

Group 8:

Deeksha Rao - 1970751

Sreenavya N - 1978635

Simerpreet Kaur - 1970697

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## HW3: Database Application Proposal

### **I. Description :**

This project is based on the idea to consider an existing dataset, design the database by normalizing the data. This project also includes designing a web application that provides various functionalities to the end user by using the designed database.

The dataset that is considered is an online retail raw dataset that is obtained from real time sales information as shown in the table Tab1. Let the dataset name be original and the schema is as follows,

Original(InvoiceNo, StockCode, Description, Quantity, InvoiceDate, UnitPrice,  
CustomerID, Country)

#### **Data Description:**

**InvoiceNo** : The unique number assigned to identify the invoice per order.

Type : Integer

**StockCode** : The unique number assigned to identify a product in the store.

Type : Alphanumeric

**Description** : This attribute is to describe the product features available in the store.

Type : String

**Quantity** : The quantity of a product bought by the customer.

Type : Integer

**InvoiceDate** : The date an invoice is generated.

Type : Date\_Time

**Unit Price** : The cost of a product per unit.

Type : Float point number

**CustomerID** : The unique ID assigned to a customer.

Type : Integer

**Country** : The country of the customer with a CustomerID

Type : String

The schema with 8 attributes has to be identified for anomalies and thus normalizing the data suitable for a database to the web application.

#### **Data Size:**

The data considered for this project was a smaller version from the original dataset and has 80 records with a memory of 6KB.

InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
536367	22622	BOX OF VINTAGE ALPHABET BLOCKS	2	12/1/10 8:34	9.95	13047	United Kingdom
536367	21754	HOME BUILDING BLOCK WORD	3	12/1/10 8:34	5.95	13047	United Kingdom
536367	21755	LOVE BUILDING BLOCK WORD	3	12/1/10 8:34	5.95	13047	United Kingdom
536367	21777	RECIPE BOX WITH METAL HEART	4	12/1/10 8:34	7.95	13047	United Kingdom
536367	48187	DOORMAT NEW ENGLAND	4	12/1/10 8:34	7.95	13047	United Kingdom
536368	22960	JAM MAKING SET WITH JARS	6	12/1/10 8:34	4.25	13047	United Kingdom
536368	22913	RED COAT RACK PARIS FASHION	3	12/1/10 8:34	4.95	13047	United Kingdom
536368	22912	YELLOW COAT RACK PARIS FASHION	3	12/1/10 8:34	4.95	13047	United Kingdom
536368	22914	BLUE COAT RACK PARIS FASHION	3	12/1/10 8:34	4.95	13047	United Kingdom
536369	21756	BATH BUILDING BLOCK WORD	3	12/1/10 8:35	5.95	13047	United Kingdom
536370	22728	ALARM CLOCK BAKELIKE PINK	24	12/1/10 8:45	3.75	12583	France
536370	22631	CIRCUS PARADE LUNCH BOX	24	12/1/10 8:45	1.95	12583	France
536370	22661	CHARLOTTE BAG DOLLY GIRL DESIGN	20	12/1/10 8:45	0.85	12583	France
536370	21731	RED TOADSTOOL LED NIGHT LIGHT	24	12/1/10 8:45	1.65	12583	France
536370	22900	SET 2 TEA TOWELS I LOVE LONDON	24	12/1/10 8:45	2.95	12583	France
536370	21913	VINTAGE SEASIDE JIGSAW PUZZLES	12	12/1/10 8:45	3.75	12583	France
536370	22540	MINI JIGSAW CIRCUS PARADE	24	12/1/10 8:45	0.42	12583	France
536370	22544	MINI JIGSAW SPACEBOY	24	12/1/10 8:45	0.42	12583	France
536370	22492	MINI PAINT SET VINTAGE	36	12/1/10 8:45	0.65	12583	France
536370	POST	POSTAGE	3	12/1/10 8:45	18	12583	France
536371	22086	PAPER CHAIN KIT 50'S CHRISTMAS	80	12/1/10 9:00	2.55	13748	United Kingdom
536373	82482	WOODEN PICTURE FRAME WHITE FINISH	6	12/1/10 9:02	2.1	17850	United Kingdom
536373	82494L	WOODEN FRAME ANTIQUE WHITE	6	12/1/10 9:02	2.55	17850	United Kingdom
536373	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	12/1/10 9:02	3.39	17850	United Kingdom
536373	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	12/1/10 9:02	3.39	17850	United Kingdom
536373	22752	SET 7 BABUSHKA NESTING BOXES	2	12/1/10 9:02	7.65	17850	United Kingdom
536373	21730	GLASS STAR FROSTED T-LIGHT HOLDER	6	12/1/10 9:02	4.25	17850	United Kingdom
536374	21258	VICTORIAN SEWING BOX LARGE	32	12/1/10 9:09	10.95	15100	United Kingdom
536375	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	12/1/10 9:32	2.55	17850	United Kingdom
536375	71053	WHITE METAL LANTERN	6	12/1/10 9:32	3.39	17850	United Kingdom
536375	84406B	CREAM CUPID HEARTS COAT HANGER	8	12/1/10 9:32	2.75	17850	United Kingdom
536375	20679	EDWARDIAN PARASOL RED	6	12/1/10 9:32	4.95	17850	United Kingdom
536375	37370	RETRO COFFEE MUGS ASSORTED	6	12/1/10 9:32	1.06	17850	United Kingdom
536375	21871	SAVE THE PLANET MUG	6	12/1/10 9:32	1.06	17850	United Kingdom
536375	21071	VINTAGE BILLBOARD DRINK ME MUG	6	12/1/10 9:32	1.06	17850	United Kingdom
536375	21068	VINTAGE BILLBOARD LOVE/HATE MUG	6	12/1/10 9:32	1.06	17850	United Kingdom
536375	82483	WOOD 2 DRAWER CABINET WHITE FINISH	2	12/1/10 9:32	4.95	17850	United Kingdom
536375	82486	WOOD S/3 CABINET ANT WHITE FINISH	4	12/1/10 9:32	6.95	17850	United Kingdom
536375	82482	WOODEN PICTURE FRAME WHITE FINISH	6	12/1/10 9:32	2.1	17850	United Kingdom
536375	82494L	WOODEN FRAME ANTIQUE WHITE	6	12/1/10 9:32	2.55	17850	United Kingdom
536376	22114	HOT WATER BOTTLE TEA AND SYMPATHY	48	12/1/10 9:32	3.45	15291	United Kingdom
536376	21733	RED HANGING HEART T-LIGHT HOLDER	64	12/1/10 9:32	2.55	15291	United Kingdom
536378	22352	LUNCH BOX WITH CUTLERY RETROSPOT	6	12/1/10 9:37	2.55	14688	United Kingdom
536378	21212	PACK OF 72 RETROSPOT CAKE CASES	120	12/1/10 9:37	0.42	14688	United Kingdom
536378	21975	PACK OF 60 DINOSAUR CAKE CASES	24	12/1/10 9:37	0.55	14688	United Kingdom
536378	21977	PACK OF 60 PINK PAISLEY CAKE CASES	24	12/1/10 9:37	0.55	14688	United Kingdom
536378	84991	60 TEATIME FAIRY CAKE CASES	24	12/1/10 9:37	0.55	14688	United Kingdom
536378	84519A	TOMATO CHARLIE+LOLA COASTER SET	6	12/1/10 9:37	2.95	14688	United Kingdom
536378	85183B	CHARLIE & LOLA WASTEPAPER BIN FLORA	48	12/1/10 9:37	1.25	14688	United Kingdom
536378	85071B	RED CHARLIE+LOLA PERSONAL DOORSIGN	96	12/1/10 9:37	0.38	14688	United Kingdom
536378	21931	JUMBO STORAGE BAG SUKI	10	12/1/10 9:37	1.95	14688	United Kingdom
536378	21929	JUMBO BAG PINK VINTAGE PAISLEY	10	12/1/10 9:37	1.95	14688	United Kingdom
536380	22961	JAM MAKING SET PRINTED	24	12/1/10 9:41	1.45	17809	United Kingdom
536382	10002	INFLATABLE POLITICAL GLOBE	12	12/1/10 9:45	0.85	16098	India
536382	21912	VINTAGE SNAKES & LADDERS	8	12/1/10 9:45	3.75	16098	India
536382	21832	CHOCOLATE CALCULATOR	12	12/1/10 9:45	1.65	16098	India
536382	22411	JUMBO SHOPPER VINTAGE RED PAISLEY	10	12/1/10 9:45	1.95	16098	India
536382	22379	RECYCLING BAG RETROSPOT	10	12/1/10 9:45	2.1	16098	India
536381	21731	RED TOADSTOOL LED NIGHT LIGHT	2	12/1/10 9:41	1.65	15311	United Kingdom
536381	22778	GLASS CLOCHE SMALL	3	12/1/10 9:41	3.95	15311	United Kingdom
536381	22719	GUMBALL MONOCHROME COAT RACK	36	12/1/10 9:41	1.06	15311	United Kingdom
536381	21523	DOORMAT FANCY FONT HOME SWEET HOME	10	12/1/10 9:41	6.75	15311	United Kingdom
581570	23077	DOUGHNUT LIP GLOSS	20	12/9/11 11:59	1.25	12662	Germany
581570	20750	RED RETROSPOT MINI CASES	2	12/9/11 11:59	7.95	12662	Germany
581570	22505	MEMO BOARD COTTAGE DESIGN	4	12/9/11 11:59	4.95	12662	Germany
581570	POST	POSTAGE	1	12/9/11 11:59	18	12662	Germany
581574	22326	ROUND SNACK BOXES SET OF4 WOODLAND	6	12/9/11 12:09	2.95	12526	Germany
581574	22328	ROUND SNACK BOXES SET OF 4 FRUITS	6	12/9/11 12:09	2.95	12526	Germany
581574	23199	JUMBO BAG APPLES	10	12/9/11 12:09	2.08	12526	Germany
581574	23581	JUMBO BAG PAISLEY PARK	10	12/9/11 12:09	2.08	12526	Germany
581574	23238	SET OF 4 KNICK KNACK TINS LONDON	6	12/9/11 12:09	4.15	12526	Germany
581574	23237	SET OF 4 KNICK KNACK TINS LEAF	6	12/9/11 12:09	4.15	12526	Germany
581578	22711	WRAP CIRCUS PARADE	25	12/9/11 12:16	0.42	12713	Germany
581578	21497	FANCY FONTS BIRTHDAY WRAP	25	12/9/11 12:16	0.42	12713	Germany
581578	22704	WRAP RED APPLES	25	12/9/11 12:16	0.42	12713	Germany
581578	22585	PACK OF 6 BIRDY GIFT TAGS	12	12/9/11 12:16	1.25	12713	Germany
581578	23205	CHARLOTTE BAG VINTAGE ALPHABET	10	12/9/11 12:16	0.85	12713	Germany
581578	23201	JUMBO BAG ALPHABET	10	12/9/11 12:16	2.08	12713	Germany
581578	23515	EMBROIDERED RIBBON REEL DAISY	6	12/9/11 12:16	2.08	12713	Germany

Tab1 : Raw sales dataset of an online retail store

## **Analysis and Normalization of the data:**

### **FIRST NORMAL FORM (1NF)**

For a relation to be in 1NF it should satisfy the following conditions:

1. Each table cell should contain a single value.
2. Each record needs to be unique.

As the relation above satisfies all the conditions in order to be in 1NF. The given relation is in 1NF.

### **SECOND NORMAL FORM(2NF)**

For a relation to be in 2NF it should satisfy the following conditions:

1. The table should be in 1NF
2. The table should not have any partial dependencies

As the relation above does not meet the requirements for it to be in 2NF, we need to decompose the table.  
The table is decomposed as follows-

**Table 1**

<b>CustomerID</b>	<b>Country</b>
<b>12526</b>	Germany
<b>12583</b>	France
<b>12662</b>	Germany
<b>12713</b>	Germany
<b>13047</b>	United Kingdom
<b>13748</b>	United Kingdom
<b>14688</b>	United Kingdom
<b>15100</b>	United Kingdom
<b>15291</b>	United Kingdom
<b>15311</b>	United Kingdom
<b>16098</b>	India
<b>17809</b>	United Kingdom
<b>17850</b>	United Kingdom

Relation : Customer

**Functional Dependencies-** CustomerID → Country

**Primary Key-** CustomerID

**Table 2**

InvoiceNo	InvoiceDate	CustomerID
536367	12/1/10 8:34	13047
536368	12/1/10 8:34	13047
536369	12/1/10 8:35	13047
536370	12/1/10 8:45	12583
536371	12/1/10 9:00	13748
536373	12/1/10 9:02	17850
536374	12/1/10 9:09	15100
536375	12/1/10 9:32	17850
536376	12/1/10 9:32	15291
536378	12/1/10 9:37	14688
536380	12/1/10 9:41	17809
536381	12/1/10 9:41	15311
536382	12/1/10 9:45	16098
581570	12/9/11 11:59	12662
581574	12/9/11 12:09	12526
581578	12/9/11 12:16	12713

Relation : CustomerInvoice

**Functional Dependencies-** InvoiceNo  $\rightarrow$  InvoiceDate, CustomerID

**Primary Key-** InvoiceNo

**Foreign Key-** CustomerID

Table 3

StockCode	Description	UnitPrice
22900	SET 2 TEA TOWELS I LOVE LONDON	2.95
84991	60 TEATIME FAIRY CAKE CASES	0.55
22728	ALARM CLOCK BAKELIKE PINK	3.75
21756	BATH BUILDING BLOCK WORD	5.95
22914	BLUE COAT RACK PARIS FASHION	4.95
22622	BOX OF VINTAGE ALPHABET BLOCKS	9.95
85183B	CHARLIE & LOLA WASTEPAPER BIN FLORA	1.25
22661	CHARLOTTE BAG DOLLY GIRL DESIGN	0.85
23205	CHARLOTTE BAG VINTAGE ALPHABET	0.85
21832	CHOCOLATE CALCULATOR	1.65
22631	CIRCUS PARADE LUNCH BOX	1.95
84406B	CREAM CUPID HEARTS COAT HANGER	2.75
21523	DOORMAT FANCY FONT HOME SWEET HOME	6.75
48187	DOORMAT NEW ENGLAND	7.95
23077	DOUGHNUT LIP GLOSS	1.25
20679	EDWARDIAN PARASOL RED	4.95
23515	EMBROIDERED RIBBON REEL DAISY	2.08
21497	FANCY FONTS BIRTHDAY WRAP	0.42
22778	GLASS CLOCHE SMALL	3.95
21730	GLASS STAR FROSTED T-LIGHT HOLDER	4.25
22719	GUMBALL MONOCHROME COAT RACK	1.06
21754	HOME BUILDING BLOCK WORD	5.95
22114	HOT WATER BOTTLE TEA AND SYMPATHY	3.45
10002	INFLATABLE POLITICAL GLOBE	0.85
22961	JAM MAKING SET PRINTED	1.45
22960	JAM MAKING SET WITH JARS	4.25
23201	JUMBO BAG ALPHABET	2.08
23199	JUMBO BAG APPLES	2.08
23581	JUMBO BAG PAISLEY PARK	2.08
21929	JUMBO BAG PINK VINTAGE PAISLEY	1.95
22411	JUMBO SHOPPER VINTAGE RED PAISLEY	1.95
21931	JUMBO STORAGE BAG SUKI	1.95
84029G	KNITTED UNION FLAG HOT WATER BOTTLE	3.39
21755	LOVE BUILDING BLOCK WORD	5.95
22352	LUNCH BOX WITH CUTLERY RETROSPOT	2.55
22505	MEMO BOARD COTTAGE DESIGN	4.95
22540	MINI JIGSAW CIRCUS PARADE	0.42
22544	MINI JIGSAW SPACEBOY	0.42
22492	MINI PAINT SET VINTAGE	0.65
22585	PACK OF 6 BIRDY GIFT TAGS	1.25
21975	PACK OF 60 DINOSAUR CAKE CASES	0.55
21977	PACK OF 60 PINK PAISLEY CAKE CASES	0.55
21212	PACK OF 72 RETROSPOT CAKE CASES	0.42
22086	PAPER CHAIN KIT 50'S CHRISTMAS	2.55
	POST POSTAGE	18
21777	RECIPE BOX WITH METAL HEART	7.95
22379	RECYCLING BAG RETROSPOT	2.1
85071B	RED CHARLIE+LOLA PERSONAL DOORSIGN	0.38
22913	RED COAT RACK PARIS FASHION	4.95
21733	RED HANGING HEART T-LIGHT HOLDER	2.55
20750	RED RETROSPOT MINI CASES	7.95
21731	RED TOADSTOOL LED NIGHT LIGHT	1.65
84029E	RED WOOLLY HOTTIE WHITE HEART.	3.39
37370	RETRO COFFEE MUGS ASSORTED	1.06
22328	ROUND SNACK BOXES SET OF 4 FRUITS	2.95
22326	ROUND SNACK BOXES SET OF4 WOODLAND	2.95
21871	SAVE THE PLANET MUG	1.06
22752	SET 7 BABUSHKA NESTING BOXES	7.65
23237	SET OF 4 KNICK KNACK TINS LEAF	4.15
23238	SET OF 4 KNICK KNACK TINS LONDON	4.15
84519A	TOMATO CHARLIE+LOLA COASTER SET	2.95
21258	VICTORIAN SEWING BOX LARGE	10.95
21071	VINTAGE BILLBOARD DRINK ME MUG	1.06
21068	VINTAGE BILLBOARD LOVE/HATE MUG	1.06
21913	VINTAGE SEASIDE JIGSAW PUZZLES	3.75
21912	VINTAGE SNAKES & LADDERS	3.75
85123A	WHITE HANGING HEART T-LIGHT HOLDER	2.55
71053	WHITE METAL LANTERN	3.39
82483	WOOD 2 DRAWER CABINET WHITE FINISH	4.95
82486	WOOD S/3 CABINET ANT WHITE FINISH	6.95
82494L	WOODEN FRAME ANTIQUE WHITE	2.55
82482	WOODEN PICTURE FRAME WHITE FINISH	2.1
22711	WRAP CIRCUS PARADE	0.42
22704	WRAP RED APPLES	0.42
22912	YELLOW COAT RACK PARIS FASHION	4.95

Relation : Item

Functional Dependencies- StockCode,Description → UnitPrice

Composite Primary Keys- StockCode, Description

Table 4

InvoiceNo	StockCode	Quantity
536367	22622	2
536367	21754	3
536367	21755	3
536367	21777	4
536367	48187	4
536368	22960	6
536368	22913	3
536368	22912	3
536368	22914	3
536369	21756	3
536370	22728	24
536370	22631	24
536370	22661	20
536370	21731	24
536370	22900	24
536370	21913	12
536370	22540	24
536370	22544	24
536370	22492	36
536370	POST	3
536371	22086	80
536373	82482	6
536373	82494L	6
536373	84029G	6
536373	84029E	6
536373	22752	2
536373	21730	6
536374	21258	32
536375	85123A	6
536375	71053	6
536375	84406B	8
536375	20679	6
536375	37370	6
536375	21871	6
536375	21071	6
536375	21068	6
536375	82483	2
536375	82486	4
536375	82482	6
536375	82494L	6
536376	22114	48
536376	21733	64
536378	22352	6
536378	21212	120
536378	21975	24
536378	21977	24
536378	84991	24
536378	84519A	6
536378	85183B	48
536378	85071B	96
536378	21931	10
536378	21929	10
536380	22961	24
536381	21731	2
536381	22778	3
536381	22719	36
536381	21523	10
536382	10002	12
536382	21912	8
536382	21832	12
536382	22411	10
536382	22379	10
581570	23077	20
581570	20750	2
581570	22505	4
581570	POST	1
581574	22326	6
581574	22328	6
581574	23199	10
581574	23581	10
581574	23238	6
581574	23237	6
581578	22711	25
581578	21497	25
581578	22704	25
581578	22585	12
581578	23205	10
581578	23201	10
581578	23515	6

Relation : InvoiceDetails

**Functional Dependencies-** InvoiceNo,StockCode  $\rightarrow$  Quantity

**Primary Key-** InvoiceNo

**Foreign Key-** StockCode

### THIRD NORMAL FORM(3NF)

For a relation to be in 3NF it should satisfy the following conditions:

1. The table should be in 2NF
2. The table should not have any transitive functional dependencies

As the relations above satisfy all the conditions in order to be in 3NF, there is no need for any decomposition. The given relation is in 3NF.

### BOYCE-CODD NORMAL FORM(BCNF)

For a relation to be in BCNF it should satisfy the following conditions:

1. The table should be in 3NF
2. For any dependency  $A \rightarrow B$ , A should be a super key.

As the relations above satisfy all the conditions in order to be in BCNF, there is no need for any decomposition. The given relation is in BCNF. In the relations above the super keys are as follows- CustomerID, InvoiceNo, StockCode.

### FOURTH NORMAL FORM(4NF)

For a relation to be in 4NF it should satisfy the following conditions:

1. The table should be in BCNF
2. There shouldn't be any multi-valued dependencies.

As the relation "Invoice" does not meet the requirements in order to be in 4NF, there is a need for us to decompose the relation.

The relation "Invoice" has multi-valued dependencies.  $\text{InvoiceNo} \twoheadrightarrow \text{CustomerID}$  and  $\text{InvoiceNo} \twoheadrightarrow \text{InvoiceDate}$  and both InvoiceDate and CustomerID are independent of each other. So we can decompose the table as follows-

InvoiceNo	CustomerID
536367	13047
536368	13047
536369	13047
536370	12583
536371	13748
536373	17850
536374	15100
536375	17850
536376	15291
536378	14688
536380	17809
536381	15311
536382	16098
581570	12662
581574	12526
581578	12713

Relation : Customer\_Invoice

InvoiceNo	InvoiceDate
536367	12/1/10 8:34
536368	12/1/10 8:34
536369	12/1/10 8:35
536370	12/1/10 8:45
536371	12/1/10 9:00
536373	12/1/10 9:02
536374	12/1/10 9:09
536375	12/1/10 9:32
536376	12/1/10 9:32
536378	12/1/10 9:37
536380	12/1/10 9:41
536381	12/1/10 9:41
536382	12/1/10 9:45
581570	12/9/11 11:59
581574	12/9/11 12:09
581578	12/9/11 12:16

Relation : Invoice

*All the relations are now in normalized form.*



### **The Schemas after normalization:**

**Customer**(CustomerID INT NOT NULL, Country VARCHAR(150), PRIMARY KEY(CustomerID));

**InvoiceDetails**(InvoiceNo INT NOT NULL, StockCode VARCHAR(7), Quantity INT, PRIMARY KEY(InvoiceNo), FOREIGN KEY(StockCode) REFERENCES Item(StockCode));

**Customer\_Invoice**(InvoiceNo INT, CustomerID INT, FOREIGN KEY(CustomerID) REFERENCES Customer(CustomerID), FOREIGN KEY(InvoiceNo) REFERENCES InvoiceDetails(InvoiceNo));

**Invoice**(InvoiceNo INT, InvoiceDate DATETIME, FOREIGN KEY(InvoiceNo) REFERENCES InvoiceDetails(InvoiceNo));

**Item**(StockCode VARCHAR(7) NOT NULL, Description VARCHAR(150) NOT NULL, UnitPrice FLOAT, PRIMARY KEY(StockCode));

Since the relations are enforced with integrity constraints, NULL values are declined from entry into the database. The primary key attribute values are unique and duplicate entries are declined with an error.

### **ADDITIONAL RELATIONS/ATTRIBUTES**

1. As we are planning to design a functionality wherein there is a separate Login for Customer and Manager, we need an additional attribute "Password" for authentication.
2. Similarly, in order for the Manager to Login, we need an additional Relation "Manager" with ManagerID and Password so that he/she can Login with ManagerID and Password.

#### **Schema:**

**Manager**(ManagerID INT NOT NULL, Password VARCHAR(20), PRIMARY KEY(ManagerID));

3. As we are adding a Trigger functionality to our Database, we are adding an additional relation "newCustomerConfirmationtoManager" which gets updated whenever a new customer tries to register his details into the database.

#### **Schema:**

**newCustomerConfirmationtoManager**(CustomerID INT NOT NULL, message VARCHAR(255) NOT NULL, PRIMARY KEY(CustomerID));

## **II. Functionalities to be implemented :** We will be implementing the following functionalities for our dataset :

1. Customer registration(ADD)
2. Login separation
  - a. Customer Login
  - b. Store Manager login
3. Updating customer details (UPDATE)
4. Customer can retrieve the Invoice History(RETRIEVE)
5. Manager can delete an existing item/customer(DELETE)
6. Manager can add a new Item(ADD)



### **III. Any Extra Functionalities/Artifacts (web-based, trigger, stored procedure, other functionalities).**

#### **1. Stored Procedure:**

- a. Created stored procedures for inserting records into a relation. So whenever we are trying to add any entries into the relation in our backend, we simply call that procedure and the query gets performed to add an entry to the database table. As we decomposed the data into five normalized relations, we have created five stored procedures for inserting rows into all these relations.
- b. New Customer Registration
- c. Manager can Add an Item

#### **2. Trigger:**

- a. We have added a message based Trigger which gets invoked and updates itself whenever a new customer is registered.
- b. Manager can view the New Customers

#### **3. Cursor:**

- a. We have created a cursor in our database with the help of cursor() method of connection object in python. These cursors are bound to the connection for the entire lifetime and all the commands are executed in the context of the database session wrapped by the connection.
- b. To execute SQL queries from Python Flask

#### **4. Views:**

- a. Views are used on certain attributes of relation or relations. In our project, views are implemented as a part of providing the existing and new customer information to the manager. The Manager might see all the customer details except the password.
- b. A view on CustomerID and Country attributes of Customer table for Manager.

#### **5. Cascade:**

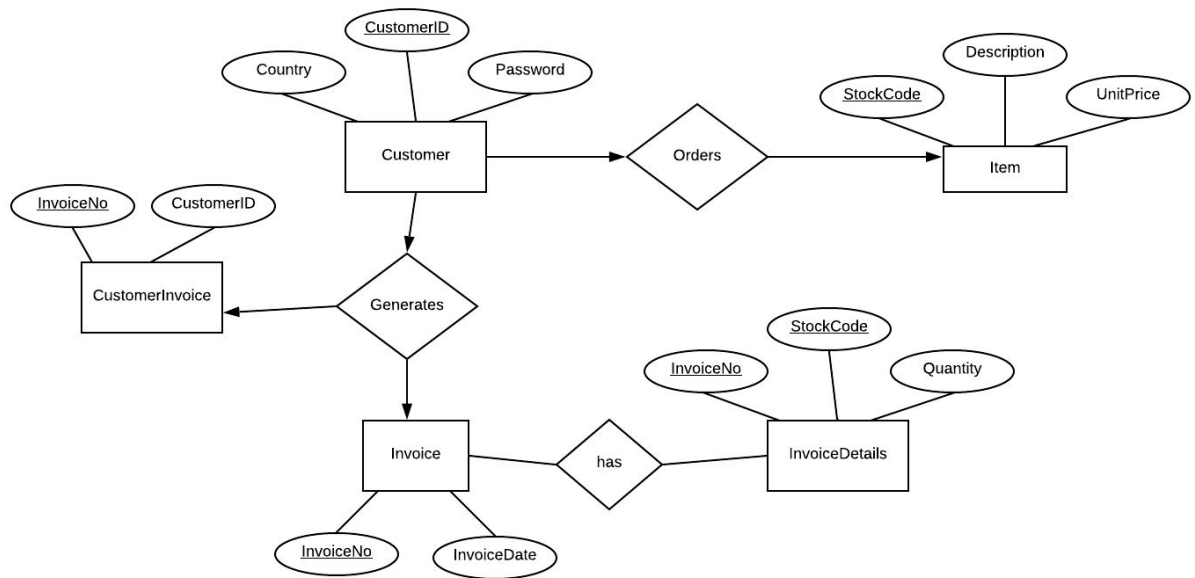
- a. Cascade on a table is used to replicate any changes (e.g Update, Delete) on the corresponding child table with a foreign key for a parent table.
- b. Everytime Customer details are deleted/updated from the Customer table, Customer\_Invoice table also deletes/updates that particular Customer details .

#### **6. Commit:** Whenever a transaction is made on the Database, by using commit the changes are reflected onto the Database from backend to maintain consistency of DB

#### **7. Sessions:**

- a. When a user logs in, the user information like ID is persistent till logs out. In this project, we have used sessions for both Customer and Manager to define separate functionalities.
- b. Customer can get his account details once logged in.
- c. Manager can get his account details once logged in.
- d. Customer can get his Invoice history.

#### IV. ER Diagram and Attributes :



**Fig: Entity-Relationship Diagram for the given Database**

Front-End : HTML,CSS,Javascript

Cloud Services : AWS Aurora DB

Back-end : Python

Web Framework : Flask

#### **AWS AURORA**

In order to implement our project, we will be using Amazon Aurora Serverless which is an on-demand, auto scaling configuration for Amazon Aurora. The benefit of using AWS Aurora is that, it is :

- Simple
- Scalable
- Cost-effective
- Highly available