To normalize the given data to the Third Normal Form (3NF), we will go through the steps of normalization: 1NF, 2NF, and 3NF.

## 1NF (First Normal Form)

First Normal Form requires that:

Each table has a primary key.

Each column contains atomic (indivisible) values.

Each record is unique.

The given table has repeating groups (multiple courses, exam boards, and teachers for each student), so we need to split those into separate rows.

Initial Table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Student Number | Student Name | Exam Score | Support | Date of Birth | Course Name | Exam Board | Teacher Name |
| 1001 | Bob Baker | 78 | No | 25/08/2001 | Computer Science | BCS | Mr Jones |
| 1001 | Bob Baker | 78 | No | 25/08/2001 | Maths | EdExcel | Ms Parker |
| 1001 | Bob Baker | 78 | No | 25/08/2001 | Physics | OCR | Mr Peters |
| 1002 | Sally Davies | 55 | Yes | 02/10/1999 | Maths | AQA | Ms Parkers |
| 1002 | Sally Davies | 55 | Yes | 02/10/1999 | Biology | WJEC | Mrs Patel |
| 1002 | Sally Davies | 55 | Yes | 02/10/1999 | Music | AQA | Ms Daniels |
| 1003 | Mark Hanmill | 90 | No | 05/06/1995 | Computer Science | BCS | Mr Jones |
| 1003 | Mark Hanmill | 90 | No | 05/06/1995 | Maths | EdExcel | Ms Parker |
| 1003 | Mark Hanmill | 90 | No | 05/06/1995 | Physics | OCR | Mr Peters |
| 1004 | Ana Alis | 70 | No | 03/08/1980 | Maths | AQA | Ms Parkers |
| 1004 | Ana Alis | 70 | No | 03/08/1980 | Physics | OCR | Mr Peters |
| 1004 | Ana Alis | 70 | No | 03/08/1980 | Biology | WJEC | Mrs Patel |
| 1005 | Cheuk Yin | 45 | Yes | 01/05/2002 | Computer science | BCS | Mr Jones |
| 1005 | Cheuk Yin | 45 | Yes | 01/05/2002 | Maths | EdExcel | Ms Parker |
| 1005 | Cheuk Yin | 45 | Yes | 01/05/2002 | Music | AQA | Ms Daniels |

## 2NF (Second Normal Form)

Second Normal Form requires that:

The table is in 1NF.

All non-key attributes are fully functional dependent on the primary key.

To achieve 2NF, we identify the composite primary key (Student Number, Course Name) and ensure all non-key attributes depend on this key.

Split into Two Tables

1. Students Table(Student Number as Primary Key)

2. Student Courses Table(Composite Primary Key: Student Number, Course Name)

Students Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Student Number | Student Name | Exam Score | Support | Date of Birth |
| 1001 | Bob Baker | 78 | No | 25/08/2001 |
| 1002 | Sally Davies | 55 | Yes | 02/10/1999 |
| 1003 | Mark Hanmill | 90 | No | 05/06/1995 |
| 1004 | Ana Alis | 70 | No | 03/08/1980 |
| 1005 | Cheuk Yin | 45 | Yes | 01/05/2002 |

Student Courses Table:

|  |  |  |  |
| --- | --- | --- | --- |
| Student Number | Course Name | Exam Board | Teacher Name |
| 1001 | Computer Science | BCS | Mr Jones |
| 1001 | Maths | EdExcel | Ms Parker |
| 1001 | Physics | OCR | Mr Peters |
| 1002 | Maths | AQA | Ms Parkers |
| 1002 | Biology | WJEC | Mrs Patel |
| 1002 | Music | AQA | Ms Daniels |
| 1003 | Computer Science | BCS | Mr Jones |
| 1003 | Maths | EdExcel | Ms Parker |
| 1003 | Physics | OCR | Mr Peters |
| 1004 | Maths | AQA | Ms Parkers |
| 1004 | Physics | OCR | Mr Peters |
| 1004 | Biology | WJEC | Mrs Patel |
| 1005 | Computer science | BCS | Mr Jones |
| 1005 | Maths | EdExcel | Ms Parker |
| 1005 | Music | AQA | Ms Daniels |

## 3NF (Third Normal Form)

Third Normal Form requires that:

The table is in 2NF.

All the attributes are functionally dependent only on the primary key.

To achieve 3NF, we must ensure there are no transitive dependencies. In this case, Teacher Name depends on the Course Name rather than on the Student Number, Course Name composite key.

Split into Three Tables

1. Students Table (as in 2NF)

2. Courses Table (Course Name as Primary Key)

3. Student Courses Table (Composite Primary Key: Student Number, Course Name)

Students Table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Student Number | Student Name | Exam Score | Support | Date of Birth |
| 1001 | Bob Baker | 78 | No | 25/08/2001 |
| 1002 | Sally Davies | 55 | Yes | 02/10/1999 |
| 1003 | Mark Hanmill | 90 | No | 05/06/1995 |
| 1004 | Ana Alis | 70 | No | 03/08/1980 |
| 1005 | Cheuk Yin | 45 | Yes | 01/05/2002 |

Courses Table:

|  |  |  |
| --- | --- | --- |
| Course Name | Exam Board | Teacher Name |
| Computer Science | BCS | Mr Jones |
| Maths | EdExcel | Ms Parker |
| Maths | AQA | Ms Parker |
| Physics | OCR | Mr Peters |
| Biology | WJEC | Mrs Patel |
| Music | AQA | Ms Daniel |

Student Courses Table:

|  |  |
| --- | --- |
| Student Number | Course Name |
| 1001 | Computer Science |
| 1001 | Maths |
| 1001 | Physics |
| 1002 | Maths |
| 1002 | Biology |
| 1002 | Music |
| 1003 | Computer Science |
| 1003 | Maths |
| 1003 | Physics |
| 1004 | Maths |
| 1004 | Physics |
| 1004 | Biology |
| 1005 | Computer science |
| 1005 | Maths |
| 1005 | Music |

Summary

We have now normalized the data into 3NF. Here is the final structure:

1. Students Table:

Student Number (PK)

Student Name

Exam Score

Support

Date of Birth

2. Courses Table:

Course Name (PK)

Exam Board

Teacher Name

3. Student Courses Table:

Student Number (Composite PK)

Course Name (Composite PK)