**Normalization:**

Normalization is the process of minimizing redundancy from a relation or set of relations. Redundancy in relation may cause insertion, deletion and updation anomalies. So, it helps to minimize the redundancy in relations. Normal forms are used to eliminate or reduce redundancy in database tables.

Example:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Emp\_Id | Emp\_Name | Emp\_Phone | Emp\_Zip | Emp\_City | Emp\_State |
| 14 | John | 72879546,  98547245 | 201010 | Noida | UP |
| 20 | Harry | 86575246 | 800011 | Patana | Bihar |
| 12 | Sam | 57624314,  75349658 | 143101 | Amritsar | Punjab |
| 22 | Lan | 58764985 | 462007 | Bhopal | MP |
| 35 | Jamy | 68745956 | 410206 | Panvel | Maharashtra |

1. **First Normal Form (1NF):**

* A relation will be 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.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Emp\_Id | Emp\_Name | Emp\_Phone | Emp\_Zip | Emp\_City | Emp\_State |
| 14 | John | 72879546 | 201010 | Noida | UP |
| 14 | John | 98547245 | 201010 | Noida | UP |
| 20 | Harry | 86575246 | 800011 | Patana | Bihar |
| 12 | Sam | 57624314 | 143101 | Amritsar | Punjab |
| 12 | Sam | 75349658 | 143101 | Amritsar | Punjab |
| 22 | Lan | 58764985 | 462007 | Bhopal | MP |
| 35 | Jamy | 68745956 | 410206 | Panvel | Maharashtra |

1. **Second Normal Form (2NF)**

* 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.

Here Emp\_Id is primary key.

|  |  |
| --- | --- |
| Emp\_Id | Emp\_Name |
| 14 | John |
| 20 | Harry |
| 12 | Sam |
| 22 | Lan |
| 35 | Jamy |

|  |  |
| --- | --- |
| Emp\_Id | Emp\_City |
| 14 | Noida |
| 20 | Patana |
| 12 | Amritsar |
| 22 | Bhopal |
| 35 | Panvel |

|  |  |
| --- | --- |
| Emp\_Id | Emp\_Zip |
| 14 | 201010 |
| 20 | 800011 |
| 12 | 143101 |
| 22 | 462007 |
| 35 | 410206 |

|  |  |
| --- | --- |
| Emp\_Id | Emp\_State |
| 14 | UP |
| 20 | Bihar |
| 12 | Punjab |
| 22 | MP |
| 35 | Maharashtra |

1. **Third Normal Form (3NF)**

* 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.

|  |  |  |
| --- | --- | --- |
| Emp\_Id | Emp\_Name | Emp\_Zip |
| 14 | John | 201010 |
| 20 | Harry | 800011 |
| 12 | Sam | 143101 |
| 22 | Lan | 462007 |
| 35 | Jamy | 410206 |

|  |  |  |
| --- | --- | --- |
| Emp\_Zip | Emp\_City | Emp\_State |
| 201010 | Noida | UP |
| 800011 | Patana | Bihar |
| 143101 | Amritsar | Punjab |
| 462007 | Bhopal | MP |
| 410206 | Panvel | Maharashtra |

1. **Boyce Codd normal form (BCNF)**

* 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:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| EMP\_ID | EMP\_COUNTRY | EMP\_DEPT | DEPT\_TYPE | DEPT\_NO |
| 264 | India | Designing | D394 | 283 |
| 264 | India | Testing | D394 | 300 |
| 364 | UK | Stores | D283 | 232 |
| 364 | UK | Developing | D283 | 456 |

Solution:

|  |  |
| --- | --- |
| EMP\_ID | EMP\_COUNTRY |
| 264 | India |
| 364 | UK |

|  |  |  |
| --- | --- | --- |
| EMP\_DEPT | DEPT\_TYPE | DEPT\_NO |
| Designing | D394 | 283 |
| Testing | D394 | 300 |
| Stores | D283 | 232 |
| Developing | D283 | 456 |

|  |  |
| --- | --- |
| DEPT\_TYPE | DEPT\_NO |
| D394 | 283 |
| D394 | 300 |
| D283 | 232 |
| D283 | 456 |