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Normalization

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What is Normalization?

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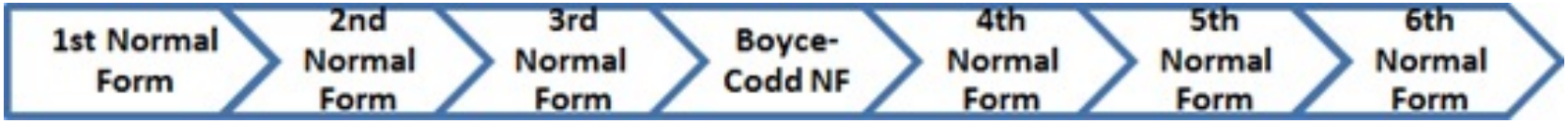
Normalization is a database design technique which organizes tables in a manner that reduces redundancy and dependency of data. It divides larger tables to smaller tables and links them using relationships.

In this tutorial, you will learn-

The inventor of the relational model Edgar Codd proposed the theory of normalization with the introduction of First Normal Form, and he continued to extend theory with Second and Third Normal Form. Later he joined with Raymond F. Boyce to develop the theory of Boyce-Codd Normal Form. Theory of Data Normalization in SQL is still being developed further. For example, there are discussions even on 6th Normal Form. However, in most practical applications, normalization achieves its best in 3rd Normal Form. The evolution of Normalization theories is illustrated below-



Database Normalization Example

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Assume a video library maintains a database of movies rented out. Without any normalization, all information is stored in one table as shown below.

Full Names	Physical Address	Movies rented	Salutation	Category
Janet Jones	First Street Plot No 4	Pirates of the Caribbean, Clash of the Titans	Ms.	Action, Action
Robert Phil	3rd Street 34	Forgetting Sarah Marshal, Daddy's Little Girls	Mr.	Romance, Romance
Robert Phil	5th Avenue	Clash of the Titans	Mr.	Action

Here you see Movies Rented column has multiple values.

Database Normal Forms

Now let's move into 1st Normal Forms

1NF (First Normal Form) Rules

1. Each table cell should contain a single value.
2. Each record needs to be unique.

The above table in 1NF-

Full Names	Physical Address	Movies rented	Salutation
Janet Jones	First Street Plot No 4	Pirates of the Caribbean	Ms.
Janet Jones	First Street Plot No 4	Clash of the Titans	Ms.
Robert Phil	3rd Street 34	Forgetting Sarah Marshal	Mr.
Robert Phil	3rd Street 34	Daddy's Little Girls	Mr.
Robert Phil	5th Avenue	Clash of the Titans	Mr.

Before we proceed let's understand a few things –

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What is a KEY?

A KEY is a value used to identify a record in a table uniquely. A KEY could be a single column or combination of multiple columns

Note: Columns in a table that are NOT used to identify a record uniquely are called non-key columns.

What is a Primary Key?

A primary is a single column value used to identify a database record uniquely.

It has following attributes

- ✓ A primary key cannot be NULL
- ✓ A primary key value must be unique
- ✓ The primary key values cannot be changed
- ✓ The primary key must be given a value when a new record is inserted.

Primary Key

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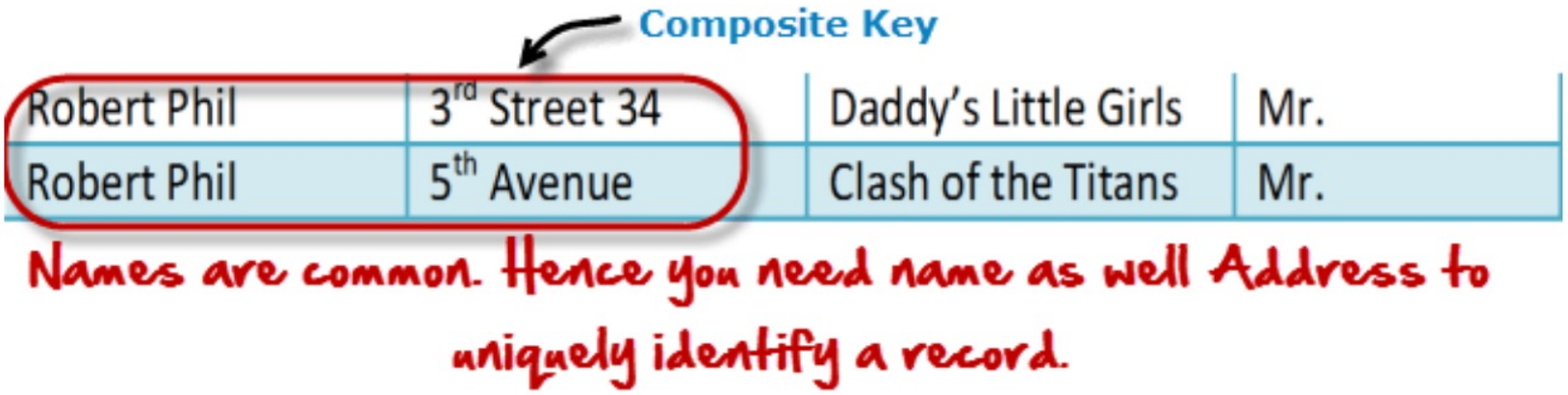
What is Composite Key?

A composite key is a primary key composed of multiple columns used to identify a record uniquely. In our database, we have two people with the same name Robert Phil, but they live in different places.



Hence, we require both Full Name and Address to identify a record uniquely. That is a composite key.

Let's move into second normal form 2NF

Database Normal Forms

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2NF (Second Normal Form) Rules

1. Rule 1- Be in 1NF
2. Rule 2- Single Column Primary Key

It is clear that we can't move forward to make our simple database in 2nd Normalization form unless we partition the table above.

MEMBERSHIP ID	FULL NAMES	PHYSICAL ADDRESS	SALUTATION
1	Janet Jones	First Street Plot No 4	Ms.
2	Robert Phil	3rd Street 34	Mr.
3	Robert Phil	5th Avenue	Mr.

MEMBERSHIP ID	MOVIES RENTED
1	Pirates of the Caribbean
1	Clash of the Titans
2	Forgetting Sarah Marshal
2	Daddy's Little Girls
3	Clash of the Titans

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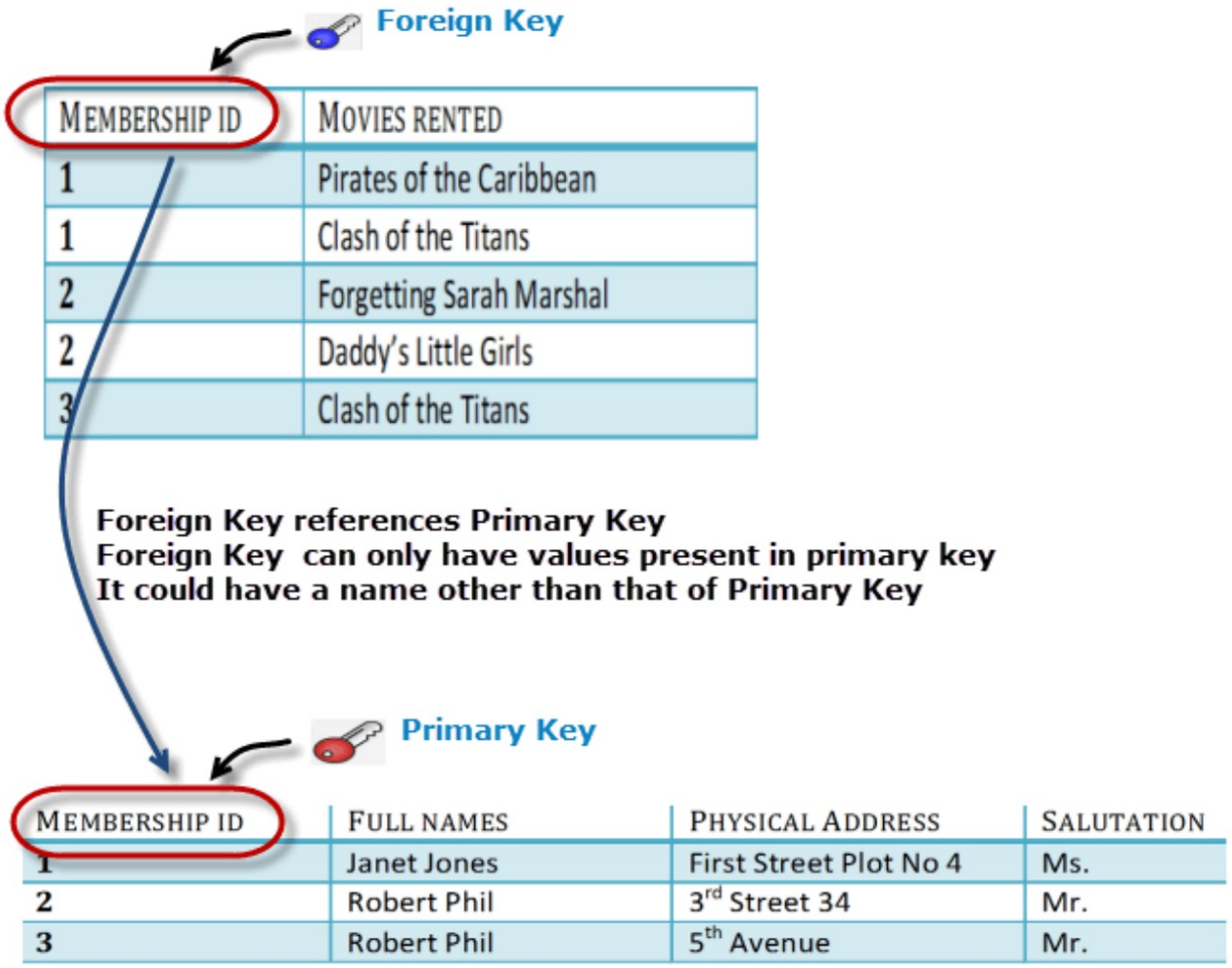
Database - Foreign Key

In Table 2, Membership_ID is the Foreign Key

Foreign Key references the primary key of another Table! It helps connect your Tables

- ✓ A foreign key can have a different name from its primary key
- ✓ It ensures rows in one table have corresponding rows in another
- ✓ Unlike the Primary key, they do not have to be unique. Most often they aren't
- ✓ Foreign keys can be null even though primary keys can not

Database Normal Forms



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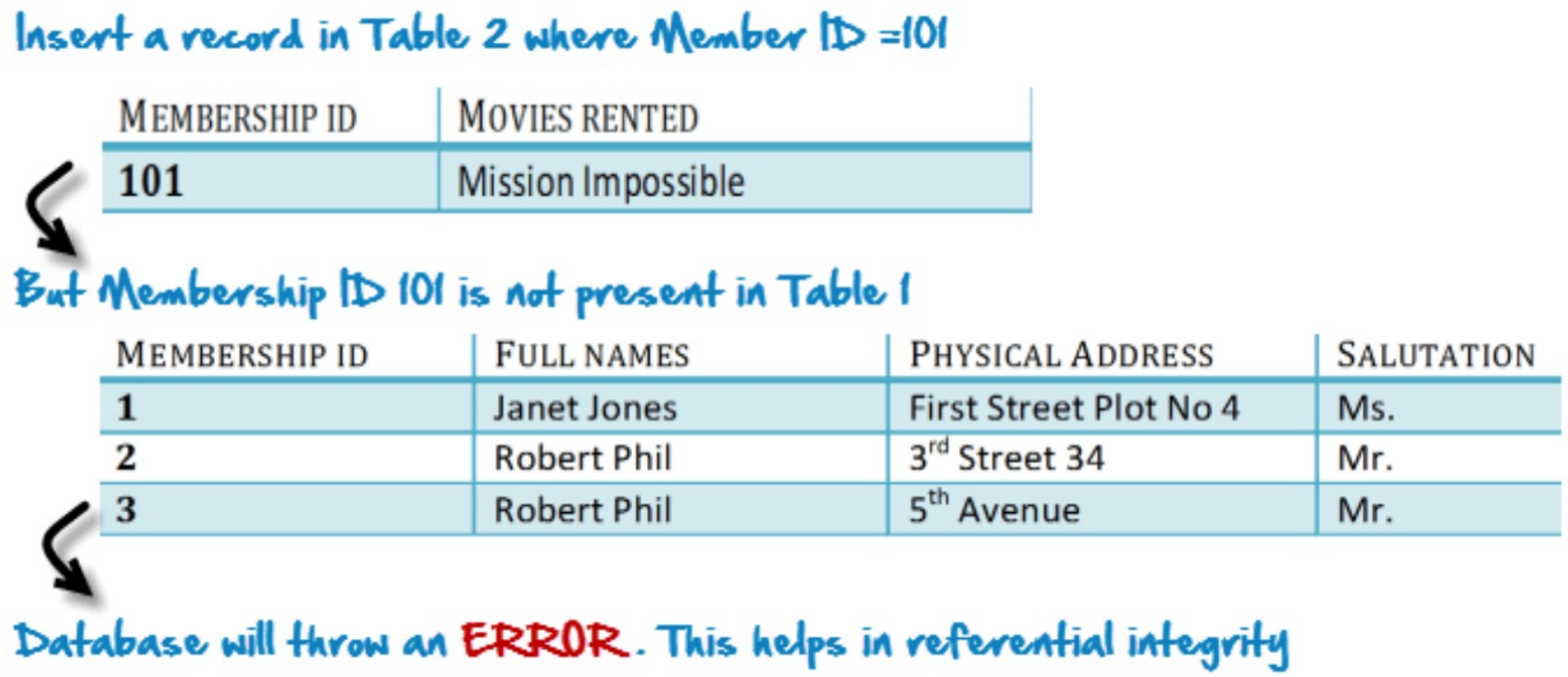

The above problem can be overcome by declaring membership id from Table2 as foreign key of membership id from Table1

Now, if somebody tries to insert a value in the membership id field that does not exist in the parent table, an error will be shown!

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What are transitive functional dependencies?

A transitive functional dependency is when changing a non-key column, might cause any of the other non-key columns to change

Consider the table 1. Changing the non-key column Full Name may change Salutation.

MEMBERSHIP ID	FULL NAMES	PHYSICAL ADDRESS	SALUTATION
1	Janet Jones	First Street Plot No 4	Ms.
2	Robert Phil	3rd Street 34	Mr.
3	Robert Phil	5th Avenue	Mr.

Change in Name

May Change Salutation

Let's move into 3NF

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3NF (Third Normal Form) Rules

1. Rule 1- Be in 2NF
2. Rule 2- Has no transitive functional dependencies

To move our 2NF table into 3NF, we again need to again divide our table.

Membership ID	Full Names	Physical Address	Salutation ID
1	Janet Jones	First Street Plot No 4	2
2	Robert Phil	3rd Street 34	1
3	Robert Phil	5th Avenue	1

Membership ID	Movies Rented
1	Pirates of the Caribbean
1	Clash of the Titans
2	Forgetting Sarah Marshal
2	Daddy's Little Girls
3	Clash of the Titans

Salutation ID	Salutation
1	Mr.
2	Ms.
3	Mrs.
4	Dr.

Exercise

Customer Name	NRC	Address	Phone Number	Room No	Booking Date	Check In Date	Check Out Date
Suzy	12/MAYAKA(N)999999	MayanKone	98765543	101,401	2/01/2022 23/02/2022	12/01/2022 27/02/2022	15/01/2022 28/02/2022
Rain	9/KASANA(N)999999	Kyaukse	65438376	501	24/02/2022	25/02/2022	28/02/2022
Jenny	5/SAKATA(N)999999	Sakaing	98776564	101	22/02/2022	25/02/2022	26/02/2022
Jackson	12/AASANA(N)999999	Insein	98765493	301,501	22/02/2022 3/03/2022	26/02/2022 4/03/2022	27/02/2022 5/03/2022
Rain	7/TANGANA(N)999999	Taungoo	98764334	201	27/02/2022	02/03/2022	06/03/2022

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Thank you!!

Q&As

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