**Question No.4**

Construct an ER diagram for a Department Store Database where;

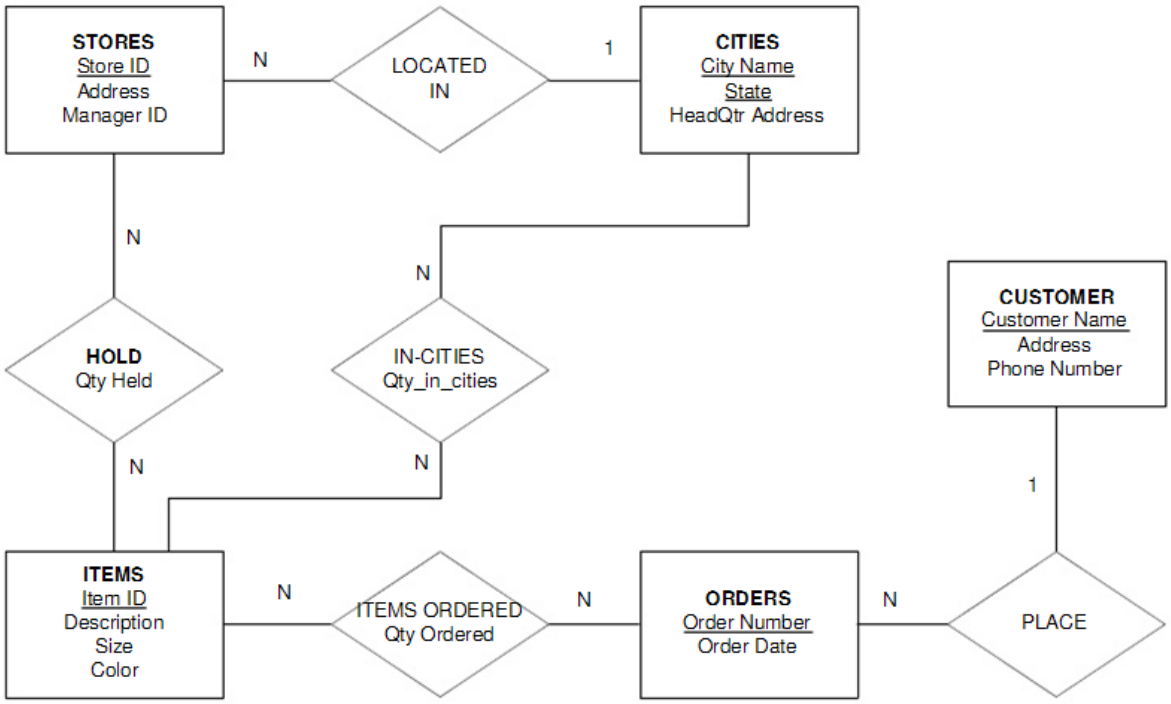
a) A department store operates in several cities.

b) In a city there is one headquarter coordinating the local operations.

c) A city may have several stores.

d) Stores hold any amount of items.

e) Customers place their orders for any number of items to a given store.



## Question No.5

By identifying the properties of 1NF, 2NF and 3NF, move the following Work table from un-normalized to 3NF.

| PROJNAME | PROJMGR | BUDGET | STARTDATE | EMPID | EMPNAME | HOURS | SALARY | EMPMGR | EMPDEPT | RATING |
|---|---|---|---|---|---|---|---|---|---|---|
| DB2 | Ali Hammad | 100000 | 15012010 | 101 | Atif | 25 | 40000 | Atif | 10 | 9 |
| | | | | 105 | Amjad | 10 | 55000 | Aftab | 12 | |
| | | | | 110 | Akbar | 10 | 43000 | Atif | 10 | 8 |
| JAVA | Irfan Majeed | 200000 | 01032010 | 101 | Atif | 15 | 40000 | Atif | 10 | |
| | | | | 105 | Amjad | 30 | 55000 | Aftab | 12 | |
| | | | | 120 | Nadeem | 15 | 45000 | Aftab | 15 | |

Assume that:

1. Each project has a unique name, but names of employees and managers are not unique.
2. Each project has one manager, whose name is stored in PROJMGR.
3. BUDGET stores the amount of budgeted for a project, and STARTDATE gives the starting date of a project.
4. Many employees may be assigned to work on each project, and an employee may be assigned to more than one project. HOURS tells the number of hours per week that a particular employee is assigned to work on a particular project.
5. SALARY gives the annual salary of an employee.
6. EMPMGR gives the name of the employee's manager, who is not the same as the project manager.
7. EMPDEPT gives the employee's department. Department names are unique. The employee's manager is the manager of the employee's department.
8. RATING gives the employee's rating for a particular project. The project manager assigns the rating at the end of the employee's work on that project.

- 1NF:
  - All data is atomic.
  - All rows have a unique primary key.
- 2NF:
  - Data is in 1NF
  - Non key attributes are fully functionally dependent on key attributes.
  - **PK/CK→NK**
- 3NF:
  - In 2NF
  - All columns must be fully functionally dependent on the primary key (no transitive dependencies).
  - **PK→NK&CK**

1NF:

**PROJNAME**, PROJMGR, BUDGET, STARTDATE, **EMPID**, EMPNAME, SALARY, EMPMGR, EMPDEPT, PROJNAME, HOURS, RATING

2NF:

Project (**PROJNAME**→ PROJMGR, BUDGET, STARTDATE)

Employee (**EMPID**→ EMPNAME, SALARY, EMPMGR, EMPDEPT)

Work (**PROJNAME, EMPID**→ HOURS, RATING)

3NF:

Project (**PROJNAME**→ PROJMGR, BUDGET, STARTDATE)

Employee (**EMPID**→ EMPNAME, SALARY, EMPDEPT)

EmpDept (**EMPDEPT**→ EMPMGR)

Work (**PROJNAME, EMPID**→ HOURS, RATING)