**Normalization** - Normalization is the process of organizing, access, and store the data in the database. Normalization divides the larger table into smaller and links them using relationships. Normalization is used to minimize the redundancy from a relation or set of relations. The normal form is used to reduce redundancy from the database table. It is a multi-step process that set the data into table from and remove the duplicated data from the relational table.

**Types of Normalization** -

* First Normal Form (1NF)
* Second Normal Form (2NF)
* Third Normal Form (3NF)
* Boyce Codd Normal Form (BCNF)
* Fourth Normal Form (4NF)
* Fifth Normal Form (5NF)

**First Normal Form (1NF)** - A relation will be 1NF if it contains an atomic value. It state that attribute of a table cannot hold multiple values. It must hold only single-valued attribute.

Example -

|  |  |  |  |
| --- | --- | --- | --- |
| Serial no. | Name | Roll no. | Subject |
| 1 | Sonu | 101 | English, Marathi |
| 2 | Monu | 102 | Maths, Hindi |
| 3 | Golu | 103 | Science, History |

( This table not 1NF)

|  |  |  |  |
| --- | --- | --- | --- |
| Serial no. | Name | Roll no. | Subject |
| 1 | Sonu | 101 | English |
| 1 | Sonu | 101 | Marathi |
| 2 | Monu | 102 | Maths |
| 2 | Monu | 102 | Hindi |
| 3 | Golu | 103 | Science |
| 3 | Golu | 103 | History |

(It is a 1NF)

**Second Normal Form (2NF) -** In the second normal form(2NF), relation must be in first normal form (1NF). In the second normal form, all non-key attribute are fully function dependent on the primary key.

Example -

|  |  |  |  |
| --- | --- | --- | --- |
| User id | Name | Age | Gender |
| User1 | Meena | 20 | Female |
| User1 | Seema | 20 | Female |
| User2 | Komal | 22 | Female |
| User2 | Monal | 22 | Female |
| User3 | kunal | 25 | male |
| User id | Age | Gender |
| User1 | 20 | Female |
| User2 | 22 | Female |
| User3 | 25 | Male |

|  |  |
| --- | --- |
| User id | Name |
| User1 | Meena |
| User1 | Seema |
| User2 | Komal |
| User2 | Monal |
| User3 | kunal |

**Third Normal Form (3NF)** - A relation is a 3NF it is 2NF and non-primary attribute function dependent on other non-primary attribute. 3NF is used to used to reduce the data duplicate. it is also used to achieve the data integrity.

Example -

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Id | Name | Mobile no. | Gender | Address |
| 001 | Payal | 978456789 | Female | Ganesh Nagar |
| 002 | Divya | 987654321 | Female | Ganesh Nagar |
| 003 | Shubham | 678912345 | Male | Ram Nagar |
| 004 | Om | 543216789 | Male | Ram Nagar |
| 005 | Minakshi | 567891234 | Female | Shankar Nagar |
| 006 | Minoti | 123456789 | Female | Shankar Nagar |

|  |  |  |  |
| --- | --- | --- | --- |
| Id | Name | Mobile no. | Gender |
| 001 | Payal | 978456789 | Female |
| 002 | Divya | 987654321 | Female |
| 003 | Shubham | 678912345 | Male |
| 004 | Om | 543216789 | Male |
| 005 | Minakshi | 567891234 | Female |
| 006 | Minoti | 123456789 | Female |

|  |  |
| --- | --- |
| Gender | Address |
| Female | Ganesh Nagar |
| Male | Ram Nagar |
| Female | Shankar Nagar |

(This table converted in 3NF)

**Boyce Codd Normal Form (BCNF) -**  BCNF is the advance version of 3NF it is stricter 3NF. A table is BCNF if every functional dependency A 🡪 B, A is the super key of the table. BCNF the table should be in 3NF and for every lift hand side (LHS) is super key.

Example –

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name | Date of Birth | Address | Pin code | Mobile no. |
| Divya | 30/02/2002 | Sanjay Nagar | 440010 | 3216549875 |
| Divya | 30/02/2002 | Lakshmi Nagar | 440020 | 7894561237 |
| Om | 06/08/2003 | Bajaj Nagar | 558810 | 2583697401 |
| Minakshi | 10/05/2010 | Ram Nagar | 336641 | 9632587414 |

|  |  |
| --- | --- |
| Name | Date of Birth |
| Divya | 30/02/2002 |
| Om | 06/08/2003 |
| Minakshi | 10/05/2010 |

|  |  |  |
| --- | --- | --- |
| Address | Pin code | Mobile no. |
| Sanjay Nagar | 440010 | 3216549875 |
| Lakshmi Nagar | 440020 | 7894561237 |
| Bajaj Nagar | 558810 | 2583697401 |
| Ram Nagar | 336641 | 9632587414 |

|  |  |
| --- | --- |
| Pin code | Mobile no. |
| 440010 | 3216549875 |
| 440020 | 7894561237 |
| 558810 | 2583697401 |
| 336641 | 9632587414 |

**Fourth Normal Form (4NF) -** A relation will be in 4NF it is boyce codd normal form (BCNF) and has no multi values dependency. MVD (multi values dependency) when two or more independent multi values about the same attribute within the same relation.

Example -

|  |  |  |
| --- | --- | --- |
| Name | Class | Roll no. |
| Priya | 5th | 75 |
| Priya | 5th | 75 |
| Tina | 6th | 26 |
| Tina | 6th | 26 |
| Tina | 6th | 26 |

|  |  |
| --- | --- |
| Name | Class |
| Priya | 5th |
| Tina | 6th |

|  |  |
| --- | --- |
| Name | Roll no. |
| Priya | 75 |
| Tina | 26 |

**Fifth Normal Form (5NF) –** The Fifth normal form (5NF) is also know as project join Normal form. A relational fifth normal form if the 4NF and have lossess decomposition into smaller tables. 5NF is satisfied when all the tables are into a many tables as possible in order to avoid redundancy after that you combined these all table, it is equal to original table then 5NF.

|  |  |  |
| --- | --- | --- |
| Name | Subject | Class division |
| Roshani | English | A |
| Suhani | Marathi | A |
| Roshani | English | B |
| Suhani | Marathi | B |
| Veena | Hindi | D |
| Suhani | Marathi | C |

|  |  |  |
| --- | --- | --- |
| Name | Subject | Class division |
| Roshani | English | A |
| Roshani | English | B |
| Suhani | Marathi | A |
| Suhani | Marathi | B |
| Suhani | Marathi | C |
| Veena | Hindi | D |

Reference – YouTube <https://youtu.be/LtcWq_G1Lvw?si=sof1Fusu2fkQHRQ3>