**NORMALISATION**

We normalise relations to avoid some anomalies (problems) of data. There are six Normal forms.

They are

**First Normal form**

**Second Normal form**

**Third Normal form**

**Fourth Normal form**

**BCNF Normal form**

**Fifth Normal form**

**First Normal form**

For a relation to be in First Normal Form:

* + Every attribute value must be atomic

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ST\_NO | ST\_NAME | YEAR&GROUP | MARKS |  |
| 950112 | Jack | 2,NDBC | 78 | Not in First Normal Form |
| 950156 | Jill | 1,CBC | 45 |  |
| 950100 | Bill | 1,CBC | 89 |  |

**NOT ATOMIC VALUES**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ST\_NO | ST\_NAME | YEAR | GROUP | MARKS |  |
| 950112 | Jack | 2 | NDBC | 78 | In First Normal Form |
| 950156 | Jill | 1 | CBC | 45 |  |
| 950100 | Bill | 1 | CBC | 89 |  |

**Functional Dependence**

The value of one attribute (the determinant) determines the value of another attribute

Example: In the above relation value 950112 of STUDENT NUMBER determines the value 78.

**Second Normal Form**

For a relation to be in Second Normal Form:

It must be in First Normal Form *plus* every non-key attribute is fully functionally dependent on the ENTIRE primary key

* + Every non-key attribute must be defined by the entire key, not by a part of the key
  + No partial functional dependencies

# Transitive Dependency

Sometimes a non-key attribute of a relation may determine the value of another non key attribute. It is called **Transitive Dependency**.

Supplier

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Supplier\_no | Supplier name | Supp- address | City | City code |
| S01 | John | 12, High Street | Rotorua | 02 |
| S02 | Mike | 12, Green Path | London | 01 |
| S03 | Peter | P.O.Box 21 | Auckland | 03 |
| S04 | Derik | Way 21 | Hamilton | 04 |
| S05 | Attar | P.O.Box21 | Wellington | 08 |

Supplier\_name

Supp-address

Transitive Dependency

City

City Code

Supplier\_no

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Supplier\_no | Supplier\_name | Supp-address | City | City Code |

**THIRD NORMAL FORM**

A relation is in Third Normal form if it is in Second Normal form and there are no Transitive Dependencies.

Above relation has a transitive dependency. We can remove it by dividing it into two relations as shown below.

**Supplier**

|  |  |  |  |
| --- | --- | --- | --- |
| Supplier\_no | Supplier name | Supp- address | City code |
| S01 | John | 12, High Street | 02 |
| S02 | Mike | 12, Green Path | 01 |
| S03 | Ali | P.O.Box 21 | 03 |
| S04 | Mohammed | Way 21 | 04 |
| S05 | Attar | P.O.Box21 | 08 |

### City Code

|  |  |
| --- | --- |
| City code | City |
| 02 | Rotorua |
| 01 | London |
| 03 | Auckland |
| 04 | Hamilton |
| 08 | Wellington |

# Boyce/Codd Normal Form

A relation (table) is in Boyce/Codd Normal Form (BCNF) if and only if every determinant is a candidate key.

Following Example is not in BCNF.

Student Advisor

|  |  |  |  |
| --- | --- | --- | --- |
| **Student\_no** | **Advisor** | **Major** | **Major\_GPA** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Student\_no | Advisor | Major | Major\_GPA |

BCNF - Make every determinant a Candidate key

|  |  |  |
| --- | --- | --- |
| Student\_no | Advisor | Major\_GPA |

|  |  |
| --- | --- |
| Advisor | Major |

### Multivalued Dependency

CTX

|  |  |  |
| --- | --- | --- |
| **Course** | **Teacher** | **Text** |
| Physics | Prof. Green | Basic Mechanics |
| Physics | Prof. Green | Principles of optics |
| Physics | Prof. Brown | Basic Mechanics |
| Physics | Prof. Brown | Principles of optics |
| Maths | Prof. Green | Basic Mechanics |
| Maths | Prof. Green | Vector Analysis |
| Maths | Prof. Green | Trigonometry |

Primary Key is – **Course + Teacher + Text**

This is in BCNF because it is all key.

#### But

|  |  |  |
| --- | --- | --- |
| **Course** | **Teacher** | **Text** |

CTX.Course 🡪 CTX.Teacher

CTX.Course 🡪 CTX.Text

#### Fourth Normal Form

A relation is in Fourth Normal Form if it is in BCNF and contains no multivalued dependencies.

Solution

CT

|  |  |
| --- | --- |
| **Course** | **Teacher** |
| Physics | Prof. Green |
| Physics | Prof. Brown |
| Maths | Prof. Green |

CTX

|  |  |
| --- | --- |
| **Course** | **Text** |
| Physics | Basic Mechanics |
| Physics | Principles of optics |
| Maths | Basic Mechanics |
| Maths | Vector Analysis |
| Maths | Trigonometry |

##### Fifth Normal Form

Related to Join Dependencies.

READ : Text Book (p.211-214 )