**Assignment 1:**

A1.) Participating Entities are :

* Shopper
* Product
* Administrator
* Category
* Order

A2.) Relations are :

* Has
* Buys
* Manages
* Added to

A3.) Key Attributes are :

* Email
* Product\_Id
* Admin\_id
* Order\_Id
* Category\_Id

A4.) ER Diagram uploaded on github

**Assignment 2 :**

**Normalization** is a systematic approach of decomposing tables to eliminate data redundancy or repetition and undesirable characteristics like Insertion, Update and Deletion Anomalies. It is a multi-step process that puts data into tabular form, removing duplicated data from the relation tables.

There are following type of Normalization :

* 1-NF Normalization
* 2-NF Normalization
* 3-NF Normalization
* BCNF Normalization

**1-NF Normalization :**

* A relation is in 1NF if it contains an atomic value.
* It states that an attribute of a table cannot hold multiple values. It must hold only single-valued attribute.
* First normal form disallows the multi-valued attribute, composite attribute, and their combinations.

Example for 1-NF :

|  |  |  |  |
| --- | --- | --- | --- |
| EMP\_ID | EMP\_NAME | EMP\_PHONE | EMP\_STATE |
| 14 | John | 7272826385,  9064738238 | UP |
| 20 | Harry | 8574783832 | Assam |
| 12 | Sam | 7390372389,  8589830302 | MP |

The decomposition of the EMPLOYEE table into 1NF is as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| EMP\_ID | EMP\_NAME | EMP\_PHONE | EMP\_STATE |
| 14 | John | 7272826385 | UP |
| 14 | John | 9064738238 | UP |
| 20 | Harry | 8574783832 | Assam |
| 12 | Sam | 7390372389 | MP |
| 12 | Sam | 8589830302 | MP |

**2-NF Normalization:**

* In the 2NF, relational must be in 1NF.
* In the second normal form, all non-key attributes are fully functional dependent on the primary key

Example for 2-NF is :

|  |  |  |
| --- | --- | --- |
| **TEACHER\_ID** | **SUBJECT** | **TEACHER\_AGE** |
| 25 | Chemistry | 30 |
| 25 | Biology | 30 |
| 47 | English | 35 |
| 83 | Math | 38 |
| 83 | Computer | 38 |

To convert the given table into 2NF, we decompose it into two tables:

**TEACHER\_DETAIL table:**

|  |  |
| --- | --- |
| **TEACHER\_ID** | **TEACHER\_AGE** |
| 25 | 30 |
| 47 | 35 |
| 83 | 38 |

**TEACHER\_SUBJECT table:**

|  |  |
| --- | --- |
| **TEACHER\_ID** | **SUBJECT** |
| **25** | Chemistry |
| **25** | Biology |
| **47** | English |
| **83** | Math |
| **83** | Computer |

**3-NF Normalization:**

* A relation will be in 3NF if it is in 2NF and not contain any transitive partial dependency.
* 3NF is used to reduce the data duplication. It is also used to achieve the data integrity.
* If there is no transitive dependency for non-prime attributes, then the relation must be in third normal form

A relation is in third normal form if it holds atleast one of the following conditions for every non-trivial function dependency X → Y.

1. X is a super key.
2. Y is a prime attribute, i.e., each element of Y is part of some candidate key.

Example of 3-NF is :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EMP\_ID** | **EMP\_NAME** | **EMP\_ZIP** | **EMP\_STATE** | **EMP\_CITY** |
| 222 | Harry | 201010 | up | Noida |
| 333 | Stephan | 02228 | us | Boston |
| 444 | Lan | 60007 | us | Chicago |
| 555 | Katharine | 06389 | uk | Norwich |
| 666 | John | 462007 | mp | Bhopal |

In the given table, all attributes except EMP\_ID are non-prime.

|  |  |  |
| --- | --- | --- |
| **EMP\_ID** | **EMP\_NAME** | **EMP\_ZIP** |
| 222 | Harry | 201010 |
| 333 | Stephan | 02228 |
| 444 | Lan | 60007 |
| 555 | Katharine | 06389 |
| 666 | John | 462007 |

|  |  |  |
| --- | --- | --- |
| **EMP\_ZIP** | **EMP\_STATE** | **EMP\_CITY** |
| 201010 | up | Noida |
| 02228 | us | Boston |
| 60007 | us | Chicago |
| 06389 | uk | Norwich |
| 462007 | mp | Bhopal |

**BCNF Normalization:**

* BCNF is the advance version of 3NF. It is stricter than 3NF.
* A table is in BCNF if every functional dependency X → Y, X is the super key of the table.
* For BCNF, the table should be in 3NF, and for every FD, LHS is super key.

Example for BCNF is :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EMP\_ID** | **EMP\_COUNTRY** | **EMP\_DEPT** | **DEPT\_TYPE** | **EMP\_DEPT\_NO** |
| 264 | india | Designing | D394 | 283 |
| 264 | india | Testing | D394 | 300 |
| 364 | uk | Stores | D283 | 232 |
| 364 | uk | Developing | D283 | 549 |

To convert the given table into BCNF, we decompose it into three tables:

|  |  |
| --- | --- |
| **EMP\_ID** | **EMP\_COUNTRY** |
| 264 | india |
| 264 | india |

|  |  |  |
| --- | --- | --- |
| **EMP\_DEPT** | **DEPT\_TYPE** | **EMP\_DEPT\_NO** |
| Designing | D394 | 283 |
| Testing | D394 | 300 |
| Stores | D283 | 232 |
| Developing | D283 | 549 |

|  |  |
| --- | --- |
| **EMP\_ID** | **EMP\_DEPT** |
| D394 | 283 |
| D394 | 300 |
| D283 | 232 |
| D283 | 549 |

**Candidate keys:**

**For the first table:** EMP\_ID

**For the second table:** EMP\_DEPT

**For the third table:** {EMP\_ID, EMP\_DEPT}