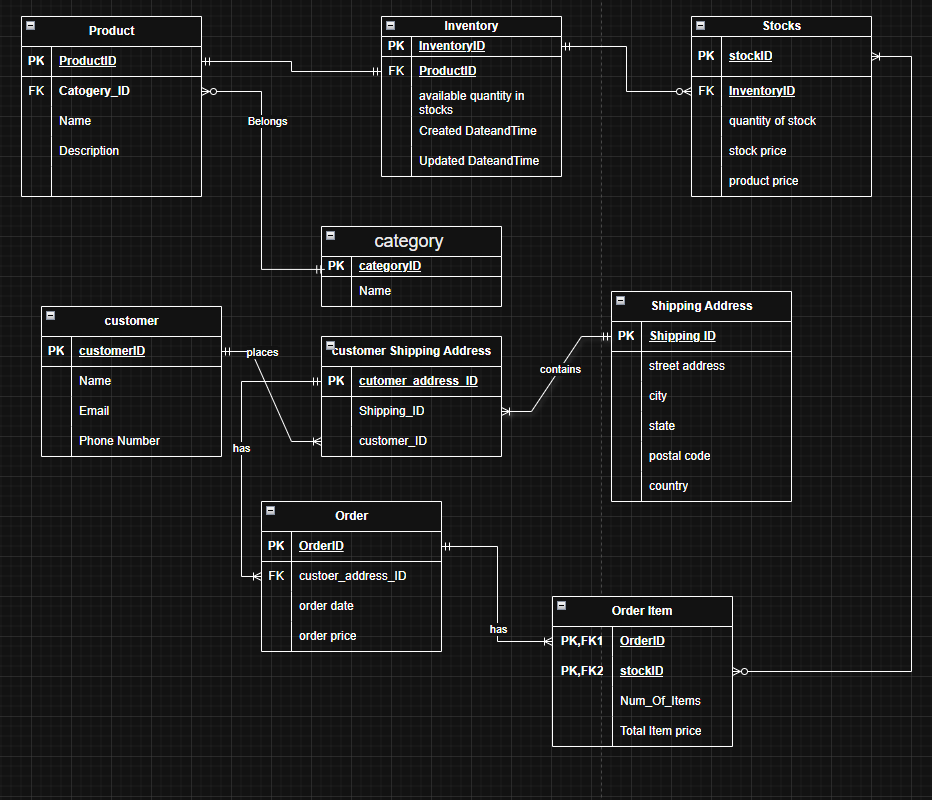
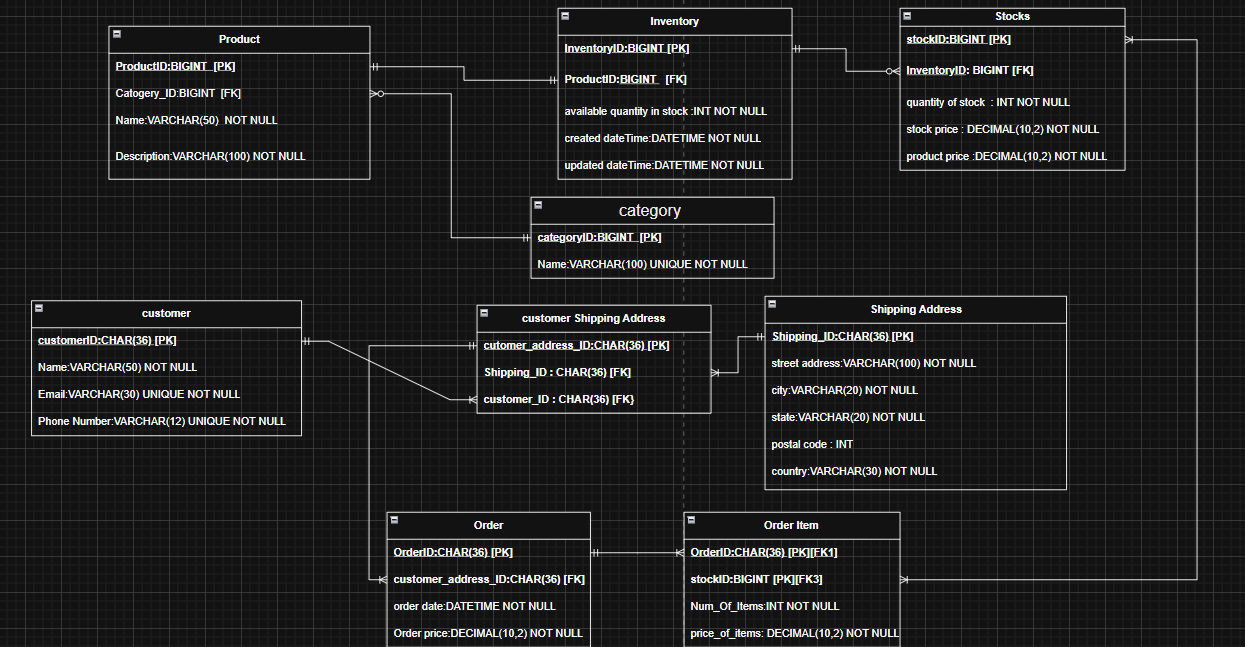
**Shop4All E commerce platform**

**ER-Diagram**

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**Relational Schema diagram**

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**Implemented optimization techniques:**

* Use of normalization:
  + The database is normalized into separate table by following upto 3rd normal form each table. As the large data has break down to smaller and related tables, it makes easy to do complex queries and ensure the data consistency
* Use of Indexes.
  + I have used the index for product name, category name, order date and customer name. As the user need to search the product by using the product name, category by using the category name and to retrieve the data of his own information by using customer name, the index has been created for the column so that it makes SELECT queries much faster as it avoids full table scan.
  + Index for the order\_date has created because of a possibility of a future requirement of retrieving sales for given period of time; for an example: sale from month January to month April.
  + Most of the time, this index has been used in Group BY queries to make it faster
* Foreign keys with referential integrity.  
  for all table with foreign keys, use ON UPDATE CASCADE AND ON DELETE CASCADE (except for order\_items table) which ensures the referential integrity and reduce the work of manual clean-up of the database.
* Use of check Constraints:
* Check constrain has been used for the columns which only should consist of positive or in some cases of natural numbers and to check the if the phone number id consists of for the given number of characters (12) and only consist of numbers. This prevents the insertion of invalid data to the database.
* Use of procedure and functions
* To insert the data to the table, procedures were implemented as it prevents writing query for each insertion. And in addNewStocks and insertnewOrderItems procedures it handles both task of updating the inventory when a new stock is introduced and when a new order is placed in a one transaction which reduces number of queries and risk of inconsistency if one succeeds and the other fails.

**security measures implemented to ensure data protection and user access control.**

There are two main roles:

* role\_shop4all\_admin: which has all the privileges of access
* role\_shop4all\_user: which has only a certain limit of access.

To make the IDs of the tables hidden from the user.

Authentication was done by using the username and password.

View for product, category, customer, shipping\_address, order, order\_items tables were created as the IDs of the tables are protected from the users and to display the tables in a meaningful way without showing the IDs. The access to Inventory, Stocks and customer\_shipping\_address were not granted to the user.

The user can access the procedures that has been written to insert the data to the table that mentioned above. As user must be able to insert data to those tables.

Then two users with names of ‘Admin’ and ‘User’ and with passwords of ‘admin’ and ‘user’ have been created to the host name of localhost. So, for the server connection with a name of localhost has two users with given passwords, they can access the data base for their own access privileges.

After that by implementing Set Role Default to the users, the roles become active when the user connects to the server and authenticates.

**Use of transaction in the assignment**

For all the procedures, the transaction was used. As my procedures consist of number of tasks, and to make those group of tasks to be executed as one single unit, the transactions was used.  
  
for the procedure the error handler was introduced and if there is an error, it rollback to the initial state of the procedure. So, if one task is failed, it rolled back to the original state without changing anything.

The SELECT FOR UPDATE statement was used in the procedures: addNewStock and insertnewOrderItems as in both procedures the available quantity is changed.

For instance, if Admin1 is updating a new stock which increases the quantity of inventory at the same time that User2 is placing an order which decreases the quantity of inventory, both operations would try to read and modify the same available\_quantity row. From this admin1’s update might overwrite the User2’s order changes.

For this the shared mode of that row should make lock.To keep that row lock until the transaction is done, the SELECT FOR UPDATE statement is used.