Employee_Address

- Product_ID->ProductName, ProductPrice, CategoryID, categoryDescription, CategoryName
- CategoryId-> CategoryDescrption, CategoryName

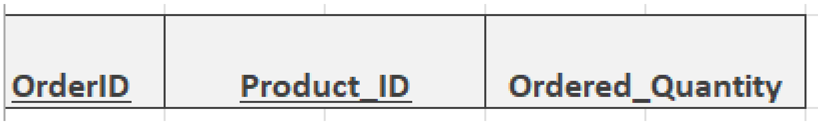
- OrderID,ProductID->Ordered_Quantity



- Product_ID->ProductName, ProductPrice, CategoryID, categoryDescription, CategoryName
- CategoryId-> CategoryDescrption, CategoryName
- SupplierID,ProductID->SupplyDate,CostPrice,QunatitySupplied
- SupplierID->Supplier_name,Supplier-Contact,Supplier_address

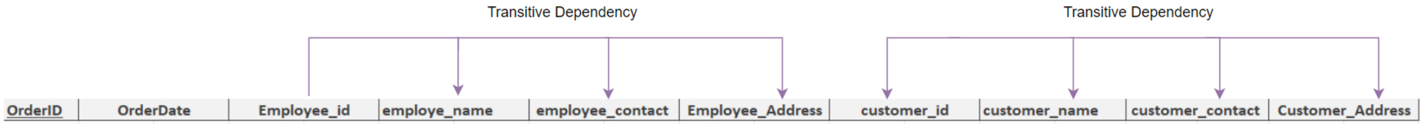
REMOVING PARTIAL DEPENDENCIES

->Order Details (3RD NF FORM)



OrderID	Product_ID	Ordered_Quantity

->Orders(2nd NF)

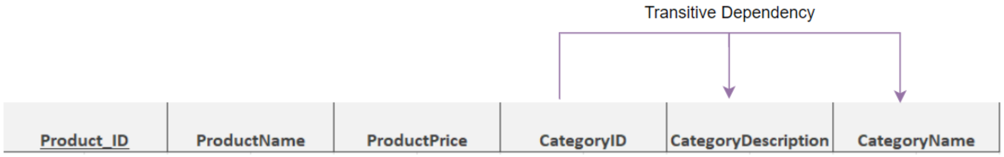


OrderID	OrderDate	Employee_id	employe_name	employee_contact	Employee_Address	customer_id	customer_name	customer_contact	Customer_Address

2nd NF

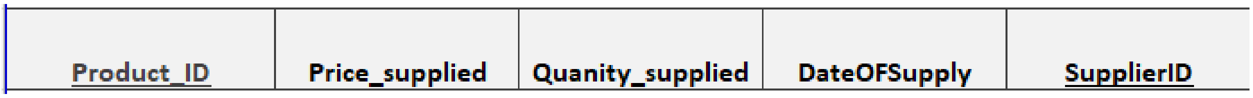
->Products table(2nd NF)

2nd NF



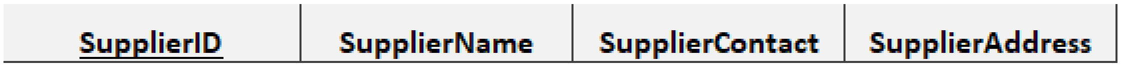
Product_ID	ProductName	ProductPrice	CategoryID	CategoryDescription	CategoryName

->SuppliedProducts(3rd NF)



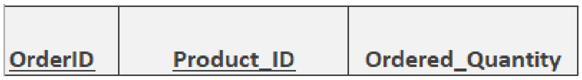
Product_ID	Price_supplied	Quanity_supplied	DateOFSupply	SupplierID

->Supplier(3rd Nf)



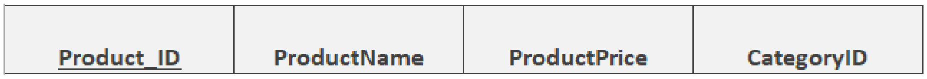
SupplierID	SupplierName	SupplierContact	SupplierAddress

3rd NF REMOVING Transitive Dependencies



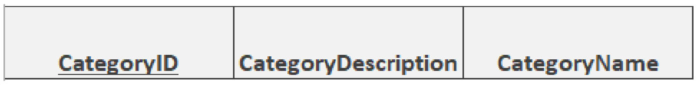
OrderID	Product_ID	Ordered_Quantity

OrderDetails 3rdNF



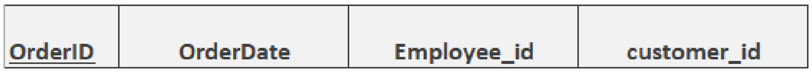
Product_ID	ProductName	ProductPrice	CategoryID

Products 3rd NF



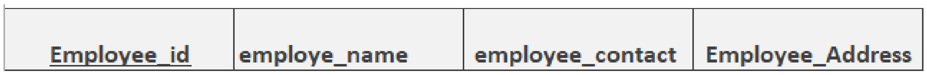
CategoryID	CategoryDescription	CategoryName

Category 3rd NF



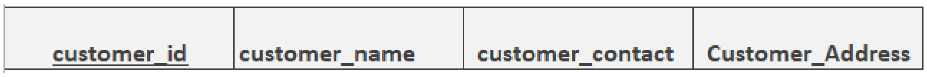
OrderID	OrderDate	Employee_id	customer_id

Orders 3rd NF



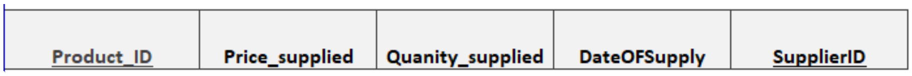
Employee_id	employe_name	employee_contact	Employee_Address

Employee 3rd NF



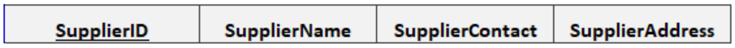
customer_id	customer_name	customer_contact	Customer_Address

Customer 3rd NF



Product_ID	Price_supplied	Quanity_supplied	DateOFSupply	SupplierID

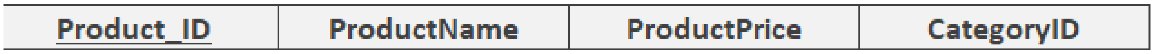
Supplied-Products 3rd NF



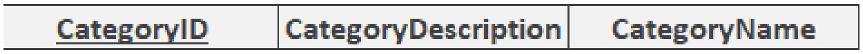
SupplierID	SupplierName	SupplierContact	SupplierAddress

Supplier 3rd NF

9) Denormalization opportunities in your design

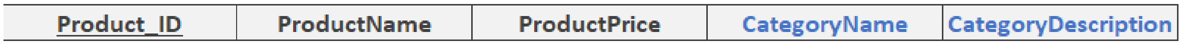


Product_ID	ProductName	ProductPrice	CategoryID



CategoryID	CategoryDescription	CategoryName

Instead of making separate table for the Category with Primary key ‘CategoryId’ we can store the Category Name and Description as attributes of Products table.



Product_ID	ProductName	ProductPrice	CategoryName	CategoryDescription

10) CONCLUSION

The entity model presented here seeks to model the data required in the system from the point of view of the Sales Department. When all the views (Inventory, Sales, Product List, Credit Customers List, Logistics and Shipping) will be integrated, some of the entities and relationships might need some modification with respect to the requirements of other systems.

11)RECOMMENDATIONS

Based on the business requirements and the recent boom in Online Grocery Market, it is recommended that the system be evolved and moved to a centralized web server. It will enable the client to manage their system from anywhere through a secure connection. Moreover, such improvements will directly cater to the business if they choose to offer Online Ordering facility to their customers. The business shall also be able to integrate online payment systems. A very user-friendly customer interface is recommended if the business plans to expand into that market. Web based database servers are often prone to attack, therefore sufficient security measures need to be held in place to avoid any nuisance. It is anticipated that these steps will enhance the productivity and greatly improve the speed of response, accuracy of information, cost effective transactions and therefore enhance the overall business process.

Word Count: 2,683