<u>מטרת העבודה:</u>

- תאור של בסיס נתונים בעזרת E/R Diagram ו-Object Defined Language
- בניית Relation Model
- הצגת יחסים ב-BCNF
- הצגת יחסים ב-4NF
- בניית בסיס נתונים
- הגדרת פעולות ביצעה ע"ס בסיס נתונים

1) ODL

```
interface Suppliers (KEY (name, address)){
        attribute string name;
        attribute string address;
        attribute string logo;
relationship Set <Stock> StockOfSupplier inverse Stock::Supplier'sStock;
};

interface Items (KEY (model, company)){
        attribute string model;
        attribute string company;
        attribute string type;
relationship Set <Stock> StockOfItem inverse Stock::Item'sStock;
};

interface Stock (KEY (sname , saddress , imodel, icompany)){
        attribute string sname;
        attribute string saddress;
        attribute string imodel;
        attribute string icompany;
        attribute float price;
relationship Suppliers Supplier'sStock inverse Suppliers::StockOfSuplier;
relationship Items Item'sStock inverse Items::StockOfItem;
relationship Set <Quantity> StockQuantity inverse Quantity::QuantityOfItemInStock;
};

interface Quantity KEY (stname , staddress , stcompany , stmodel , oid)){
        attribute string stname;
        attribute string staddress;
        attribute string stmodel;
        attribute string stcompany;
        attribute integer oid;
        attribute integer quantity;
relationship  Stock QuantityOfItemInStock inverse Stock::StockQuantity;
relationship Orders QuantityOfItemInOrder inverse Orders::OrderQuantity;
};

interface Orders (KEY id){
        attribute integer id;
relationship CreditCards Order'sCard inverse CreditCards::CardForPay;
relationship Set <Quantity> OrderQuantity inverse Quantity::QuantityOfItemsInOrder;
};

interface CreditCards (KEY number){
        attribute string number;
        attribute string company;
        attribute date expirationdate;
relationship Set <Orders> Order'sCard inverse Orders::CardForPay;
relationship Customers CastomerOfCard inverse Customers::Customer'sCards;
```

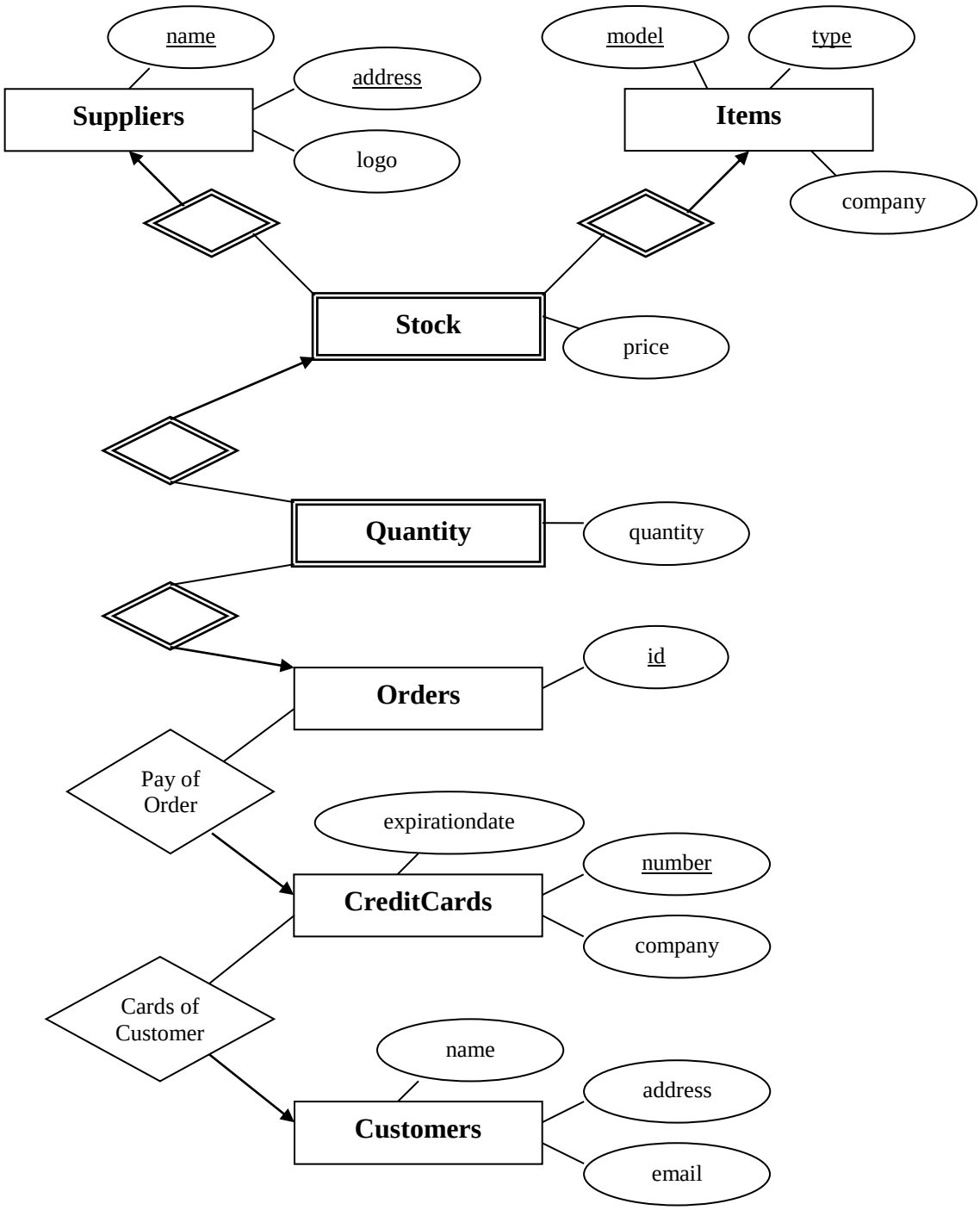
```
};

interface Customers (KEY (name, address)){
        attribute string name;
        attribute string address;
        attribute string email;
relationship Set <CreditCards> Customer'sCards inverse CreditCards::CustomerOfCard;
};
```

בניית Relation Model לפי ODL :

Suppliers (name, address, logo)
Items (model, company , type)
Stock (sname, saddress, imodel, icompany, price)
Quantities (stname , staddress , stcompany , imodel, oid, quantity)
Orders (id, ccnumber)
CreditCards (number, company, expirationdate, cname, caddress)
Customers (name, address, email)

2) E/R Diagram



בניית Relation Model לפי E/R Diagram :

Suppliers (name, address, logo)
Items (type, model, company)
Stock (sname , saddress, imodel, icompany, price)
Quantity (stname , staddress, stmodel, stcompany, oid, quantity)
Orders (id)
CreditCards (company, number, expirationdate)
Customers (name, address, email)
PayOfOrder (oid, ccnumber)

CardsOfCastomer (ccnumber, cname, caddress)

3) Set of relations for database design

Suppliers (name, address, logo)
Items (model, company , type)
Stock (sname, saddress, imodel, icompany, price)
Quantities (stname , staddress, stmodel, stcompany, oid, quantity)
Orders (id, ccnumber)
CreditCards (number, company, expirationdate, cname, caddress)
Customers (name, address, email)

4) Relations in BCNF

1) Suppliers (name, address, logo)

אין FD's לא טריויאלים לכן לפי הגדרה (Suupliers נמצא ב-BCNF.

2) Items (model, company , type)

אין FD's לא טריויאלים לכן לפי הגדרה (Items נמצא ב-BCNF.

3) Stock (sname, saddress, imodel, icompany, price)

אין FD's לא טריויאלים לכן לפי הגדרה (Stock נמצא ב-BCNF.

4) Quantities (stname , staddress , stmodel, stcompany, oid, quantity)

אין FD's לא טריויאלים לכן לפי הגדרה (Quantities נמצא ב-BCNF.

5) Orders (id, ccnumber)

אין FD's לא טריויאלים לכן לפי הגדרה (Orders נמצא ב-BCNF.

6) CreditCards (number, company, expirationdate, cid)

$$number \xrightarrow{FD} company, number \xrightarrow{FD} expirationdate, number \xrightarrow{FD} cname, number \xrightarrow{FD} caddress$$

$$number \xrightarrow{FD} company, expirationdate;\ number \xrightarrow{FD} company, cname;$$

$$number \xrightarrow{FD} company, caddress;\ number \xrightarrow{FD} expirationdate, cname;$$

$$number \xrightarrow{FD} expirationdate, caddress;\ number \xrightarrow{FD} cname, caddress;$$

$$number \xrightarrow{FD} company, expirationdate, cname;\ number \xrightarrow{FD} company, expirationdate, caddress;$$

$$number \xrightarrow{FD} company, cname, caddress;\ number \xrightarrow{FD} expirationdate, cname, caddress;$$

$$number \xrightarrow{FD} company, expirationdate, cname, caddress;$$

number - הוא key לכן גם superkey לכן לפי הגדרה של BCNF יחס (CreditCards נמצא ב-BCNF.

7) Customers (name, address, email)

אין FD's לא טריויאלים לכן לפי הגדרה (Customers נמצא ב-BCNF.

5) **Relations in 4NF**

1) Suppliers (name, address, logo)

$$\text{name, address} \overset{MD}{\rightarrow} \text{logo}$$

key הוא - name, address הוא גם superkey לכן Suppliers() נמצא ב-4NF לפי הגדרה של 4NF.

2) Items (model, company , type)

$$\text{model, company} \overset{MD}{\rightarrow} \text{type}$$

key הוא - model, company הוא גם superkey לכן Items() נמצא ב-4NF לפי הגדרה של 4NF.

3) Stock (sname, saddress, imodel, icompany, price)

$$\text{sname, saddress, imodel, icompany} \overset{MD}{\rightarrow} \text{price}$$

key הוא - sname, saddress, imodel, icompany הוא גם superkey לכן Stock() נמצא ב-4NF לפי הגדרה של 4NF.

4) Quantities (stname , staddress, stmodel, stcompany, oid, quantity)

$$\text{stname, staddress, stmodel, stcompany, oid} \overset{MD}{\rightarrow} \text{quantity}$$

key הוא - stname, staddress, stmodel, stcompany, oid הוא גם superkey לכן Quantities() נמצא ב-4NF לפי הגדרה של 4NF.

5) Orders (id, ccnumber)

$$\text{id} \overset{MD}{\rightarrow} \text{ccnumber}$$

key הוא - id הוא גם superkey לכן Orders() נמצא ב-4NF לפי הגדרה של 4NF.

6) CreditCards (number, company, expirationdate, cname, caddress)

$$\text{number} \overset{MD}{\rightarrow} \text{company, number} \overset{MD}{\rightarrow} \text{expirationdate, number} \overset{MD}{\rightarrow} \text{cname, number} \overset{MD}{\rightarrow} \text{caddress}$$

$$\text{number} \overset{MD}{\rightarrow} \text{company, expirationdate;}\quad \text{number} \overset{MD}{\rightarrow} \text{company, cname;}$$

$$\text{number} \overset{MD}{\rightarrow} \text{company, caddress;}\quad \text{number} \overset{MD}{\rightarrow} \text{expirationdate, cname;}$$

$$\text{number} \overset{MD}{\rightarrow} \text{expirationdate, caddress;}\quad \text{number} \overset{MD}{\rightarrow} \text{cname, caddress;}$$

$$\text{number} \overset{MD}{\rightarrow} \text{company, expirationdate, cname;}\quad \text{number} \overset{MD}{\rightarrow} \text{company, expirationdate, caddress;}$$

$$\text{number} \overset{MD}{\rightarrow} \text{company, cname, caddress;}\quad \text{number} \overset{MD}{\rightarrow} \text{expirationdate, cname, caddress;}$$

$$\text{number} \overset{MD}{\rightarrow} \text{company, expirationdate, cname, caddress;}$$

key הוא - number הוא גם superkey לכן CreditCards() נמצא ב-4NF לפי הגדרה של 4NF.

7) Customers (name, address, email)

$$\text{name, address} \overset{MD}{\rightarrow} \text{email}$$

key הוא - name, address הוא גם superkey לכן Customers() נמצא ב-4NF לפי הגדרה של 4NF.