**Normalization**

**What is Normalization-**

Normalization is the process of organizing data into a related table it also eliminates redundancy and increases the integrity which improves performance of the query. To normalize a database, we divide the database into tables and establish relationships between the tables.

Link - https://www.c-sharpcorner.com/UploadFile/nipuntomar/normalization-and-its-types/

**Types of anomalies -**

The different types of anomalies are:

* Insertion Anomalies: This refers to the situation when we are unable to insert data in a database due to some attributes not being present.
* Deletion Anomalies: This refers to the situation in which due to the deletion of one part of the data, the other necessary information is also deleted.
* Updation Anomalies: This refers to the situation when the updation of one data value requires the updation of multiple rows.

Link - https://trainings.internshala.com/blog/normalization-in-dbms/

* s refers to the situation when the updation of one data value requires the updation of multiple rows. It happens because the same data items are repeated with the same values but are not linked with each other.

**Advantages of Normalization-**

* Data consistency within the database.
* Much more flexible database design.
* Enforces the concept of relational integrity.

**Disadvantages of Normalization-**

* You cannot start building the database before knowing what the user needs.
* It is very time-consuming and difficult to normalize relations of a higher degree.
* Careless decomposition may lead to a bad database design, leading to serious problems.

Link - <https://www.javatpoint.com/dbms-normalization>

**Normalization Types –**

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

**First normal forms (1NF)**

In 1st NF

* The first normal form if it contains no repeating groups. In relational terms, a table is in the first normal form if it contains no repeating columns.

EXAMPLE:

|  |  |  |  |
| --- | --- | --- | --- |
| Order | Customer | Contact Person | Total |
| 1 | Rishabh | Manish | 134.23 |
| 2 | Preeti | Rohan | 521.24 |
| 3 | Rishabh | Manish | 1042.42 |
| 4 | Rishabh | Manish | 928.53 |

**Second normal forms (2NF)**

In 2st NF

* A relation is in 2NF if it is in 1NF and every non-key attribute is fully dependent on each candidate key of the relation.

**EXAMPLE:**

|  |  |  |  |
| --- | --- | --- | --- |
| Order | Customer | Contact Person | Total |
| 1 | Rishabh | Manish | 134.23 |
| 2 | Preeti | Rohan | 521.23 |
| 3 | Rishabh | Manish | 1042.42 |
| 4 | Rishabh | Manish | 928.53 |

In 2st NF

|  |  |
| --- | --- |
| Customer | Contact Person |
| 1 | Manish |
| 2 | Rohan |

|  |  |  |
| --- | --- | --- |
| Order | Customer | Total |
| 1 | Rishabh | 134.23 |
| 2 | Preeti | 521.23 |
| 3 | Rishabh | 1042.42 |
| 4 | Rishabh | 928.53 |

**Third normal forms (3NF)**

In 3st NF

* A relation is in third normal form if it is in 2NF and every non-key attribute of the relation is non-transitively dependent on each candidate key of the relation.

Non-transitive dependency

* Let A, B, and C be three attributes of a relation R such that A◊B and B◊C. From these FDs, we may derive A-C. This dependence A-C is transitive.

EXAMPLE:

|  |  |  |  |
| --- | --- | --- | --- |
| Company | City | State | ZIP |
| ABC Ltd. | Mumbai | MH | 10169 |
| XYZ Ltd. | Noida | UP | 33196 |
| ASD Ltd. | Chennai | TP | 21046 |

|  |  |
| --- | --- |
| Company | ZIP |
| ABC Ltd. | 10169 |
| XYZ Ltd. | 33196 |
| ASD Ltd. | 21046 |

|  |  |  |
| --- | --- | --- |
| City | state | ZIP |
| Mumbai | MH | 10169 |
| Noida | UP | 33196 |
| Chennai | TP | 21046 |

**Boyce & Codd normal forms (BCNF)**

In BCNF

* A relation is in Boyce-Codd Normal Form (BCNF) if every determinant is a candidate key. (See the links in the box at right for definitions of determinant and candidate key.)

EXAMPLE:

**CLIENT INTERVIEW**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Client No | Interview Date | Interview Time | Staff No | Room No |
| CR76 | 13-may-11 | 10:30 | SG5 | G101 |
| CR76 | 13-may-11 | 12:00 | SG5 | G101 |
| CR74 | 13-may-11 | 12:00 | SG37 | G102 |
| CR56 | 02-july-11 | 10:30 | SG5 | G102 |

In BCNF

**INTERVIEW**

|  |  |  |  |
| --- | --- | --- | --- |
| Client No | Interview Date | Interview Time | Room No |
| CR76 | 13-may-11 | 10:30 | G101 |
| CR76 | 13-may-11 | 12:00 | G101 |
| CR74 | 13-may-11 | 12:.00 | G102 |
| CR56 | 02-july-11 | 10:30 | G102 |

**STAFFROOM**

|  |  |  |
| --- | --- | --- |
| Staff No | Interview Date | Room No |
| SG5 | 13-may-11 | G101 |
| SG37 | 13-may-11 | G102 |
| SG5 | 02-july-11 | G102 |

**Fourth Normal Form (4th NF)**

In 4th NF

* A table is in fourth normal form (4NF) if and only if it is in BCNF and contains no more than one multi-valued dependency.

EXAMPLE:

**Info (Employee, Skills, Hobbies)**

|  |  |  |
| --- | --- | --- |
| Employee | Skills | Hobbies |
| 1 | Programming | Golf |
| 1 | Programming | Bowling |
| 1 | Analysis | Golf |
| 1 | Analysis | Bowling |
| 2 | Analysis | Golf |
| 2 | Analysis | Gardening |
| 2 | Management | Golf |
| 2 | Management | Gardening |

|  |  |
| --- | --- |
| Employee | Skills |
| 1 | Programing |
| 1 | Analysis |
| 2 | Analysis |
| 2 | Management |

**Hobbies (Employee, Hobby)**

|  |  |
| --- | --- |
| Employee | Hobbies |
| 1 | Golf |
| 1 | Blowing |
| 2 | Golf |
| 2 | Gardening |

**Fifth Normal Form (5th NF)**

In 5th NF

* A table is in the fifth normal form (5NF) or Project-Join Normal Form (PJNF) if it is in 4NF and it cannot have a lossless decomposition into any number of smaller tables.

EXAMPLE:

|  |  |  |
| --- | --- | --- |
| Buyer | Vendor | Item |
| Shalley | Kashmir House | Jeans |
| Mary | Kashmir House | Jeans |
| Shalley | Radhika House | Saree |
| Mary | Radhika House | Saree |
| Shalley | Radhika House | Suit |

**BUYER-VENDOR**

|  |  |
| --- | --- |
| Buyer | Vendor |
| Shalley | Kashmir House |
| Mary | Kashmir House |
| Shalley | Radhika House |
| Mary | Radhika House |

**BUYER-ITEM**

|  |  |
| --- | --- |
| Buyer | Item |
| Shalley | Jeans |
| Mary | Jeans |
| Shalley | Saree |
| Mary | Saree |
| Shalley | Suit |

**VENDOR- ITEM**

|  |  |
| --- | --- |
| Vendor | Item |
| Kashmir House | Jeans |
| Radhika House | Saree |
| Radhika House | Suit |

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