## What is normalization?1

Database Normalization is organizing non structured data in to structured data. Database normalization is nothing but organizing the tables and columns of the tables in such way that it should reduce the data redundancy and complexity of data and improves the integrity of data.

TODO => Example pending

## What is First normal form(1NF)?

A relation is in first normal form if and only if the domain (i.e. Customer \_Table) of each attribute (i.e. Each column) contains only atomic (indivisible, column should contain single value) values, and the value of each attribute contains only a single value from that domain (i.e. Customer \_Table).

First normal form enforces these criteria:

* Eliminate repeating groups in individual tables
* Create a separate table for each set of related data
* Identify each set of related data with a primary key

Example:

Before first normal form(1NF)

|  |  |  |  |
| --- | --- | --- | --- |
| **Customer** | | | |
| **Customer ID** | **First Name** | **Surname** | **Contact Number** |
| 123 | Pooja | Singh | 555-861-2025, 192-122-1111 |
| 456 | San | Zhang | (555) 403-1659 Ext. 53; 182-929-2929 |
| 789 | John | Doe | 555-808-9633 |

After first normal form(1NF)

1NF => Design 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Customer** | | | |
| **Customer ID** | **First Name** | **Surname** | **Contact Number** |
| 123 | Pooja | Singh | 555-861-2025 |
| 123 | Pooja | Singh | 192-122-1111 |
| 456 | San | Zhang | 182-929-2929 |
| 456 | San | Zhang | (555) 403-1659 Ext. 53 |
| 789 | John | Doe | 555-808-9633 |

1NF => Design 2

|  |  |  |
| --- | --- | --- |
| **Customer Name** | | |
| **Customer ID** | **First Name** | **Surname** |
| 123 | Pooja | Singh |
| 456 | San | Zhang |
| 789 | John | Doe |

|  |  |  |
| --- | --- | --- |
| **Customer Contact Number** | | |
| **Id** | **Customer ID** | **Contact Number** |
| 1 | 123 | 555-861-2025 |
| 2 | 123 | 192-122-1111 |
| 3 | 456 | (555) 403-1659 Ext. 53 |
| 4 | 456 | 182-929-2929 |
| 5 | 789 | 555-808-9633 |

## What is Second normal form(2NF)?

To qualify for second normal form a relation must:

* be in first normal form (1NF)
* not have any non-prime attribute (i.e. product\_name, product\_type, product\_price) that is dependent on any proper subset (i.e. Product\_Table) of any candidate key [\*\*] (i.e. product\_id) of the relation. A non-prime attribute of a relation is an attribute that is not a part of any candidate key [\*\*] of the relation.

Put simply, a relation is in 2NF if it is in 1NF and every non-prime attribute of the relation is dependent on the whole of every candidate key [\*\*]. Note that it does not put any restriction on the non-prime to non-prime attribute dependency.

Example:

Before Second normal form(2NF)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Shop\_No.** | **Shop\_Name** | **Shop\_owner** | **Shop\_Address** | **Phone\_No** | **Product\_Name** | **Product\_type** | **Product\_Price** |
| 1 | aaa | owner1 | Pune | 111111111 | tomato | Red | 1 |
| 2 | bbb | owner2 | mumbai | 222222222 | carrot | Small | 2 |
| 3 | ccc | owner3 | hydrabad | 333333333 | banana | Yellow | 3 |
| 4 | ddd | owner4 | kolkata | 444444444 | Apple | Kashmiri | 4 |
| 5 | eee | owner5 | delhi | 555555555 | Cucumber | small | 5 |
| 6 | fff | owner6 | banglore | 666666666 | Pineapple | big | 6 |

After second Normal form(2NF)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Shop\_No.** | **Shop\_Name** | **Shop\_owner** | **Shop\_Address** | **Phone\_No** |
| 1 | aaa | owner1 | pune | 111111111 |
| 2 | bbb | owner2 | mumbai | 222222222 |
| 3 | ccc | owner3 | hydrabad | 333333333 |
| 4 | ddd | owner4 | kolkata | 444444444 |
| 5 | eee | owner5 | delhi | 555555555 |
| 6 | fff | owner6 | banglore | 666666666 |

|  |  |  |
| --- | --- | --- |
| **Product\_Name** | **Product\_type** | **Product\_Price** |
| tomato | Red | 1 |
| carrot | Small | 2 |
| banana | Yellow | 3 |
| Apple | Kashmiri | 4 |
| Cucumber | small | 5 |
| Pineapple | big | 6 |

\*\* A **candidate key (i.e. Primary key, Unique key & Foreign key)** is a column, or set of columns, in a table that can uniquely identify any database record without referring to any other data. Each table may have one or more candidate keys, but one candidate key is unique, and it is called the primary key.

\*\*\* The constituent attributes are called prime attributes (i.e. primary key column). Conversely, an attribute that does not occur in ANY candidate key is called a non-prime attribute (i.e. non-primary key column).

## What is Third normal form(3NF)?

This normalization is a database design to reduce the duplication of data and ensure referential integrity by ensuring that:

1. the entity (i.e. Table) is in second normal form
2. all the attributes (i.e. column) in a table are determined only by the candidate keys (i.e. Primary key, Unique key) of that relation and not by any non-prime attributes.

3NF was designed to: eliminate undesirable data anomalies (i.e. duplicate data); reduce the need for restructuring over time; make the data model more informative; make the data model neutral to different kinds of query statistics.

Example:

Before First normal form(1NF)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Shop\_Name** | **Shop\_owner** | **Shop\_Address** | **Phone\_No** | **Product\_Name** | **Product\_type** | **Product\_Price** |
| Aaa | owner1 | Pune | 111111111 | tomato | Red | 1 |
| Bbb | owner2 | Mumbai | 222222222,  777777777 | carrot | Small | 2 |
| Ccc | owner3 | Hydrabad | 333333333 | banana | Yellow | 3 |
| Ddd | owner4 | Kolkata | 444444444 | Apple | Kashmiri | 4 |
| Eee | owner5 | Delhi | 555555555,  888888888 | Cucumber | small | 5 |
| Fff | owner6 | Banglore | 666666666 | Pineapple | big | 6 |

Before Second normal form(2NF) OR After first normal form((1NF)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Shop\_Name** | **Shop\_owner** | **Shop\_Address** | **Phone\_No** | **Product\_Name** | **Product\_type** | **Product\_Price** |
| Aaa | owner1 | Pune | 111111111 | tomato | Red | 1 |
| Bbb | owner2 | Mumbai | 222222222 | carrot | Small | 2 |
| Bbb | owner2 | Mumbai | 777777777 | carrot | Small | 2 |
| Ccc | owner3 | Hydrabad | 333333333 | banana | Yellow | 3 |
| Ddd | owner4 | Kolkata | 444444444 | Apple | Kashmiri | 4 |
| Eee | owner5 | Delhi | 555555555 | Cucumber | small | 5 |
| Eee | owner5 | Delhi | 888888888 | Cucumber | small | 5 |
| Fff | owner6 | Banglore | 666666666 | Pineapple | big | 6 |

Before third normal form(3NF) OR After second Normal form (2NF)

|  |  |  |
| --- | --- | --- |
| **Shop\_Name** | **Shop\_owner** | **Shop\_Address** |
| Aaa | owner1 | pune |
| Bbb | owner2 | mumbai |
| Ccc | owner3 | hydrabad |
| Ddd | owner4 | kolkata |
| Eee | owner5 | delhi |
| Fff | owner6 | banglore |

|  |  |  |
| --- | --- | --- |
| **Product\_Name** | **Product\_type** | **Product\_Price** |
| Tomato | Red | 1 |
| Carrot | Small | 2 |
| Banana | Yellow | 3 |
| Apple | Kashmiri | 4 |
| Cucumber | small | 5 |
| Pineapple | big | 6 |

|  |  |
| --- | --- |
| **Contact\_Number1** | **Contact\_Number2** |
| 111111111 |  |
| 222222222 | 777777777 |
| 333333333 |  |
| 444444444 |  |
| 555555555 | 888888888 |
| 666666666 |  |

After third normal form(3NF)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Shop\_No.** | **Shop\_Name** | **Shop\_owner** | **Shop\_Address** | **Contact\_Id** | **Product\_Id** |
| 1 | Aaa | owner1 | Pune | 1 | 1 |
| 2 | Bbb | owner2 | Mumbai | 2 | 6 |
| 3 | Ccc | owner3 | Hydrabad | 3 | 1 |
| 4 | Ddd | owner4 | Kolkata | 4 | 3 |
| 5 | Eee | owner5 | Delhi | 5 | 4 |
| 6 | Fff | owner6 | Banglore | 6 | 4 |

|  |  |  |  |
| --- | --- | --- | --- |
| **Product\_Id** | **Product\_Name** | **Product\_type** | **Product\_Price** |
| 1 | Tomato | Red | 1 |
| 2 | Carrot | Small | 2 |
| 3 | Banana | Yellow | 3 |
| 4 | Apple | Kashmiri | 4 |
| 5 | Cucumber | small | 5 |
| 6 | Pineapple | Big | 6 |

|  |  |  |
| --- | --- | --- |
| **Contact\_Id** | **Contact\_Number1** | **Contact\_Number2** |
| 1 | 111111111 |  |
| 2 | 222222222 | 777777777 |
| 3 | 333333333 |  |
| 4 | 444444444 |  |
| 5 | 555555555 | 888888888 |
| 6 | 666666666 |  |

(data integrity achieved)