PROJECT REPORT

E-Commerce Grocery System for 'InstaCart'

In partial fulfilment for the course of

DATABASE MANAGEMENT AND DATABASE DESIGN

NORTHEASTERN UNIVERSITY

Boston, MA

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1. Introduction

1.1 Abstract:

Groceries are required on a daily basis. As our life becomes busy day by day, it is difficult to remove time for groceries. Here comes in 'Instacart' with their tag line: "never go to a grocery store again". Instacart is the grocery delivery service that delivers the groceries in less than an hour. It connects the customer with personal shoppers in the same area as the customer and delivers the groceries from the local stores.

Customers can choose from a variety of local stores including Whole Foods, Safeway, Costco, Mariano's, and more.

There are two types of Customers: Regular and Express. Express customer fee for the year is $99. Once the customer is an Express Customer, he can get free deliveries. The regular customer is charged for the shipping.

1.2 Purpose of Database:

As Instacart is an online e-commerce system, it needs to maintain a database for its daily activities like taking orders, shipping them, maintaining the order records and the increase its customer base.

1.3 Project Goals:

To understand the working of the Instacart and understand the concepts of database through their online e-commerce website. The database address the following scenarios:

1) Enable customer feedback on the products purchased via the review.

2) Enable customers to view their past orders

3) Customers can store their payment details so the transactions can occur quickly.

4) Maintaining the discounts given to the customers via the discounts and the coupons.

5) Each Order consisting of a unique shipping code so that the customers can easily track their order

6) Increasing the sales via the data mining techniques implemented .

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2. User Roles and Use Case Diagrams

1. User Roles:

A database user has special privileges on tables to insert, modify or delete data in the tables. The user roles supported in this project are:

1) Instacart Database Administrator:

A database administrator is a person who has access to the whole database system. He maintains the transactions for the Instacart. He is considered to be the super user with all the privileges granted to him. With proper approvals he can add new user account, modify the credentials, create reports for the management.

2) Manager:

The Manager has access to the data of all the employees in of Instacart. He has access to manage the salary of the employees. Additional responsibilities include managing product price, discounts and customer coupons.

3) Shipping Employee

The shipping employee is the one who is responsible for shipping the orders to the customers. He has access to all the orders of Instacart. He can modify the shipping status of the order and also can track the order.

4) Financial Accountant

The Financial accountant has access to the financial records of the database. He creates the financial reports and monitors the overall performance of Instacart.

5) Customer

The whole and sole of the Enterprise. Customer is the one who orders products and helps in generating the revenue for Instacart. There are two types of customer- Regular and Express. By default the customer is a regular customer unless he wishes to pay a premium amount to become an express customer. The benefits of being an express customer is that the shipping costs are removed on every order. Customer is not only the consumer of the data but also the producer of the data. He can provide a feedback of the products via the ratings.

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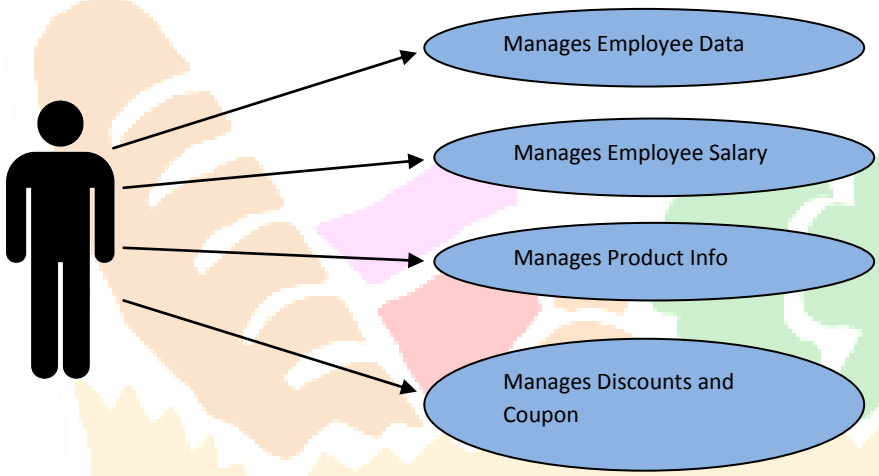
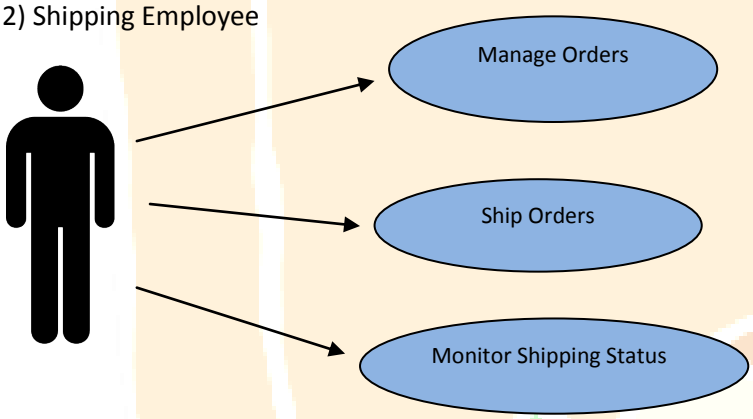
2. Use- Case Diagrams:

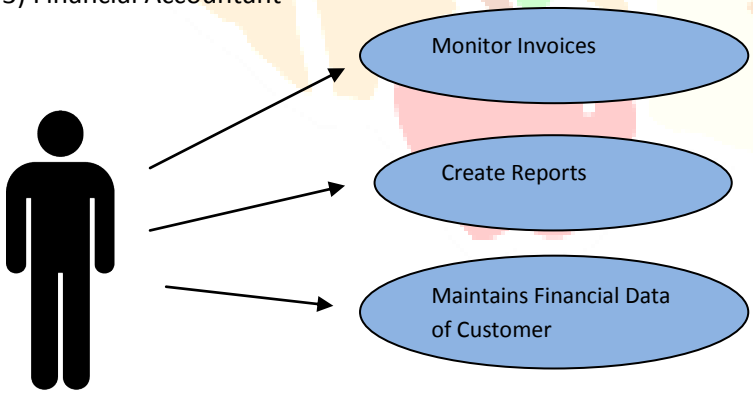
1) Manager:



2) Shipping Employee



3) Financial Accountant



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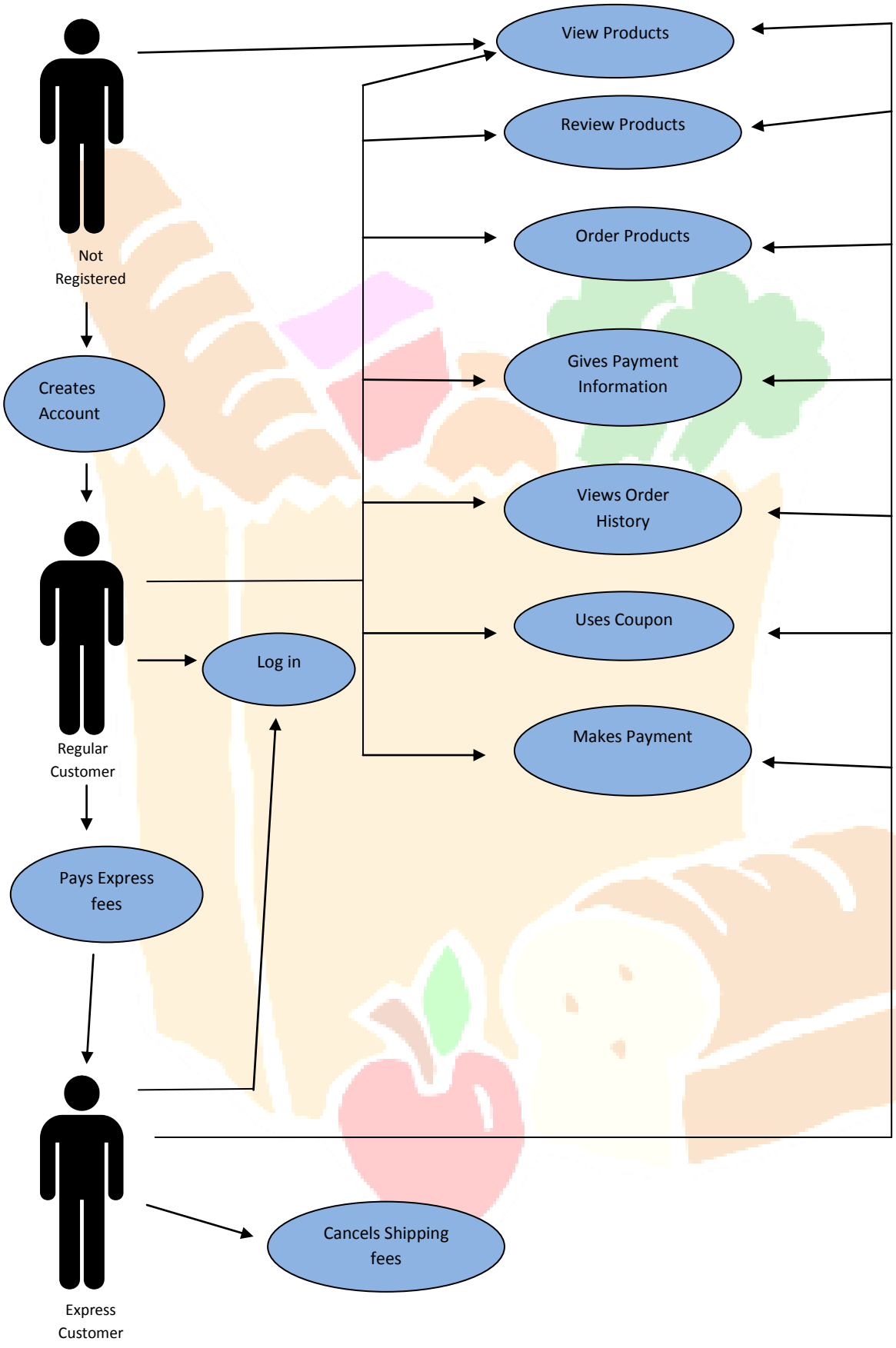
4) Customer:



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3. Normalization

Normalization is the process of decomposing relations with anomalies to produce smaller, well-structured relations.

Normalization are of types: 1NF, 2NF, 3NF, Boyce/Codd NF, 4NF, 5NF, Domain Key Normal Form. Of which 1NF,2NF,3NF and Boyce Codd depend on Functional dependencies.

1st Normal form:

For tables to be in 1st NF there should not be any multi-valued attributes. Each column should be atomic.

2nd Normal Form

For tables to be in 2NF, they should be in 1NF and partial dependencies should be removed. It means that all non-key fields should depend on the key field.

3rd Normal Form

For tables to be in 3NF, they should be in 2NF and all the transitive dependencies should be removed.

Boyce/Codd Normal Form:

For Tables to be in BCNF, they should be in 3NF and every determinant should be a primary key.

4th Normal Form

For 4NF, the tables should be in BCNF and it should not contain any multi-valued dependencies.

5th Normal Form

For 5NF, the tables should be in 4NF and the tables shouldn't contain any related multi-valued dependencies.

Domain Key Normal Form.

For table to be in DKNF, the table should consist no constraints except domain constraints and key constraints.

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Following Normalization steps were carried out in the project:

1) For my project during the initial phase the tables such as the person consisted of an attribute address which had multiple values such as the street name, city,state and zip. To convert the table in 1st NF, the data was separated. Likewise many other multivalued attributes were removed from the tables.

2) All the tables have a single primary key attribute which has been kept as Auto-Increment. So partial dependencies have been eliminated. This is to comply with 2NF

3) Person's table initially included information such as the email, phone which could determine the person's name so separate tables were made for them.

4) Tax percentage and state were initially included in the Orders table. But the state could determine the tax percentage which violated the 3NF, so they were separated out.

5) The product table consisted of department and department id but this violated 3NF as through department id, department could be found out hence they were separated into another table.

6) For customer, the payment details were first included in the customer table. This created transitive dependencies that using card details, other payment details could be found out, so they were separated into another table.

7) Invoice details were separated from the orders table to a new table, to comply with 3NF so that transitive dependencies could be removed.

Thus all the tables were converted into 3NF, since all the tables consists of primary key, they are in BCNF as the determinant is the primary key.

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4.Business Rules

The following business rules were implemented while designing the Instacart database:

1) The data is persisted in the database. None of the data is deleted.

2) The person who can access the database is either an employee of Instacart or a customer.

3) Customers are of two types: Regular and Express. For express customers, the shipping costs are removed.

4) A person must have and email, phone and address associated with him.

5) A Customer may have none or more than one payment methods. But to create an order, he requires the payment details.

6) A Customer has to be of one of the type: Regular or Express.

7) A customer can have none or more than one discount coupon. But a Discount coupon needs to have a customer.

8) A product can have none or more than one rating. But a rating needs to have a customer associated.

9) Every product belongs to a department and a department should atleast have a product.

10) A product can have none or more than one discount but a discount needs to be associated with a product

11) A product can be associated with one or more grocery store.

12) The availability depends on the grocery store.

13) A Shipment employee can handle more than one shipments

14) A customer can place none or more than one order but the order needs to have a customer associated with him

15) An Order must have a tax associated with it whereas a tax can be applied on multiple orders.

16) Every order needs to have card details.

17) Every invoice has customer payment details

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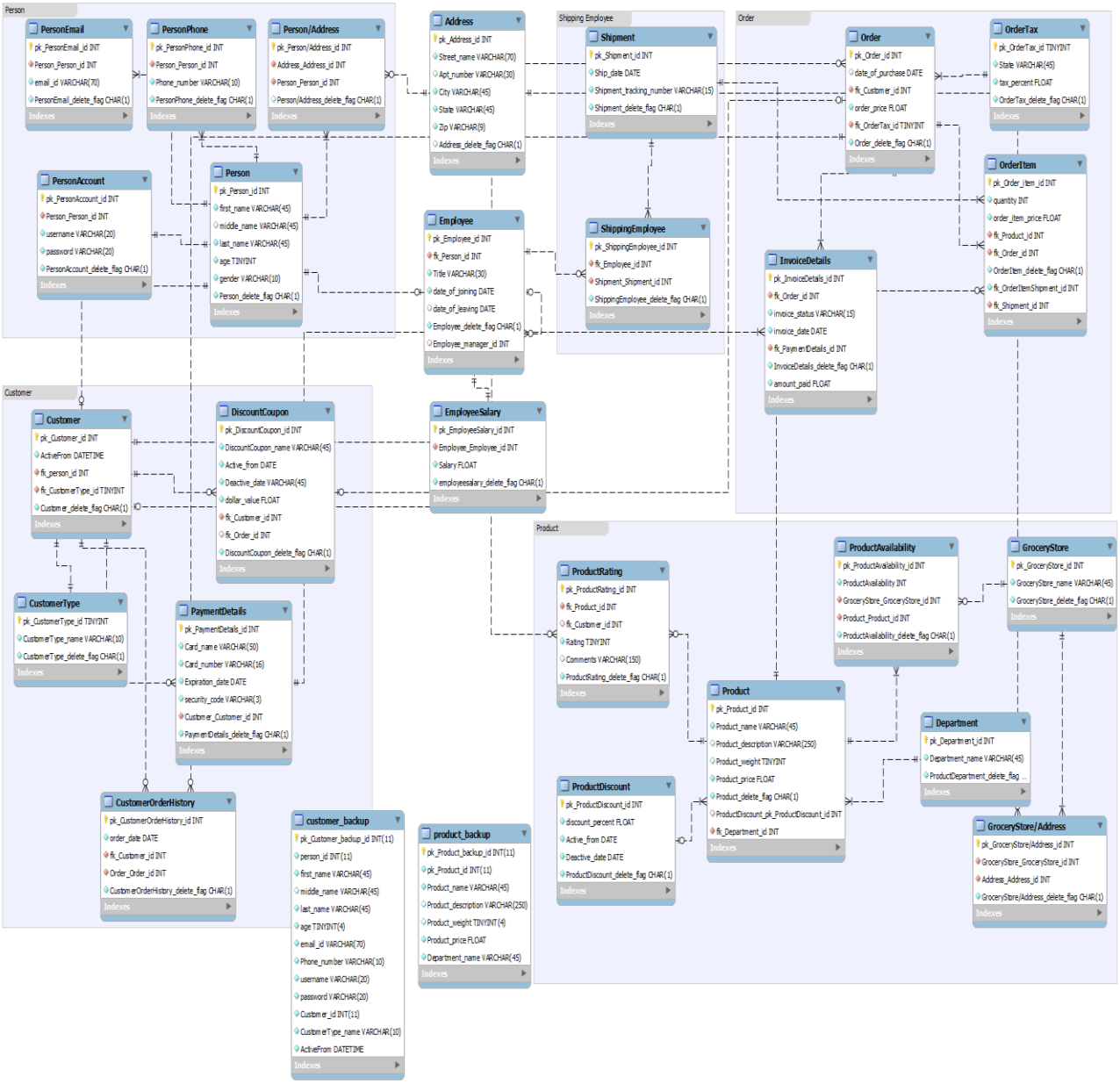
5. E-R Diagram



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6. Concepts Used

1) Primary Key:

A primary key is an attribute or combination of attributes which helps in uniquely identifying the row.
The value of primary key cannot be null.
The value should be unique.
Normally we use auto-increment for the fields so that values are not repeated.
All the primary key attributes in the project are prefixed by "pk_"

2) Foreign Key

A foreign key is the attribute which maintains the referential integrity and points to the primary key where it is referenced.
The value of foreign key can be null and be repetitive.
Foreign keys can be of following types:
1 to 1 relationship: Here the foreign key is kept on the table with minimum nulls.
1 to N relationship: Here foreign key is kept on the many side.
M to N relationship : Here we establish a new link table with primary keys of both the tables as foreign keys.
In the project the foreign keys are denoted with "fk_" suffix.

3) Relationships:

a) Unary Relationship: Here the relationship exist between the same entity.
In the project Unary relationship is created in the Employee Table where there Employee who is the manager can manage multiple staff under him. Hence a one to many relationship is created in the Employee table.

b) Binary Relationship: Here the relationship exists between two different entities. This is the most common type of relationship. There can be 1:1, 1:N or M:N type of relationship.
In the project many binary relationships are established.
example:
Employee table is linked with Salary having 1:1 relationship
Order linked with OrderItem table having 1:N relationship
Person and Address having M:N relationship so a link table was created Person/Address .

c) Ternary Relationship: Here the relationship exists between three different entities.
In the project no such relationship exists.

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4) Indexes:

Indexes help in getting the search results quicker. When Joins are performed on the tables the indexing can help in getting faster results. Indexes are of following types:

a) Primary key Index

b) Foreign key Index

c) Unique key Index

d) Index

e) Full- Text Index.

In the project following indexes were defined:

Table Name	Attribute	Index Type
Person	last_name	UNIQUE
PersonEmail	email_id	FULLTEXT
CustomerType	customerType_name	INDEX
Product	product_price	INDEX
InvoiceDetails	invoice_status	INDEX
PaymentDetails	card_number	INDEX

SQL Code:

```
CREATE UNIQUE INDEX last_name_idx ON Person (last_name);
CREATE FULLTEXT INDEX email_idx ON PersonEmail (email_id);
CREATE INDEX customer_type_idx ON CustomerType (customerType_name);
CREATE INDEX product_price_idx ON Product (product_price);
CREATE INDEX invoice_status_idx ON InvoiceDetails (invoice_status);
CREATE INDEX card_number_idx ON PaymentDetails (card_number);
```

7. Views

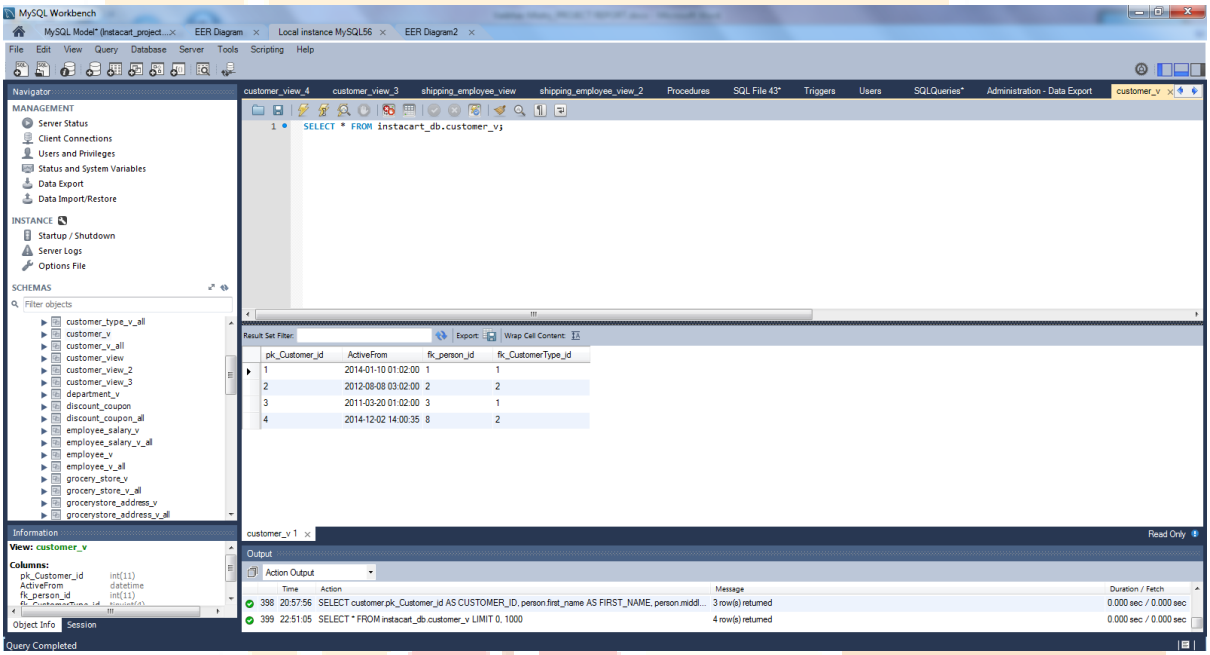
Views act as virtual tables . They are stored queries which when invoked produces a result set. Users can be assigned to these views. Any changes made in the data in the views also affect the base tables which the view is pointing to.

In this project as the data needs to be persistent, there are two views made of each table. One with delete flag as 'F' and the other will the complete view of the table. This is done so that when a delete action needs to be performed, the data admistrator would simply change the delete_flag = 'T', Hence to the user the data would appear as deleted but in the back the data would persist.

The views with suffix "_v" have the data with delete_flag ='F'. The views with complete view of table have suffix "_v_all".

One such example is shown below:

CREATE VIEW customer_v AS
SELECT pk_Customer_id, ActiveFrom , fk_person_id , fk_CustomerType_id FROM customer where Customer_delete_flag='F';



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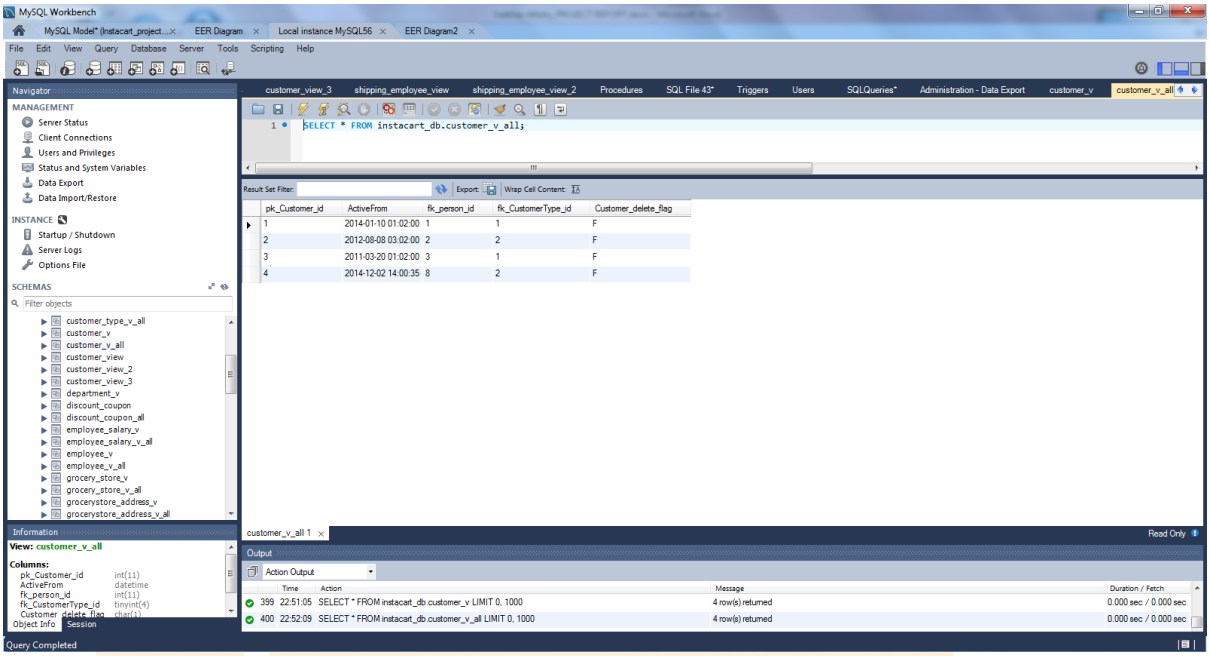
CREATE VIEW customer_v_all AS
SELECT * FROM customer;



Following views were created in the above manner:

address_v
address_v_all
customer_v
customer_v_all
customer_order_history_v
customer_order_history_v_all
customer_type_v
customer_type_v_all
department_v
department_v_all
discount_coupon
discount_coupon_all
employee_v
employee_v_all
employee_salary_v
employee_salary_v_all
grocery_store_v
grocery_store_v_all
grocerystore_address_v
grocerystore_address_v_all
invoice_details_v
invoice_details_v_all
order_v
order_v_all

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order_item_v
order_item_v_all
order_tax_v
order_tax_v_all
payment_details_v
payment_details_v_all
person_v
person_v_all
person_address_v
person_address_v_all
person_account_v
person_account_v_all
person_email_v
person_email_v_all
person_phone_v
person_phone_v_all
product_v
product_v_all
product_availability_v
product_availability_v_all
product_discount_v
product_discount_v_all
product_rating_v
product_rating_v_all
shipment_v
shipment_v_all
shipping_employee_v
shipping_employee_v_all

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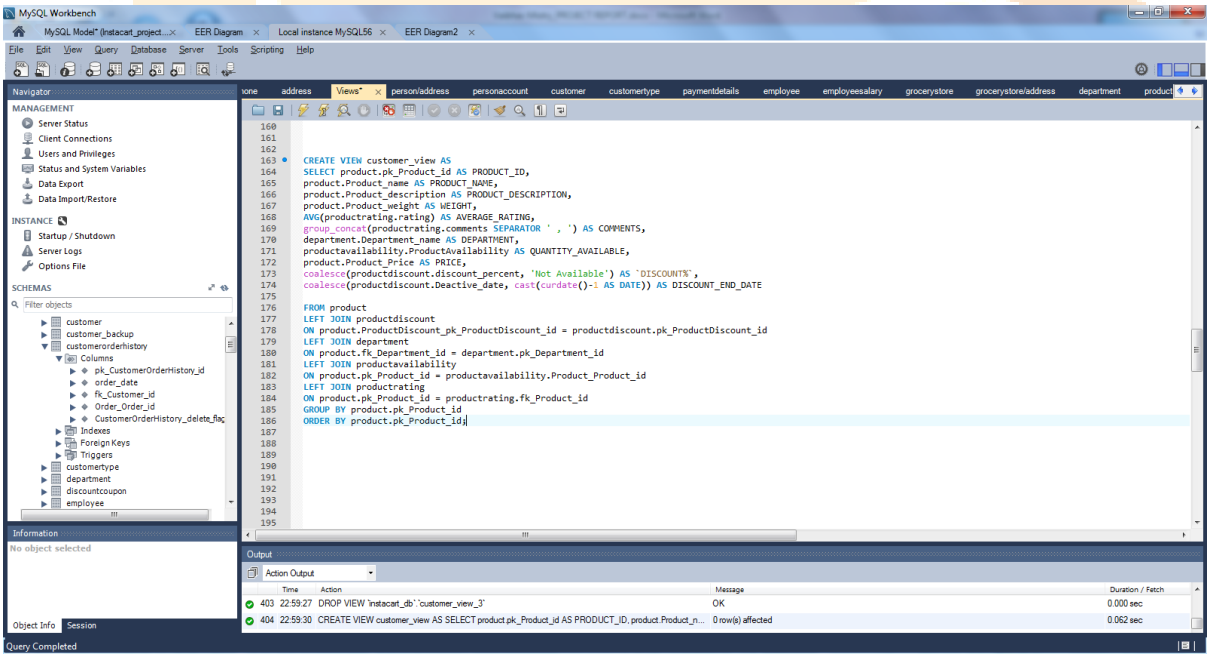
1) The following view was created for customer so that he can see the complete product details before making a purchase

```
CREATE VIEW customer_view AS
SELECT product.pk_Product_id AS PRODUCT_ID,
product.Product_name AS PRODUCT_NAME,
product.Product_description AS PRODUCT_DESCRIPTION,
product.Product_weight AS WEIGHT,
AVG(productrating.rating) AS AVERAGE_RATING,
group_concat(productrating.comments SEPARATOR ' , ') AS COMMENTS,
department.Department_name AS DEPARTMENT,
productavailability.ProductAvailability AS QUANTITY_AVAILABLE,
product.Product_Price AS PRICE,
coalesce(productdiscount.discount_percent, 'Not Available') AS `DISCOUNT%`,
coalesce(productdiscount.Deactive_date, cast(curdate()-1 AS DATE)) AS DISCOUNT_END_DATE

FROM product
LEFT JOIN productdiscount
ON product.ProductDiscount_pk_ProductDiscount_id = productdiscount.pk_ProductDiscount_id
LEFT JOIN department
ON product.fk_Department_id = department.pk_Department_id
LEFT JOIN productavailability
ON product.pk_Product_id = productavailability.Product_Product_id
LEFT JOIN productrating
ON product.pk_Product_id = productrating.fk_Product_id
GROUP BY product.pk_Product_id
ORDER BY product.pk_Product_id;
```



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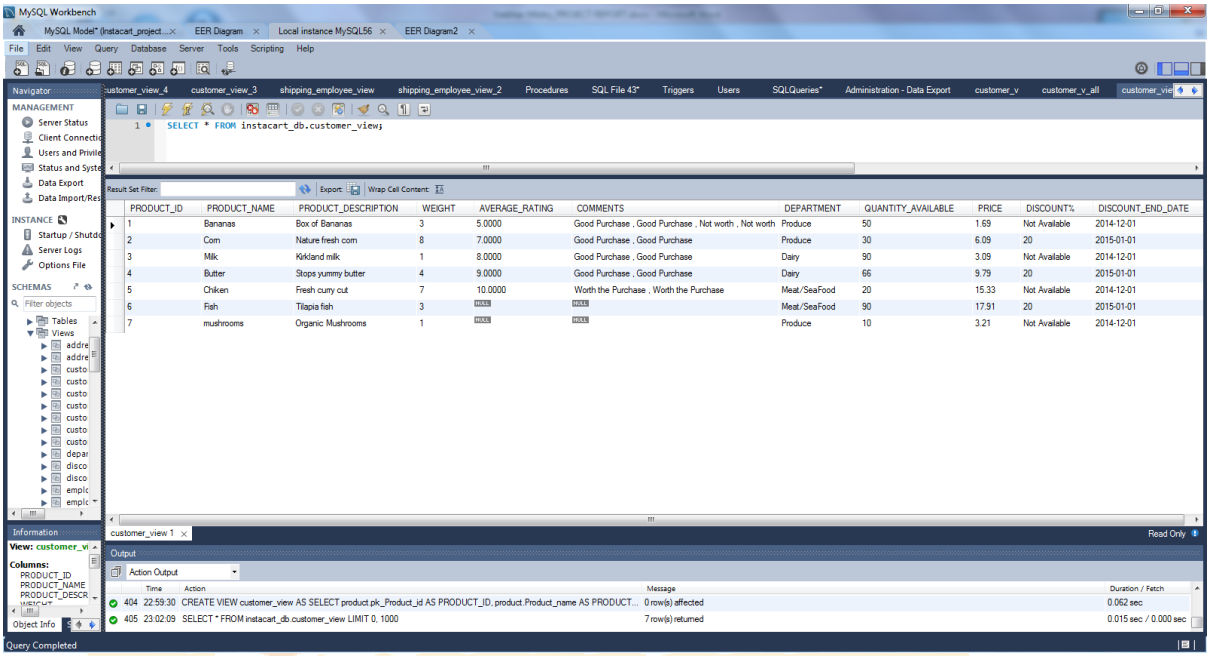
The output is as shown below:



2) Another view is created for the shipping employee so that he can view all the shipping details :

```
CREATE VIEW shipping_employee_view AS
SELECT
shipment.pk_Shipment_id AS SHIPMENT_ID,
shipment.Shipment_tracking_number AS TRACKING_NUMBER,
orderitem.quantity AS QUANTITY,
orderitem.fk_Product_id AS PRODUCT_ID,
product.Product_name AS PRODUCT_NAME,
`order`.pk_Order_id AS ORDER_ID,
`order`.date_of_purchase AS ORDER_DATE,
customer.pk_Customer_id AS CUSTOMER_ID,
concat(person.first_name,' ', coalesce(person.middle_name, ' ') , person.last_name) AS
CUSTOMER_NAME,
personemail.email_id AS EMAIL_ID,
concat(address.Street_name, ' , ', address.Apt_number, ' , ' , address.City, ' , ', address.state, ' , ' ,
address.zip) AS SHIP_ADDRESS

FROM `order`
INNER JOIN customer
ON `order`.fk_Customer_id = customer.pk_Customer_id
INNER JOIN person
ON person.pk_Person_id = customer.fk_person_id
INNER JOIN `person/address`
ON `person/address`.Person_Person_id = person.pk_Person_id
INNER JOIN address
ON address.pk_Address_id = `person/address`.Address_Address_id
```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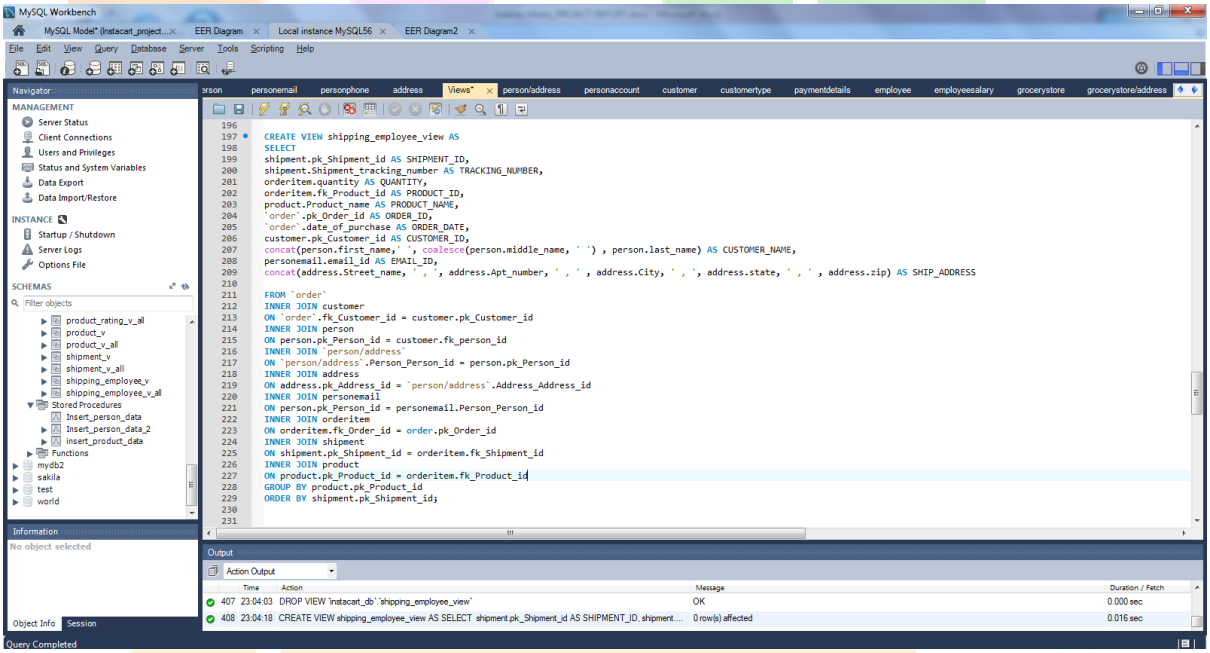
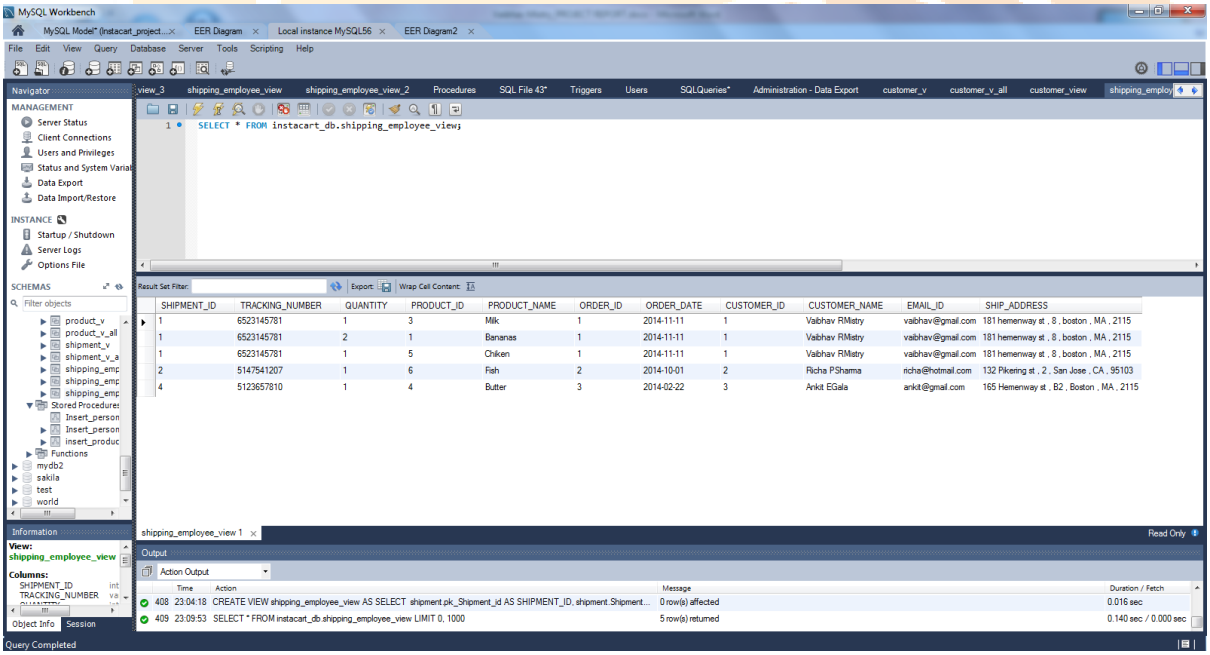
```
INNER JOIN personemail
ON person.pk_Person_id = personemail.Person_Person_id
INNER JOIN orderitem
ON orderitem.fk_Order_id = order.pk_Order_id
INNER JOIN shipment
ON shipment.pk_Shipment_id = orderitem.fk_Shipment_id
INNER JOIN product
ON product.pk_Product_id = orderitem.fk_Product_id
GROUP BY product.pk_Product_id
ORDER BY shipment.pk_Shipment_id;
```



The output is as shown below:



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8. Security/ Users

Database security should be considered of the prime importance when a database is created. Following factors need to considered when security is implemented in the database:
a) Select good passwords
b) Restricting the users by limiting the access given to them
c) Providing physical security

In the project following priviledeges are given to the users depending on their roles on the views created above.

1) Instacart Database Administrator

```
CREATE USER 'instacart_db_admin'@'%';
GRANT ALL PRIVILEGES ON instacart_db.* TO 'instacart_db_admin'@'%';
```

2)Manager

```
CREATE USER 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.employee_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.employeesalary_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.product_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.product_availability_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.product_discount_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.grocery_store_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.grocerystore_address_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.department_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.shipping_employee_v TO 'manager'@'%';
GRANT SELECT ON instacart_db.product_rating_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.order_v TO 'manager'@'%';
GRANT SELECT ON instacart_db.order_item_v TO 'manager'@'%';
GRANT SELECT ON instacart_db.order_tax_v TO 'manager'@'%';
GRANT SELECT ON instacart_db.invoice_details_v TO 'manager'@'%';
GRANT SELECT ON instacart_db.shipment_v TO 'manager'@'%';
GRANT SELECT,UPDATE, INSERT ON instacart_db.address_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_address_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_email_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_phone_v TO 'manager'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.discount_coupon TO 'manager'@'%';
GRANT SELECT ON instacart_db.customer_v TO 'manager'@'%';
```


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3) Shipping Employee

```
CREATE USER 'shipping_employee'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.shipment_v TO 'shipping_employee'@'%';
GRANT SELECT ON instacart_db.order_v TO 'shipping_employee'@'%';
GRANT SELECT ON instacart_db.order_item_v TO 'shipping_employee'@'%';
GRANT SELECT ON instacart_db.order_v TO 'shipping_employee'@'%';
GRANT SELECT ON instacart_db.invoice_details_v TO 'shipping_employee'@'%';
GRANT SELECT ON instacart_db.order_v TO 'shipping_employee'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.address_v TO 'shipping_employee'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person TO 'shipping_employee'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_email_v TO 'shipping_employee'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_phone_v TO 'shipping_employee'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_address_v TO 'shipping_employee'@'%';
GRANT SELECT ON instacart_db.product_v TO 'shipping_employee'@'%';
GRANT SELECT ON instacart_db.product_availability_v TO 'shipping_employee'@'%';
GRANT SELECT ON instacart_db.grocery_store_v TO 'shipping_employee'@'%';
```

4) Financial Accountant:

```
CREATE USER 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.order_tax_v TO 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.invoice_details_v TO 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.order_v TO 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.order_item_v TO 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.order_tax_v TO 'financial_accountant'@'%';
GRANT SELECT ON instacart_db.discount_coupon TO 'financial_accountant'@'%';
GRANT SELECT ON instacart_db.product_discount_v TO 'financial_accountant'@'%';
GRANT SELECT ON instacart_db.order_tax_v TO 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person TO 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_email_v TO 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_phone_v TO 'financial_accountant'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_address_v TO 'financial_accountant'@'%';
```


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5) Customer:

```
CREATE USER 'customer'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.customer_v TO 'customer'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.payment_details_v TO 'customer'@'%';
GRANT SELECT ON instacart_db.customer_type_v TO 'customer'@'%';
GRANT SELECT ON instacart_db.discount_coupon TO 'customer'@'%';
GRANT SELECT ON instacart_db.customer_order_history_v TO 'customer'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.product_rating_v TO 'customer'@'%';
GRANT SELECT ON instacart_db.product_v TO 'customer'@'%';
GRANT SELECT ON instacart_db.product_availability_v TO 'customer'@'%';
GRANT SELECT ON instacart_db.grocery_store_v TO 'customer'@'%';
GRANT SELECT ON instacart_db.product_v TO 'customer'@'%';
GRANT SELECT, INSERT ON instacart_db.order_item_v TO 'customer'@'%';
GRANT SELECT, INSERT ON instacart_db.order_v TO 'customer'@'%';
GRANT SELECT ON instacart_db.department TO 'customer'@'%';
GRANT SELECT,INSERT ON instacart_db.invoice_details_v TO 'customer'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person TO 'customer'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_email_v TO 'customer'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_phone_v TO 'customer'@'%';
GRANT SELECT,UPDATE,INSERT ON instacart_db.person_address_v TO 'customer'@'%';
```

9. Stored Procedures

A) To enter the product details:

```
DELIMITER !!!

CREATE PROCEDURE insert_product_data (product_name varchar(45), product_description
varchar(250), weight tinyint(4), price float, department varchar(45),
quantity int(10), grocery_store varchar(45))

BEGIN
IF EXISTS (SELECT pk_GroceryStore_id FROM grocerystore WHERE GroceryStore_name =
grocery_store)
THEN
SET @grocery_s_id = (SELECT pk_GroceryStore_id FROM grocerystore WHERE GroceryStore_name =
grocery_store);
ELSE
INSERT INTO grocerystore values (null, GroceryStore_name, 'F');
SET @grocery_s_id = (SELECT MAX(pk_GroceryStore_id) FROM grocerystore);
END IF;
IF EXISTS (SELECT pk_Department_id FROM department WHERE Department_name=department)
THEN
SET @dept_id =(SELECT pk_Department_id FROM department WHERE
Department_name=department);
ELSE
INSERT INTO department values (null,department,'F');
SET @dept_id = (SELECT MAX(pk_Department_id) FROM department);
END IF;
INSERT INTO product values (null, product_name, product_description, weight, price, 'F', null,
@dept_id);
SET @prod_id = (SELECT MAX(pk_Product_id) FROM product);
INSERT INTO productavailability values(null,quantity, @grocery_s_id,@prod_id,'F');
END; !!!
```


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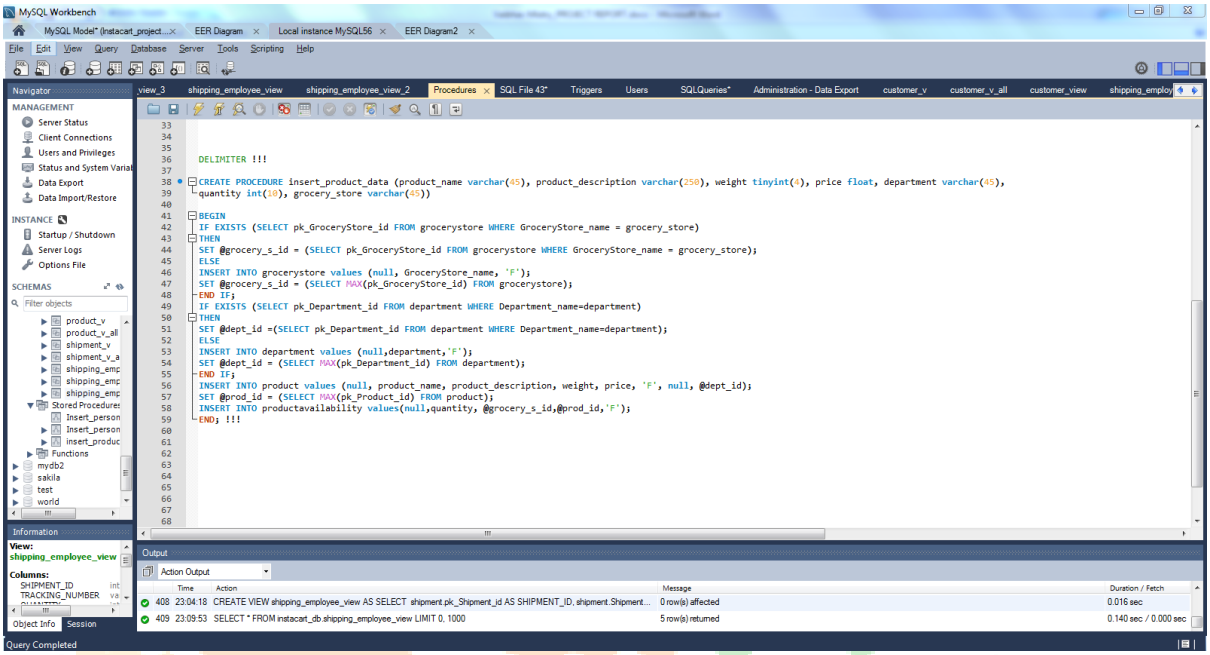
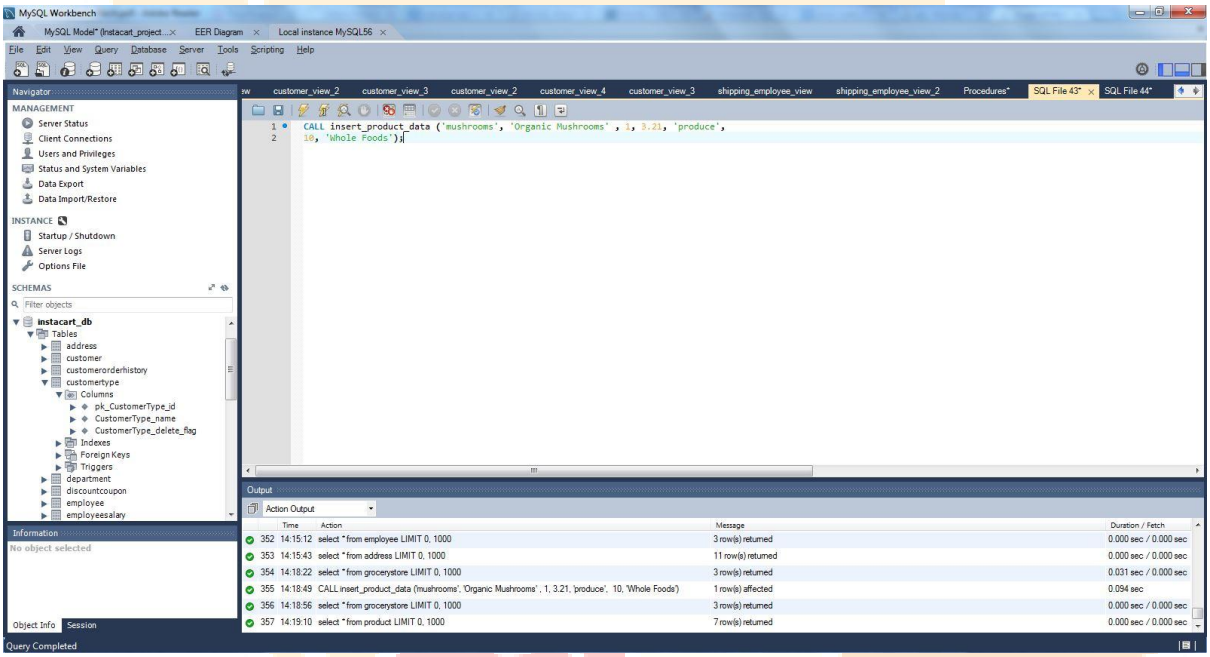


CALL insert_product_data ('mushrooms', 'Organic Mushrooms' , 1, 3.21, 'produce', 10, 'Whole Foods');



The updated tables are shown below:

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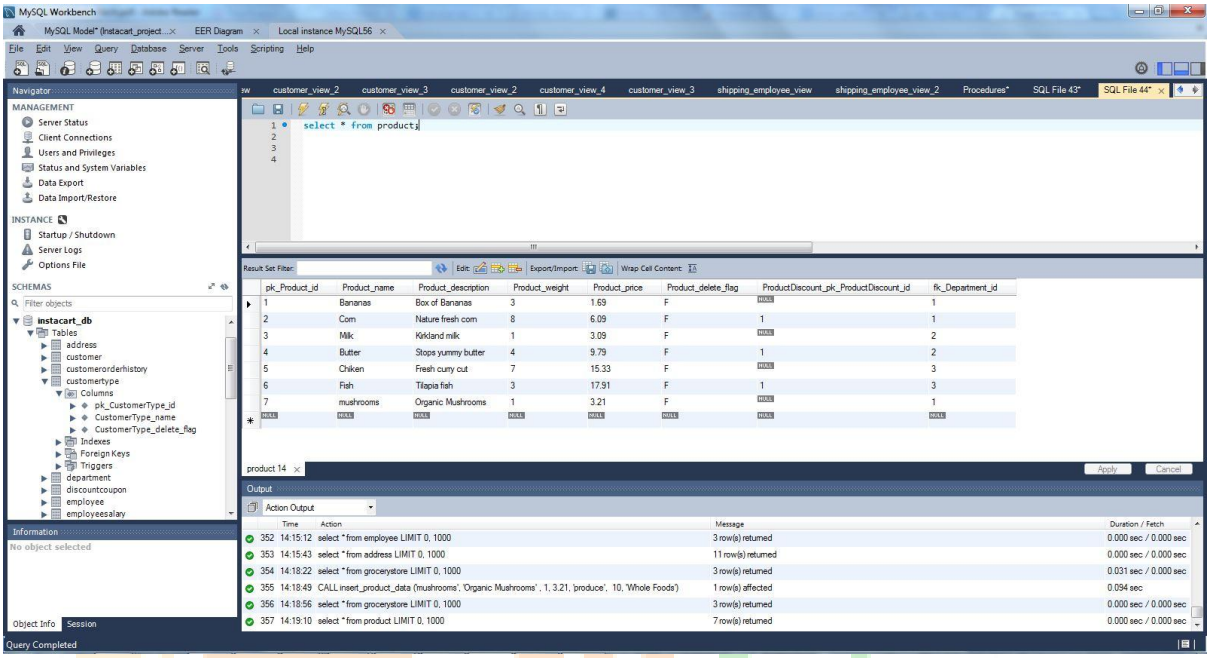

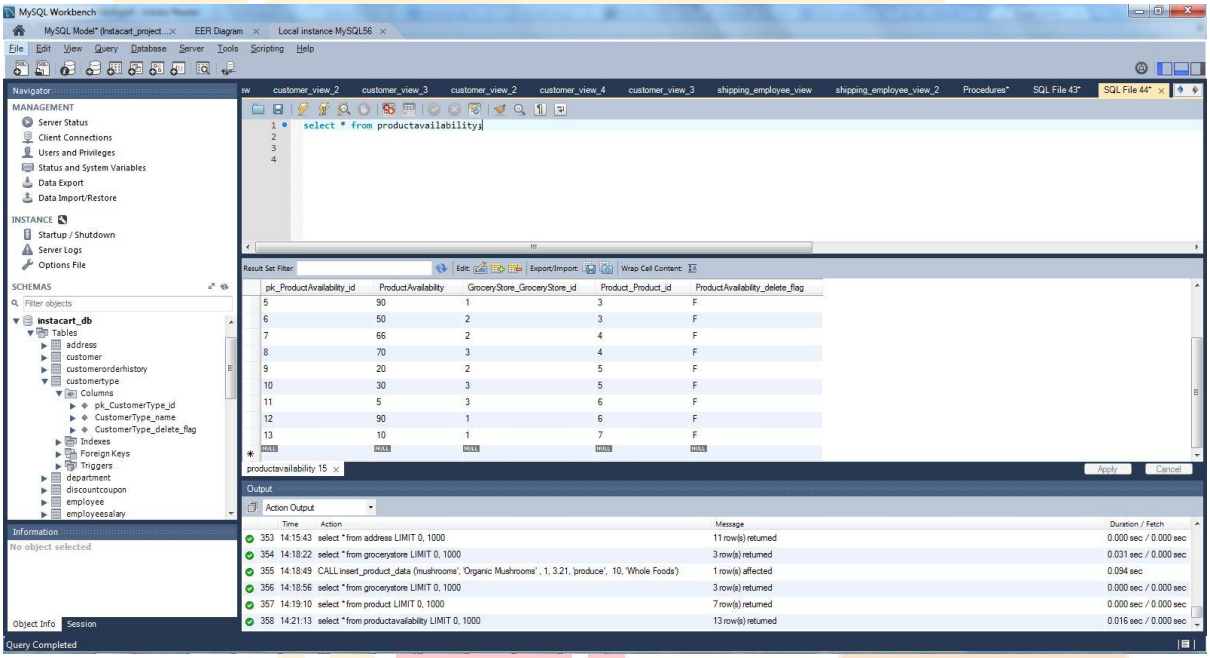

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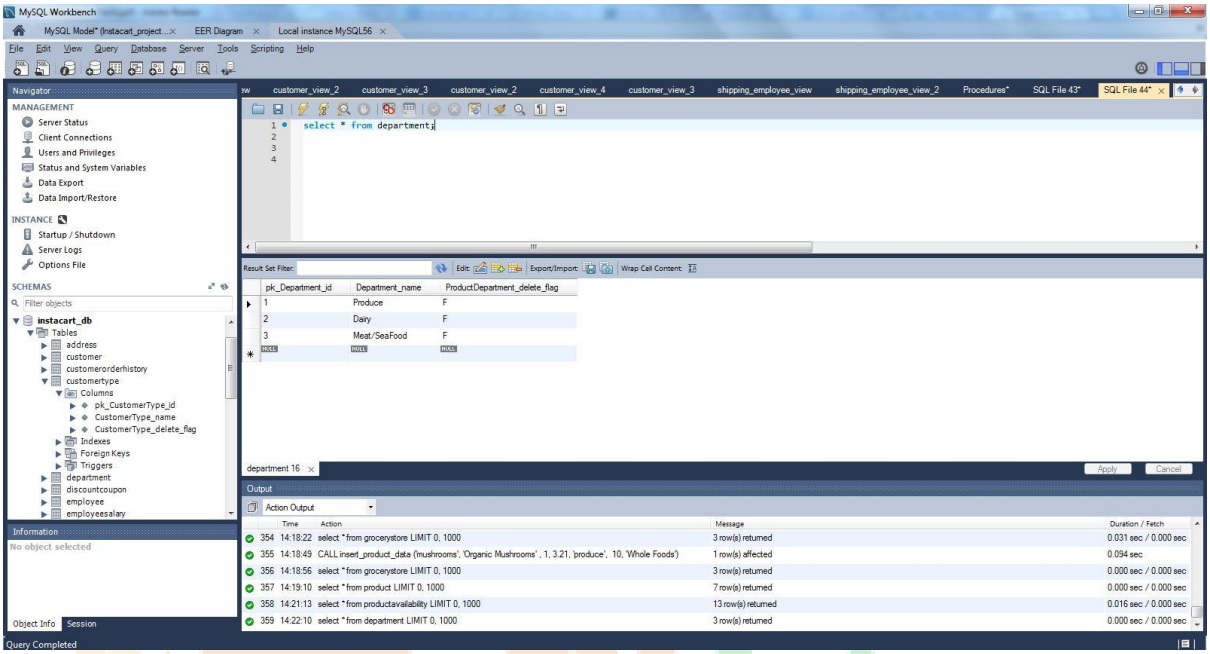

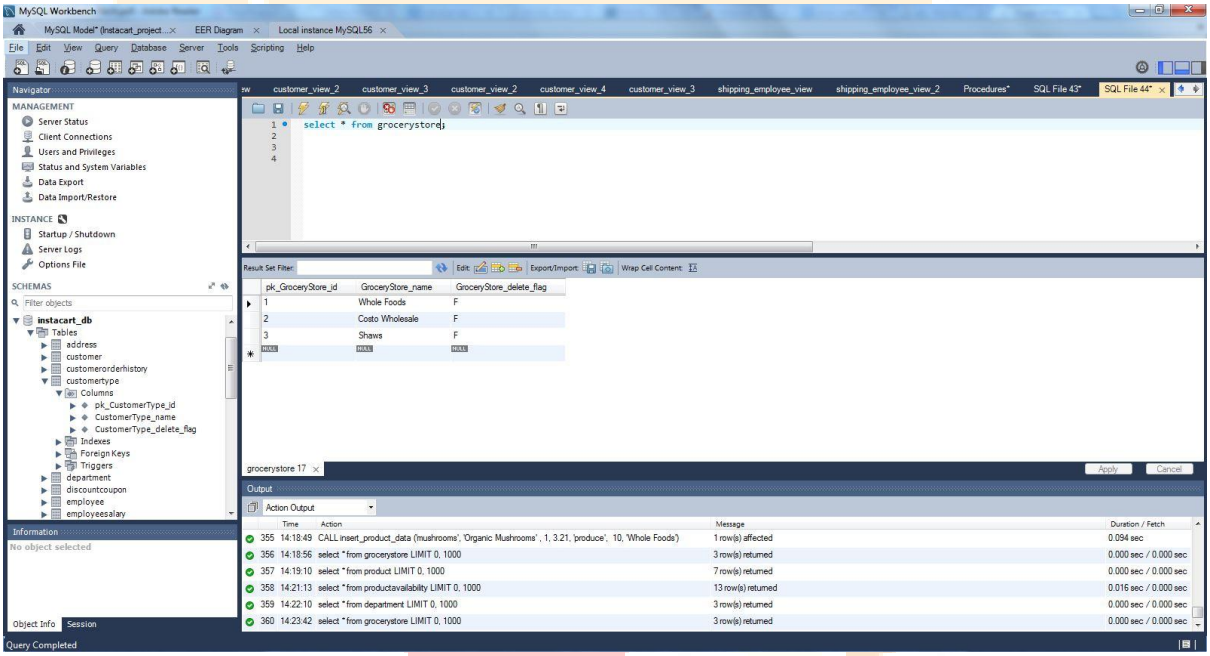

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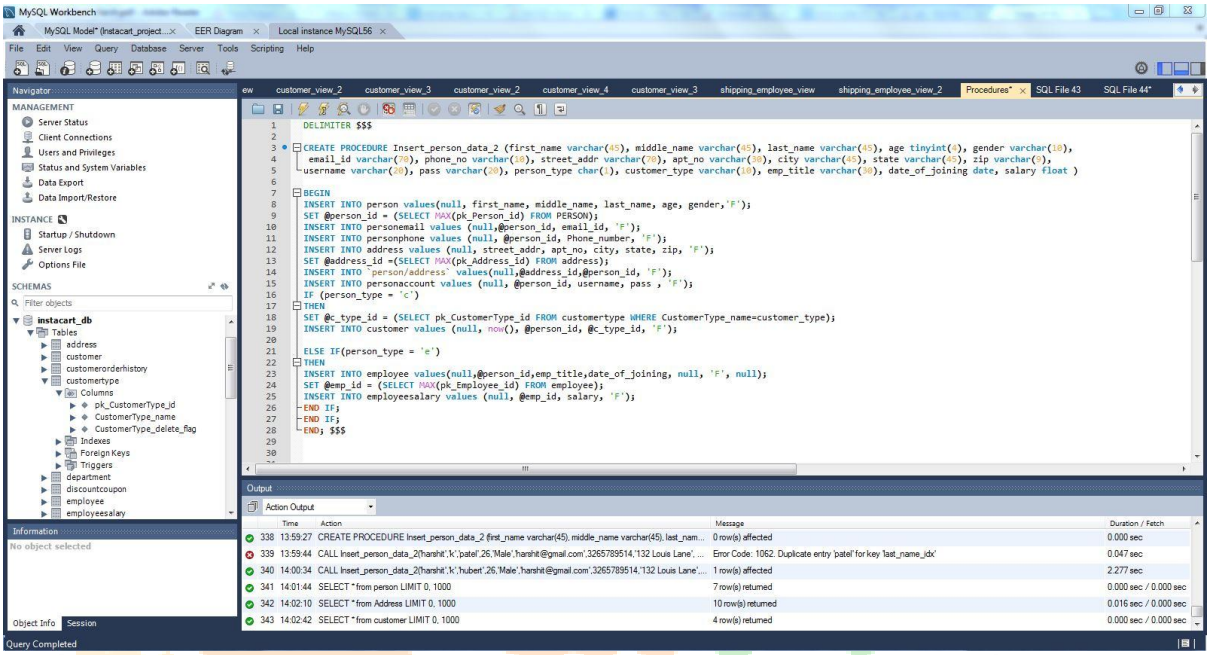
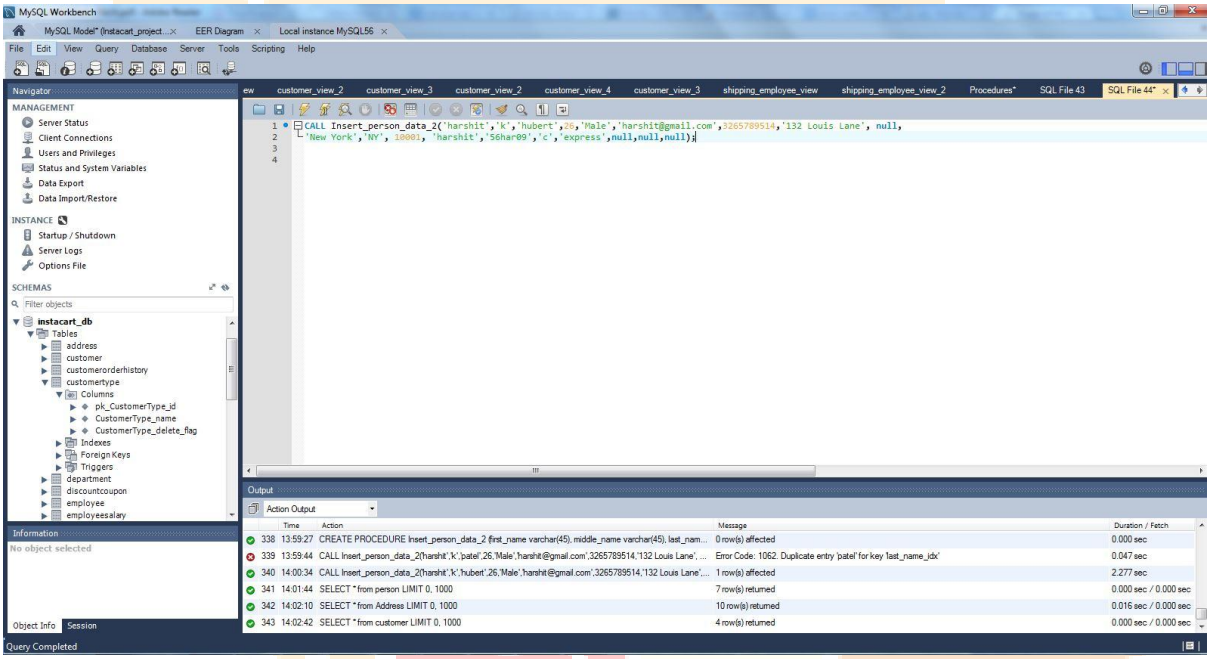
B) Stored Procedure created to enter the person data based on the type of person:

```
DELIMITER $$$

CREATE PROCEDURE Insert_person_data_2 (first_name varchar(45), middle_name varchar(45),
last_name varchar(45), age tinyint(4), gender varchar(10),
 email_id varchar(70), phone_no varchar(10), street_addr varchar(70), apt_no varchar(30), city
varchar(45), state varchar(45), zip varchar(9),
username varchar(20), pass varchar(20), person_type char(1), customer_type varchar(10), emp_title
varchar(30), date_of_joining date, salary float )

BEGIN
INSERT INTO person values(null, first_name, middle_name, last_name, age, gender,'F');
SET @person_id = (SELECT MAX(pk_Person_id) FROM PERSON);
INSERT INTO personemail values (null,@person_id, email_id, 'F');
INSERT INTO personphone values (null, @person_id, Phone_number, 'F');
INSERT INTO address values (null, street_addr, apt_no, city, state, zip, 'F');
SET @address_id =(SELECT MAX(pk_Address_id) FROM address);
INSERT INTO `person/address` values(null,@address_id,@person_id, 'F');
INSERT INTO personaccount values (null, @person_id, username, pass , 'F');
IF (person_type = 'c')
THEN
SET @c_type_id = (SELECT pk_CustomerType_id FROM customertype WHERE
CustomerType_name=customer_type);
INSERT INTO customer values (null, now(), @person_id, @c_type_id, 'F');

ELSE IF(person_type = 'e')
THEN
INSERT INTO employee values(null,@person_id,emp_title,date_of_joining, null, 'F', null);
SET @emp_id = (SELECT MAX(pk_Employee_id) FROM employee);
INSERT INTO employeesalary values (null, @emp_id, salary, 'F');
END IF;
END IF;
END; $$$
```

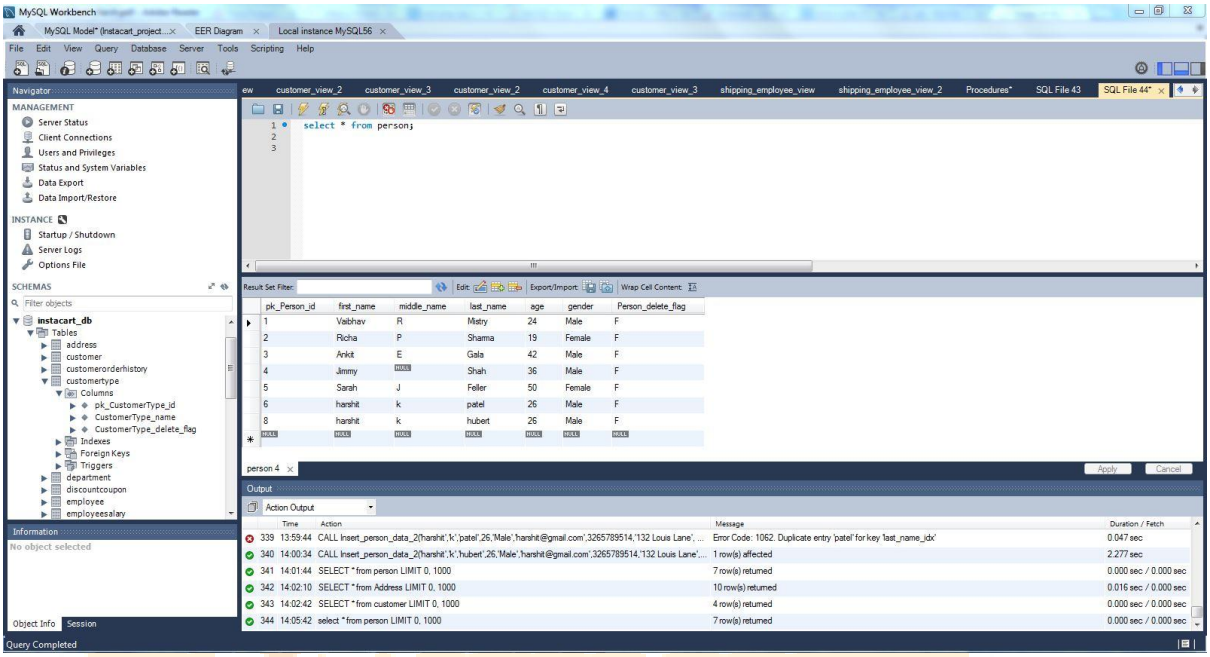


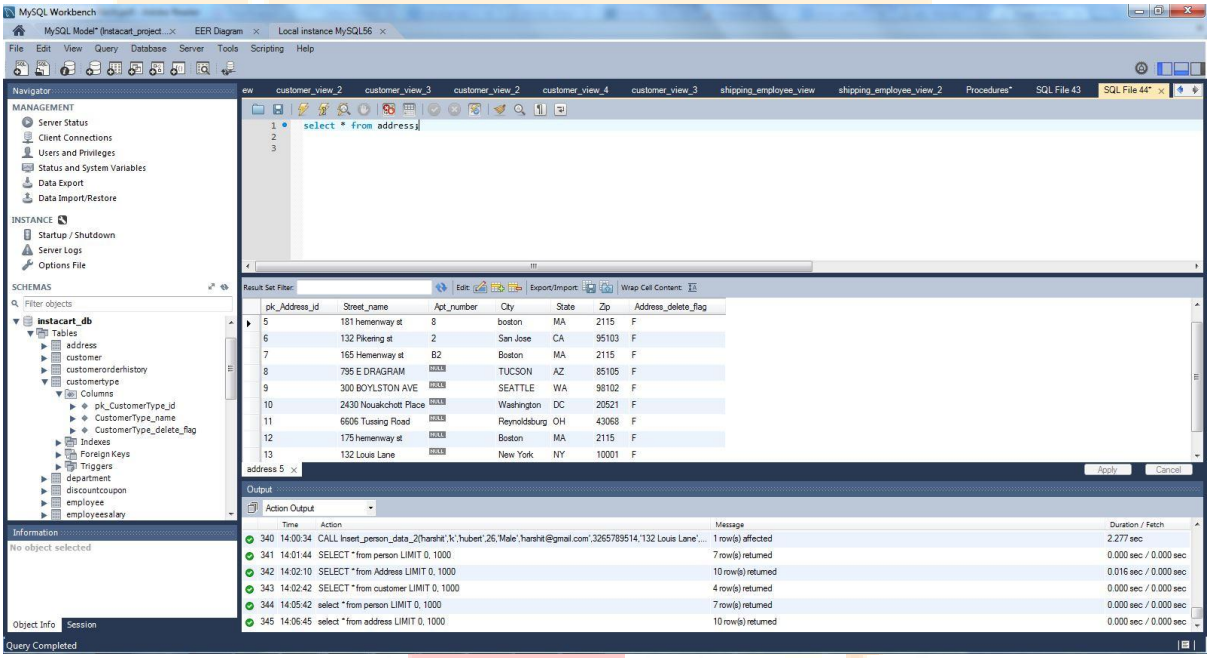
Calling the procedure:

1) When person is of type customer:



Updated Tables:





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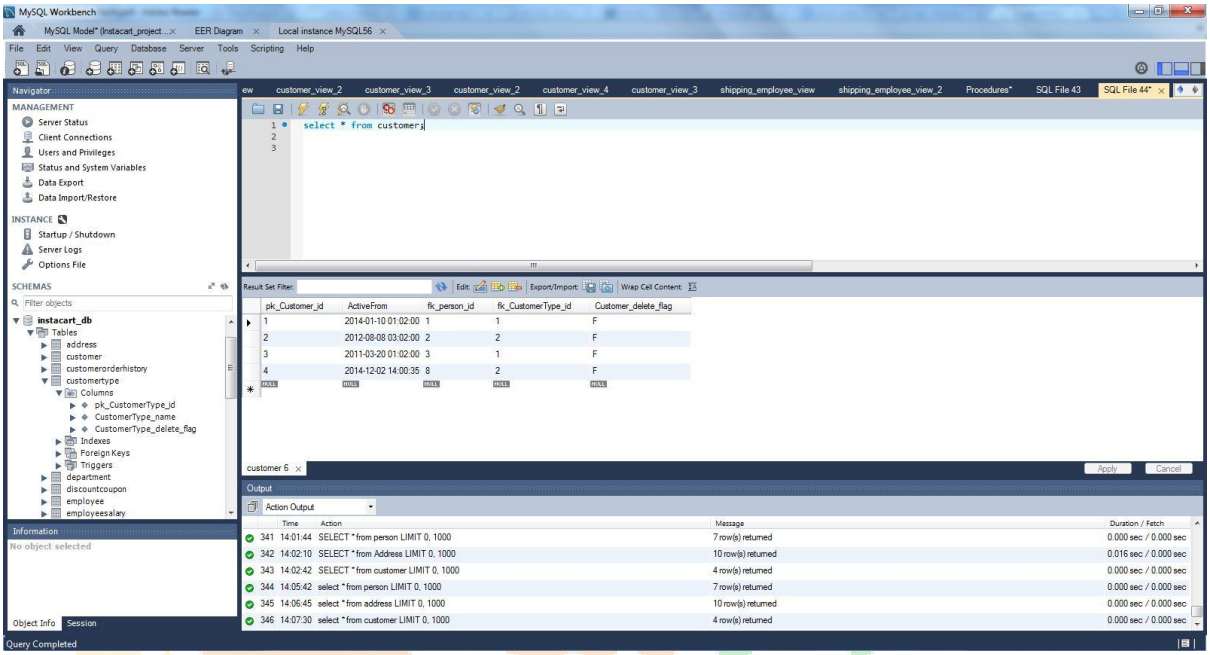
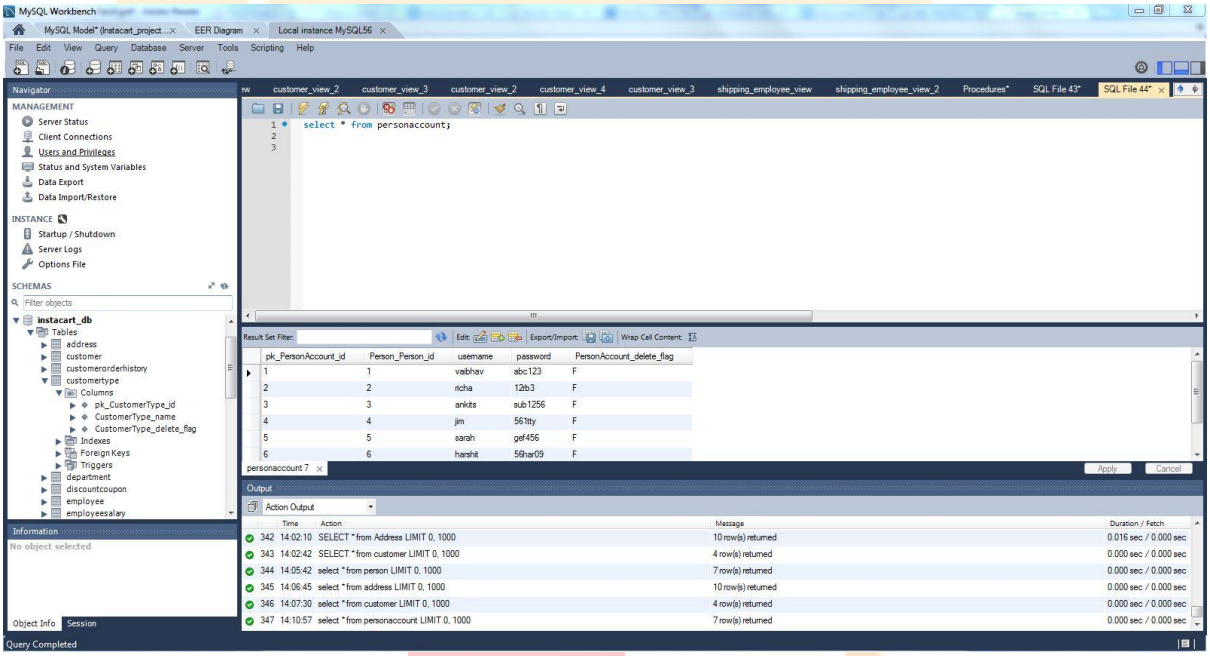
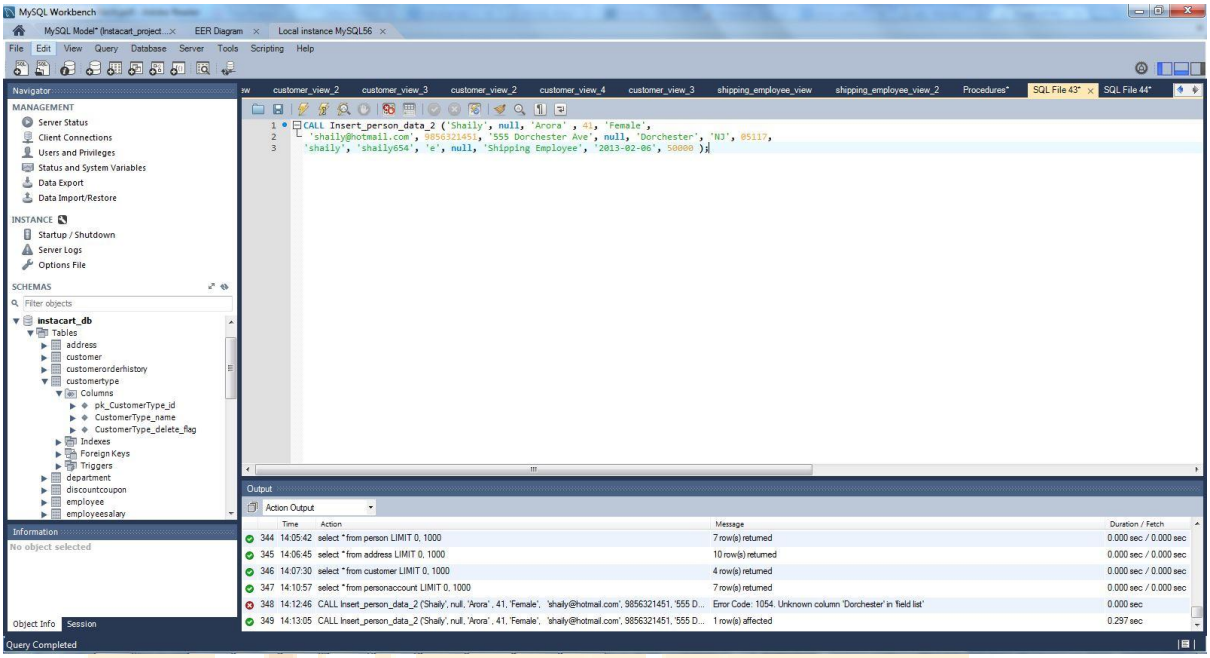
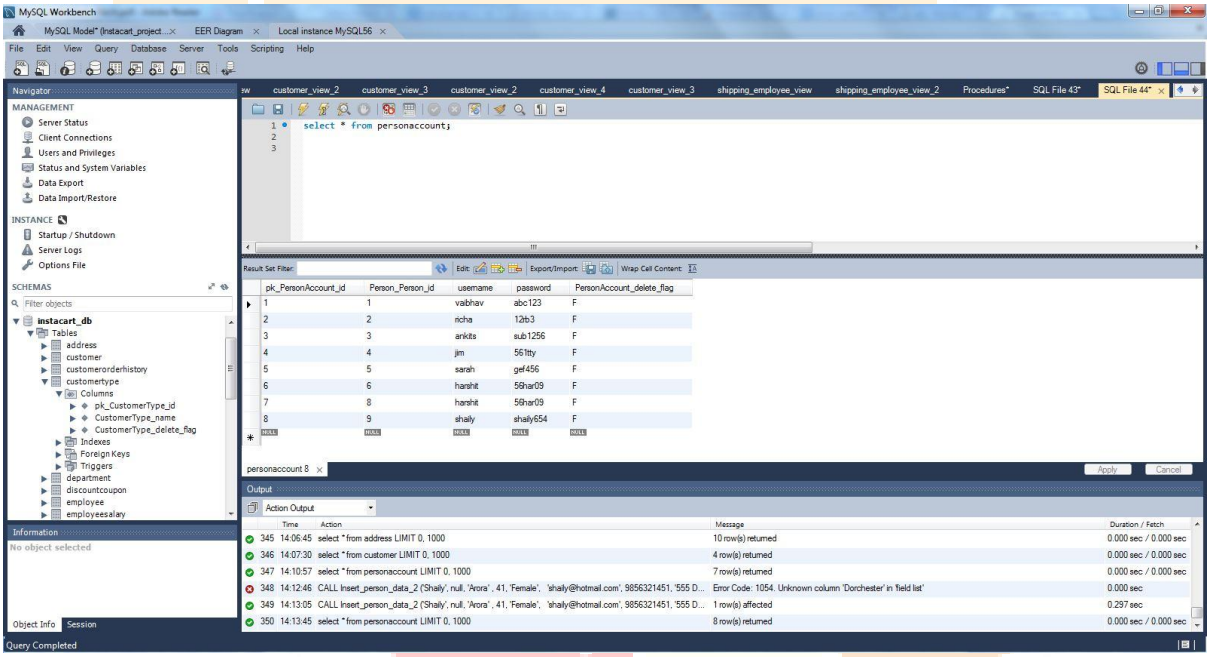

MySQL Workbench
select * from customer;
pk_Customer_id | ActiveFrom | fk_person_id | fk_CustomerType_id | Customer_delete_flag
1 | 2014-01-10 01:02:00 | 1 | 1 | F
2 | 2012-08-08 03:02:00 | 2 | 2 | F
3 | 2011-03-20 01:02:00 | 3 | 1 | F
4 | 2014-12-02 14:00:35 | 8 | 2 | F
341 14:01:44 SELECT * from person LIMIT 0, 1000 7 row(s) returned 0.000 sec / 0.000 sec
342 14:02:10 SELECT * from Address LIMIT 0, 1000 10 row(s) returned 0.016 sec / 0.000 sec
343 14:02:42 SELECT * from customer LIMIT 0, 1000 4 row(s) returned 0.000 sec / 0.000 sec
344 14:05:42 select * from person LIMIT 0, 1000 7 row(s) returned 0.000 sec / 0.000 sec
345 14:06:45 select * from address LIMIT 0, 1000 10 row(s) returned 0.000 sec / 0.000 sec
346 14:07:30 select * from customer LIMIT 0, 1000 4 row(s) returned 0.000 sec / 0.000 sec
Query Completed


MySQL Workbench
select * from personaccount;
pk_PersonAccount_id | Person_Person_id | username | password | PersonAccount_delete_flag
1 | 1 | vaibhav | abc123 | F
2 | 2 | richa | 12tb3 | F
3 | 3 | ankita | sub1256 | F
4 | 4 | jim | 561tty | F
5 | 5 | sarah | gef456 | F
6 | 6 | harshit | 58har09 | F
342 14:02:10 SELECT * from Address LIMIT 0, 1000 10 row(s) returned 0.016 sec / 0.000 sec
343 14:02:42 SELECT * from customer LIMIT 0, 1000 4 row(s) returned 0.000 sec / 0.000 sec
344 14:05:42 select * from person LIMIT 0, 1000 7 row(s) returned 0.000 sec / 0.000 sec
345 14:06:45 select * from address LIMIT 0, 1000 10 row(s) returned 0.000 sec / 0.000 sec
346 14:07:30 select * from customer LIMIT 0, 1000 4 row(s) returned 0.000 sec / 0.000 sec
347 14:10:57 select * from personaccount LIMIT 0, 1000 7 row(s) returned 0.000 sec / 0.000 sec
Query Completed

2) Calling the procedure when the person is of type employee



The updated tables are as below:



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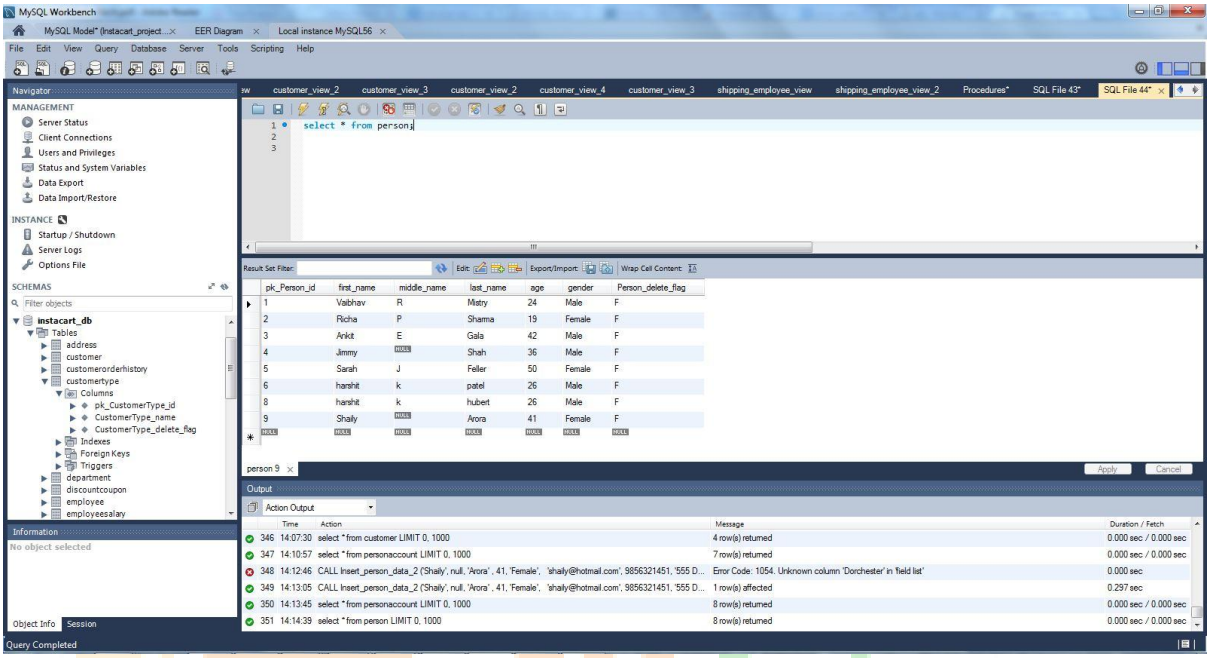

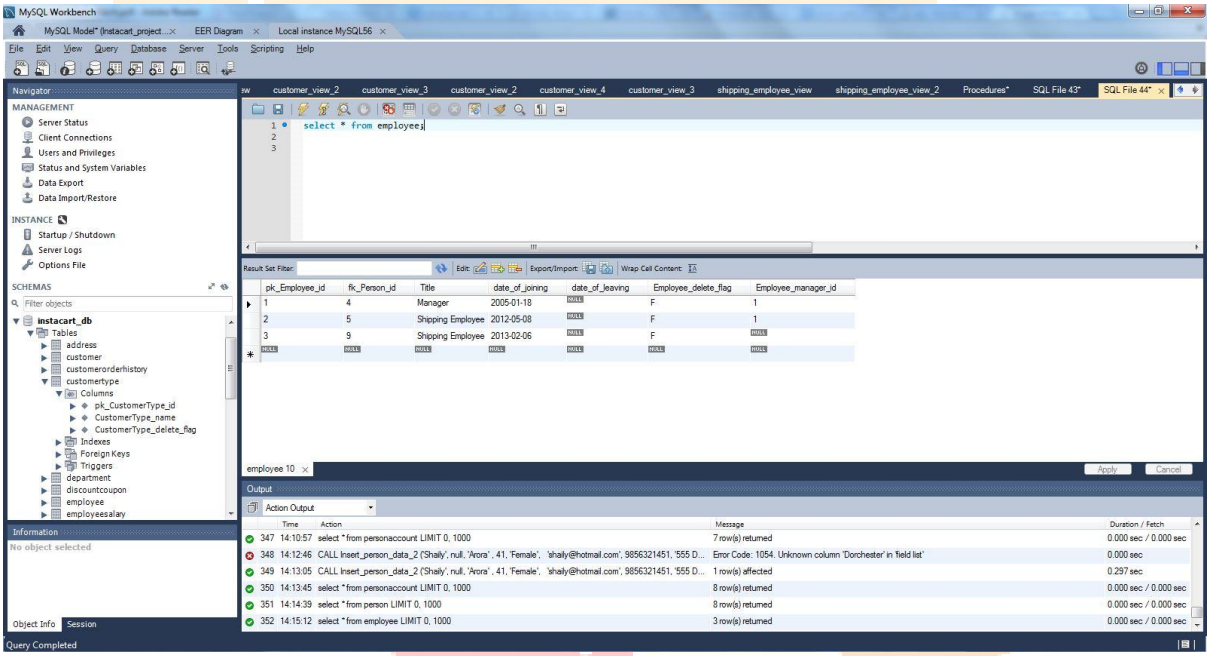

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10. Triggers

1) To create a backup of product:

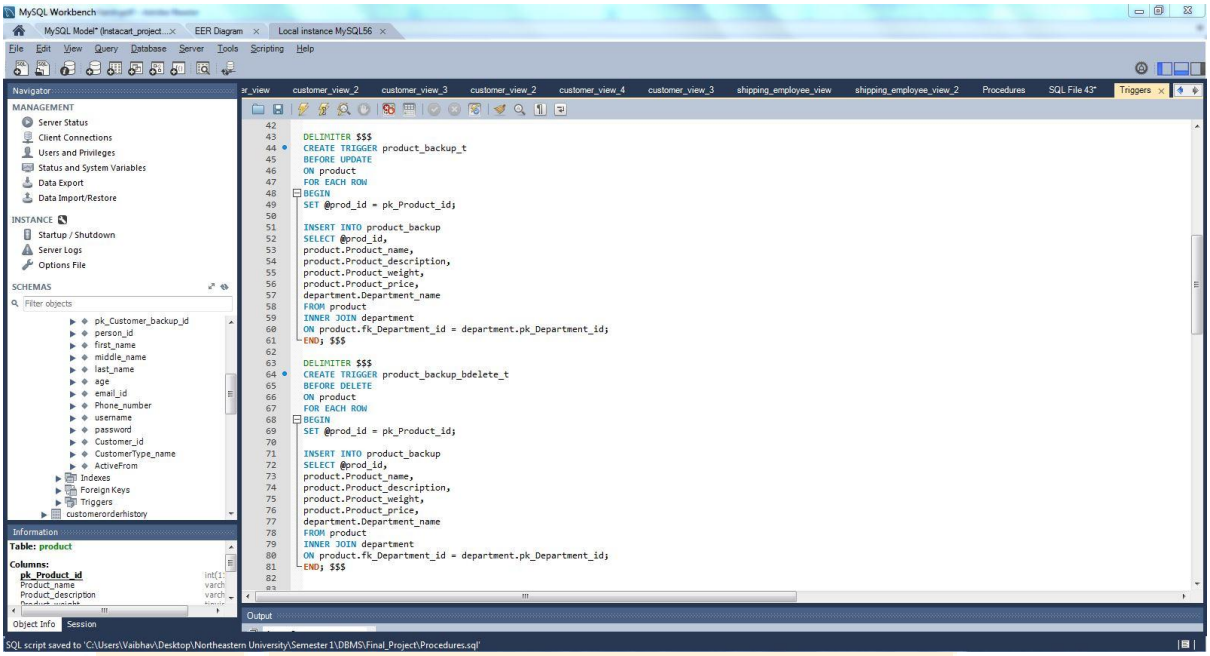
a) ON UPDATE:

```
DELIMITER $$$
CREATE TRIGGER product_backup_t
BEFORE UPDATE
ON product
FOR EACH ROW
BEGIN
SET @prod_id = pk_Product_id;

INSERT INTO product_backup
SELECT @prod_id,
product.Product_name,
product.Product_description,
product.Product_weight,
product.Product_price,
department.Department_name
FROM product
INNER JOIN department
ON product.fk_Department_id = department.pk_Department_id;
END; $$$
```

b) ON DELETE

```
DELIMITER $$$
CREATE TRIGGER product_backup_bdelete_t
BEFORE DELETE
ON product
FOR EACH ROW
BEGIN
SET @prod_id = pk_Product_id;

INSERT INTO product_backup
SELECT @prod_id,
product.Product_name,
product.Product_description,
product.Product_weight,
product.Product_price,
department.Department_name
FROM product
INNER JOIN department
```

```
ON product.fk_Department_id = department.pk_Department_id;
END; $$$
```

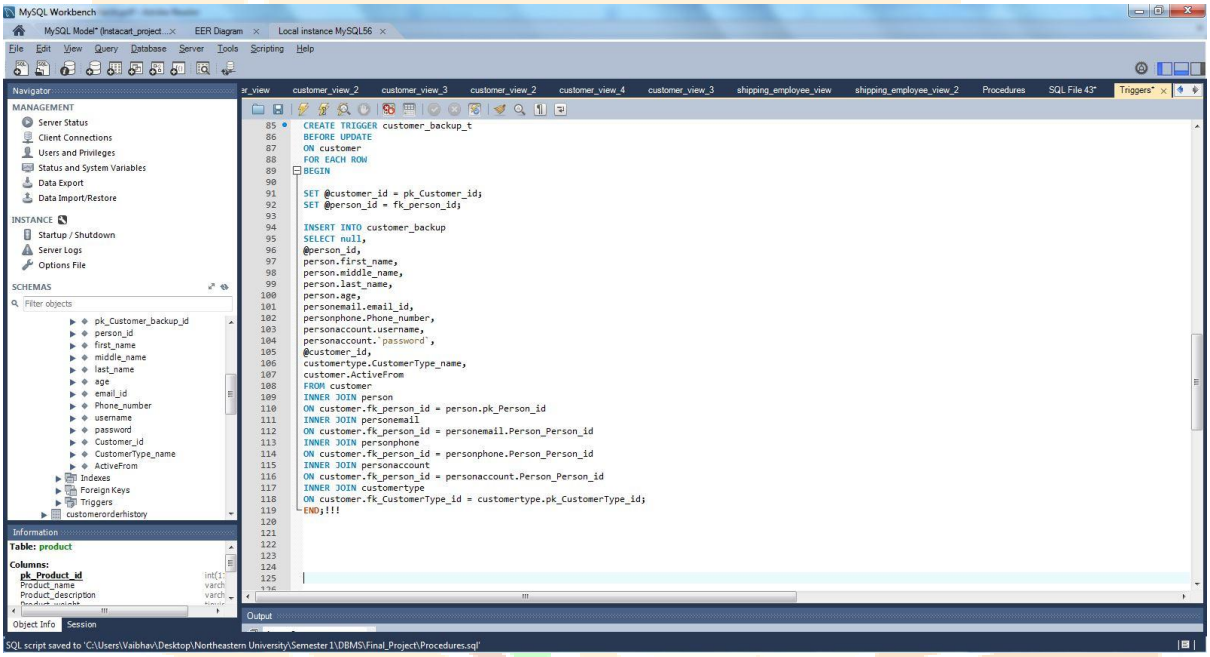


2) To create a backup of the customer:

A) ON UPDATE

```
DELIMITER !!!
CREATE TRIGGER customer_backup_t
BEFORE UPDATE
ON customer
FOR EACH ROW
BEGIN

SET @customer_id = pk_Customer_id;
SET @person_id = fk_person_id;

INSERT INTO customer_backup
SELECT null,
@person_id,
person.first_name,
person.middle_name,
person.last_name,
person.age,
personemail.email_id,
personphone.Phone_number,
```

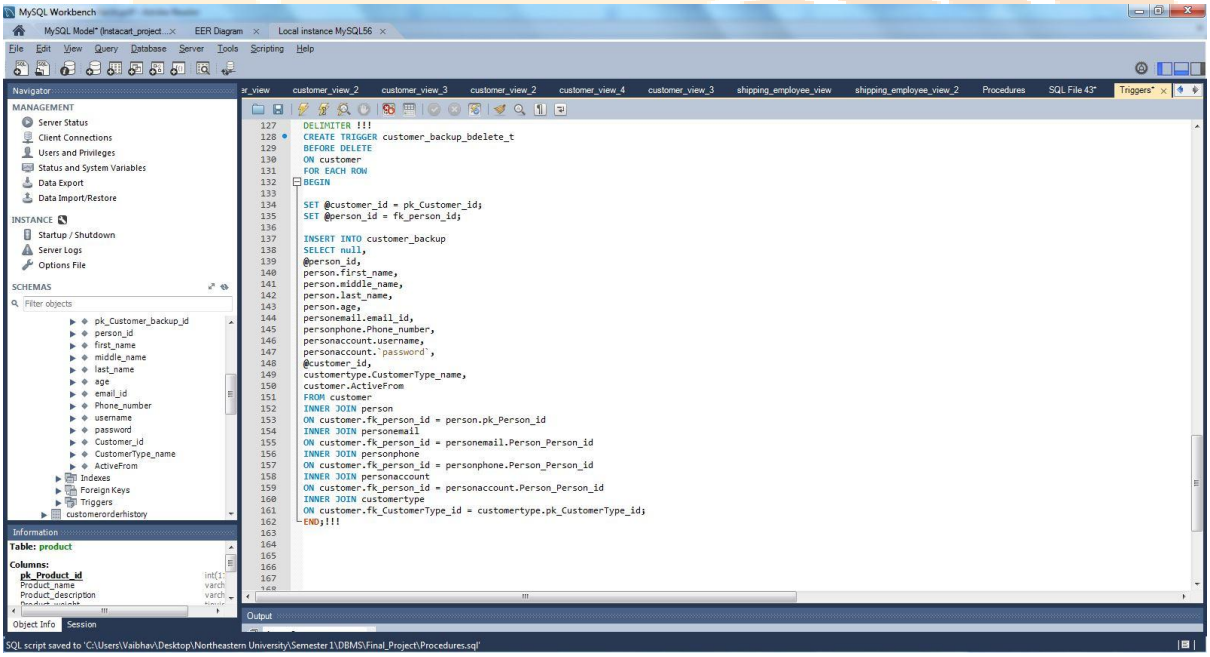
```
personaccount.username,
personaccount.`password`,
@customer_id,
customertype.CustomerType_name,
customer.ActiveFrom
FROM customer
INNER JOIN person
ON customer.fk_person_id = person.pk_Person_id
INNER JOIN personemail
ON customer.fk_person_id = personemail.Person_Person_id
INNER JOIN personphone
ON customer.fk_person_id = personphone.Person_Person_id
INNER JOIN personaccount
ON customer.fk_person_id = personaccount.Person_Person_id
INNER JOIN customertype
ON customer.fk_CustomerType_id = customertype.pk_CustomerType_id;
END;!!!
```



b) ON DELETE

```
DELIMITER !!!
CREATE TRIGGER customer_backup_bdelete_t
BEFORE DELETE
ON customer
FOR EACH ROW
BEGIN
```

```
SET @customer_id = pk_Customer_id;
SET @person_id = fk_person_id;

INSERT INTO customer_backup
SELECT null,
@person_id,
person.first_name,
person.middle_name,
person.last_name,
person.age,
personemail.email_id,
personphone.Phone_number,
personaccount.username,
personaccount.`password`,
@customer_id,
customertype.CustomerType_name,
customer.ActiveFrom
FROM customer
INNER JOIN person
ON customer.fk_person_id = person.pk_Person_id
INNER JOIN personemail
ON customer.fk_person_id = personemail.Person_Person_id
INNER JOIN personphone
ON customer.fk_person_id = personphone.Person_Person_id
INNER JOIN personaccount
ON customer.fk_person_id = personaccount.Person_Person_id
INNER JOIN customertype
ON customer.fk_CustomerType_id = customertype.pk_CustomerType_id;
END;!!!
```



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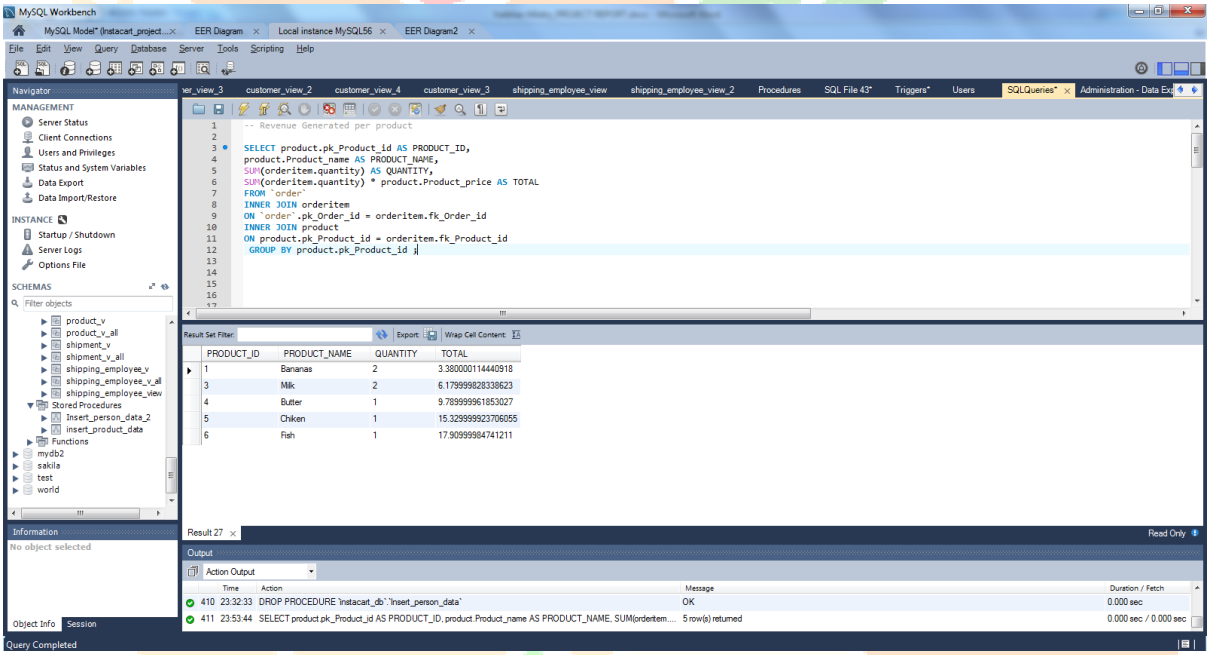
11. High Level Questions

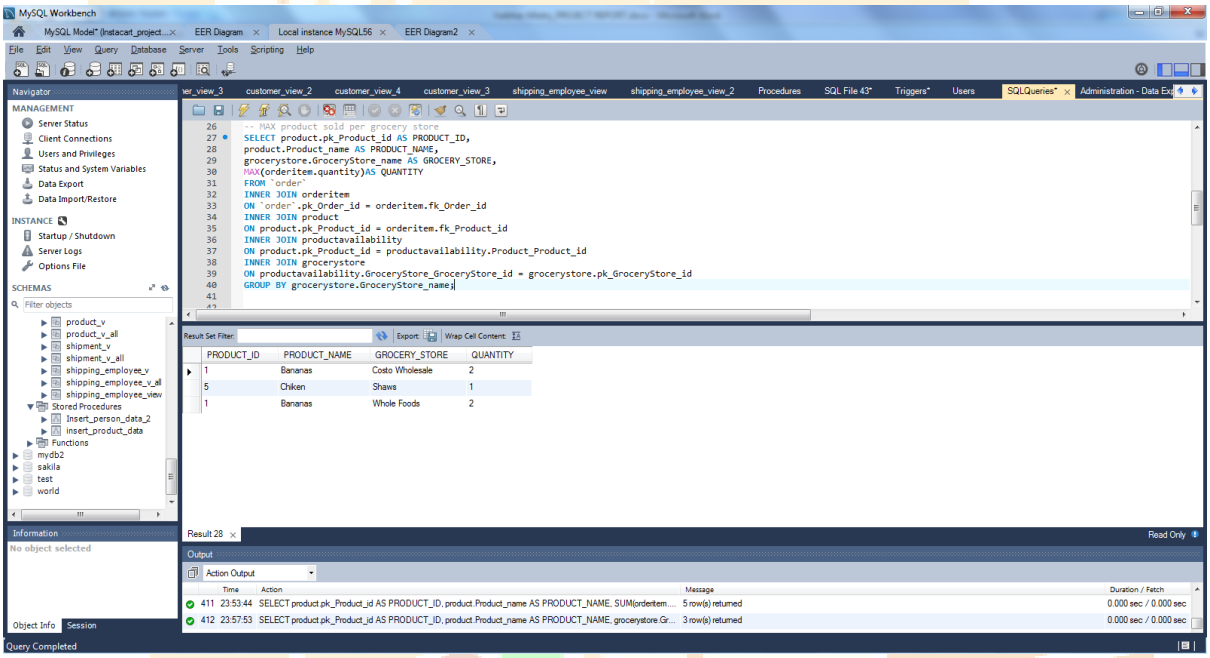
A) To find out the revenue generated per product:

```
SELECT product.pk_Product_id AS PRODUCT_ID,
product.Product_name AS PRODUCT_NAME,
SUM(orderitem.quantity) AS QUANTITY,
SUM(orderitem.quantity) * product.Product_price AS TOTAL
FROM `order`
INNER JOIN orderitem
ON `order`.pk_Order_id = orderitem.fk_Order_id
INNER JOIN product
ON product.pk_Product_id = orderitem.fk_Product_id
 GROUP BY product.pk_Product_id ;
```



B) To find out the maximum product sold per Grocery Store:

```
SELECT product.pk_Product_id AS PRODUCT_ID,
product.Product_name AS PRODUCT_NAME,
grocerystore.GroceryStore_name AS GROCERY_STORE,
MAX(orderitem.quantity)AS QUANTITY
FROM `order`
INNER JOIN orderitem
ON `order`.pk_Order_id = orderitem.fk_Order_id
INNER JOIN product
ON product.pk_Product_id = orderitem.fk_Product_id
INNER JOIN productavailability
ON product.pk_Product_id = productavailability.Product_Product_id
INNER JOIN grocerystore
ON productavailability.GroceryStore_GroceryStore_id = grocerystore.pk_GroceryStore_id
GROUP BY grocerystore.GroceryStore_name;
```



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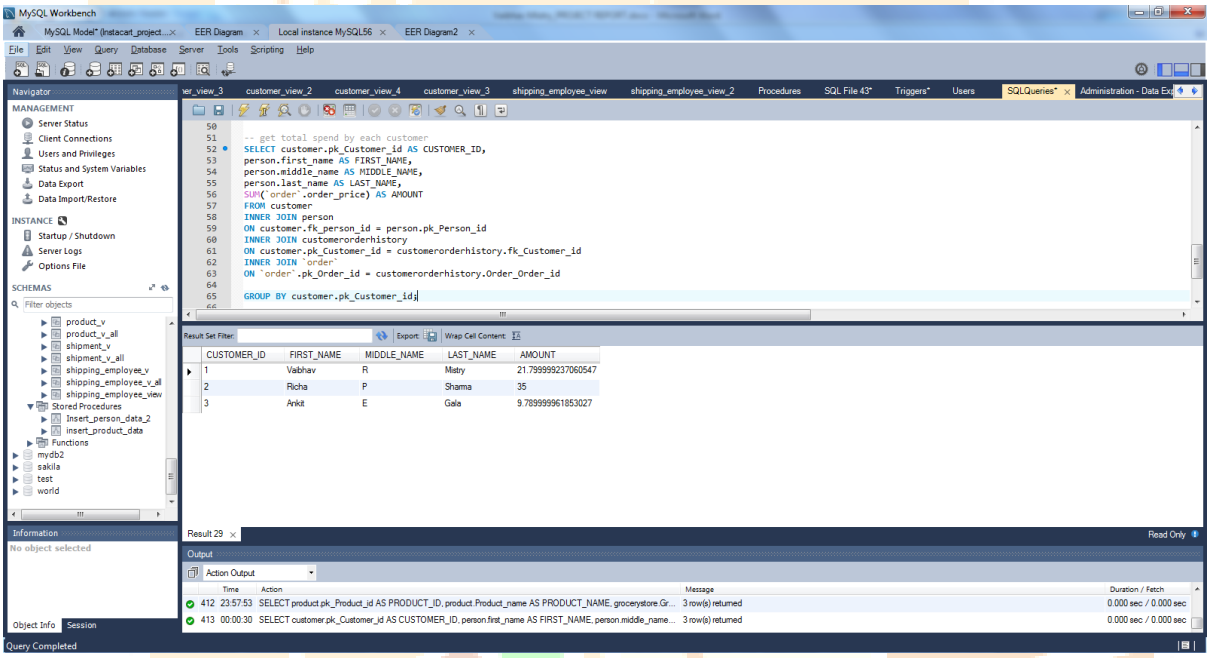
c) To find out total amount spend by each customer:

```
SELECT customer.pk_Customer_id AS CUSTOMER_ID,
person.first_name AS FIRST_NAME,
person.middle_name AS MIDDLE_NAME,
person.last_name AS LAST_NAME,
SUM(`order`.order_price) AS AMOUNT
FROM customer
INNER JOIN person
ON customer.fk_person_id = person.pk_Person_id
INNER JOIN customerorderhistory
ON customer.pk_Customer_id = customerorderhistory.fk_Customer_id
INNER JOIN `order`
ON `order`.pk_Order_id = customerorderhistory.Order_Order_id

GROUP BY customer.pk_Customer_id;
```



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12. Conclusion

The report consists all the functional and design specifications explained in detail. Data integrity and security standards were considered while making this application. Business model was understood and based on the requirements gathered application was designed using business rules and constraints.

BIBLIOGRAPHY

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3 – Beginning SQL, Paul Wilton
4 – Class Slides, Prof. Yusuf Ozbek
Websites
1 - www.mysql.com
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3 - www.wikipedia.org

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