

**Normalisation Workbook**



**First Normal Form (1NF)**

The rules for 1NF:

* Each data item cannot be broken down any further i.e. it is ‘atomic’
* Each row/record is unique and has a primary key
* There are no records with repeating data
* Each field should be unique
1. **Atomic data**

**Rule 1:** Each data item cannot be broken down any further i.e. it is ‘atomic’

State whether the following examples are atomic or non atomic

| **Data** | **Atomic or non atomic** |
| --- | --- |
| Miss Jane Green |  |
| 9 Oak Crescent, Warwick |  |
| Teacher |  |
| 01926 123456 |  |
| King George IV School London |  |
| CV11 9NB |  |
| Keyboard |  |
| Star Trek 12A |  |
| Jaguar XJS |  |
| Buckingham Palace |  |
| Supersize cheeseburger |  |

Change the following examples of non atomic data into atomic data

| **Non Atomic** | **Atomic** |
| --- | --- |
| Name: Sally Chadwick | First name: SallySurname: Chadwick |
| Address: 9 Oak Crescent, Snitterfield, CV11 9NB |  |
| King George IV School London |  |
| Star Trek 12A |  |
| Jaguar XJS |  |

1. **Rule 2:** Each row/record is unique and has a primary key

The records below have no primary key. Choose a suitable primary key and complete the table.

|  | **Title** | **First Name** | **Surname** | **Dob** |
| --- | --- | --- | --- | --- |
|  | Mr | James | Smith | 14/05/57 |
|  | Miss | Emma | White | 21/11/78 |

The records below have no primary key. Choose a suitable primary key and complete the table.

|  | **FilmTitle** | **Rating** | **Genre** |
| --- | --- | --- | --- |
|  | Star Trek | 12A | Sci Fi |
|  | The Little Mermaid | U | Children |

1. **Rule 3:** There are no records with repeating data

Look at the tables below and answer the questions:

Table 1:

| **ID\*** | **Title** | **Surname** | **Telephone no** |
| --- | --- | --- | --- |
| 001 | Miss | Smith | 01234 567890 |
| 002 | Miss | White | 01234 890123 |
| 003 | Miss | James | 01234 798453 |
| 004 | Miss | Green | 01234 578345 |

Is this table in 1NF? Yes No

Reason:

Table 2:

| **ID\*** | **Title** | **Surname** | **Full Name** | **Telephone no** |
| --- | --- | --- | --- | --- |
| 001 | Mrs | Field | Mrs Field | 01234 523645 |
| 002 | Miss | White | Miss White | 01234 890123 |
| 003 | Mr | Hancock | Mr Hancock | 01234 989654 |
| 004 | Miss | Green | Miss Green | 01234 578345 |

Is this table in 1NF? Yes No

Reason:

Table 3:

| **ID\*** | **Title** | **Surname** | **Email** |
| --- | --- | --- | --- |
| 001 | Mrs | Field | field.m@yahoo.com |
| 002 | Miss | White | White123@hotmail.com white\_a@btinternet.com |
| 003 | Mr | Hancock | Hancock1982@aol.com |
| 004 | Miss | Green | alisongreen@btinternet.com greenam@yahoo.com |

Is this table in 1NF? Yes No

Reason:

1. **Rule 4:** Each field name should be unique

Look at the tables below and answer the questions:

Table 1:

| **ID\*** | **Title** | **Surname** | **Telephone no** | **Telephone no** | **Telephone no** |
| --- | --- | --- | --- | --- | --- |
| 001 | Mr | Smith | 01234 567890 | 01234 789123 | 01234 345678 |
| 002 | Miss | White | 01234 890123 | 01234 456789 | 01234 213456 |

Is this table in 1NF? Yes No

Reason:

Table 2:

| **ID\*** | **FirstName** | **Surname** | **Course** | **Module** | **Module** |
| --- | --- | --- | --- | --- | --- |
| 00123 | Tamsin | Wall | Business Studies | Accounts | Economics |
| 00245 | Steven | Weeks | Business Studies | Operations Management | Business Law |

Is this table in 1NF? Yes No

Reason:

1. **Identifying tables in First Normal Form (1NF)**

Remembering all of the rules of First Normal Form, identify which of the following tables are in 1NF. Explain your reason

Example 1:

| **Title** | **FirstName** | **Surname** | **Address** | **City** | **Postcode** |
| --- | --- | --- | --- | --- | --- |
| Mr | Tom | Smith | 42 Mill Street | London | SE31 1WE |

Is this table in 1NF? Yes No

Reason:

Example 2:

| **ID\*** | **Username** | **Last accessed** | **Activity** | **Result** | **AccountActive** |
| --- | --- | --- | --- | --- | --- |
| 1003 | Smithj08 | 2009 06 21: 14:03 | Save file | Success | Y |

Is this table in 1NF? Yes No

Reason:

Example 3:

| **ItemID\*** | **Product** | **Description** | **Size** | **Colour** | **Colour** | **Colour** |
| --- | --- | --- | --- | --- | --- | --- |
| 234 | Shoe | High Heel | 6 | Red | Blue | Green |

Is this table in 1NF? Yes No

Reason:

Example 4:

| **StudentID\*** | **FirstName** | **Surname** | **SchoolID** | **ClassID** |
| --- | --- | --- | --- | --- |
| 354 | Tom | James | 016 | 5F |

Is this table in 1NF? Yes No

Reason:



**Second Normal Form (2NF)**

The rules for 2NF:

* The table must be in 1NF
* Non-key attributes must depend on every part of the primary key

| **Venue\*** | **Artist\*** | **Date\*** | **Attendance** | **Profit** | **Style** |
| --- | --- | --- | --- | --- | --- |
| Wembley | Girls Aloud | 14/05/09 | 23000 | 12334 | Girl band |
| NEC | Leona Lewis | 18/05/09 | 15000 | 43025 | Female soloist |

Identify the key attributes in this table:

Identify the non-key attributes in this table:

Does every non-key attribute depend on every key attribute?

If your answer above was no, is this table in 2NF?

If it is not in 2NF, identify which non-key attribute does not depend on one of the key attributes.

Answer:

Redesign this database so that it is in 2NF

CONCERT:

| **Venue\*** | **ArtistID\*** | **Date\*** | **Attendance** | **Profit** |
| --- | --- | --- | --- | --- |
| Wembley | 002 | 14/05/09 | 23000 | 12334 |

ARTIST:

| ArtistID\* |  |  |
| --- | --- | --- |
|  |  |  |

STYLE:

| StyleID\* |  |
| --- | --- |
|  |  |

1. **2NF another example**

COURSES:

| **CourseID\*** | **Term\*** | **PlacesAvailable** | **CourseTitle** |
| --- | --- | --- | --- |
| 001 | Autumn | 50 | Computing |
| 001 | Spring | 40 | Computing |
| 001 | Summer | 45 | Computing |
| 002 | Autumn | 100 | ICT |
| 002 | Spring | 90 | ICT |
| 003 | Summer | 100 | Robotics |

Identify the key attributes in this table:

Identify the non-key attributes in this table:

Does every non-key attribute depend on every key attribute? Explain your answer

Redesign this database so that it is in 2NF

COURSES AVAILABLE:

|  |  |  |
| --- | --- | --- |
|  |  |  |

COURSE:

|  |  |
| --- | --- |
|  |  |

10.



**Third Normal Form (3NF)**

The rules for 3NF:

* The table must be in 2NF
* There are no non-key attributes that depend on another non-key attribute
* Every non-key attribute is non-transitively dependent on the primary key

**Example 1: Concert table**

| **Venue\*** | **Artist\*** | **Date\*** | **Attendance** | **Profit** | **City** | **Country** |
| --- | --- | --- | --- | --- | --- | --- |
| Wembley | Girls Aloud | 14/05/09 | 23000 | 12334 | London | UK |
| NEC | Leona Lewis | 18/05/09 | 15000 | 43025 | Birmingham | UK |
| Carnegie Hall | Girls Aloud | 20/05/09 | 13453 | 16785 | New York | USA |

Key attributes: Venue, Artist, Date

Non-key attributes: Attendance, Profit, City, Country

The table is in 2NF but it is not in 3NF because ‘Country’ could be derived from ‘City’

Country could be stored in another table e.g.

| **City\*** | **Country** |
| --- | --- |
| London | UK |
| Birmingham | UK |
| New York | USA |

The new table called ‘countries’ has City as the primary key and ‘country’ as an attribute.

The concert table has ‘city’ as a foreign key. Now there is no redundant data.

**3NF – an example**

COURSES AVAILABLE:

| **CourseID\*** | **Term\*** | **PlacesAvailable** | **TeacherID** | **Teacher** |
| --- | --- | --- | --- | --- |
| 001 | Autumn | 50 | 024 | Mrs White |
| 001 | Spring | 40 | 024 | Mrs White |
| 001 | Summer | 45 | 019 | Mr Brown |
| 002 | Autumn | 100 | 024 | Mrs White |
| 002 | Spring | 90 | 031 | Miss Green |
| 003 | Summer | 100 | 026 | Mr Black |

Is this table in 3NF?

If you answered ‘no’, explain your reason.

Redesign this database so that it is in 3NF

COURSES AVAILABLE

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

TEACHER

|  |  |
| --- | --- |
|  |  |