Database Design

Ahmed El-Nemr
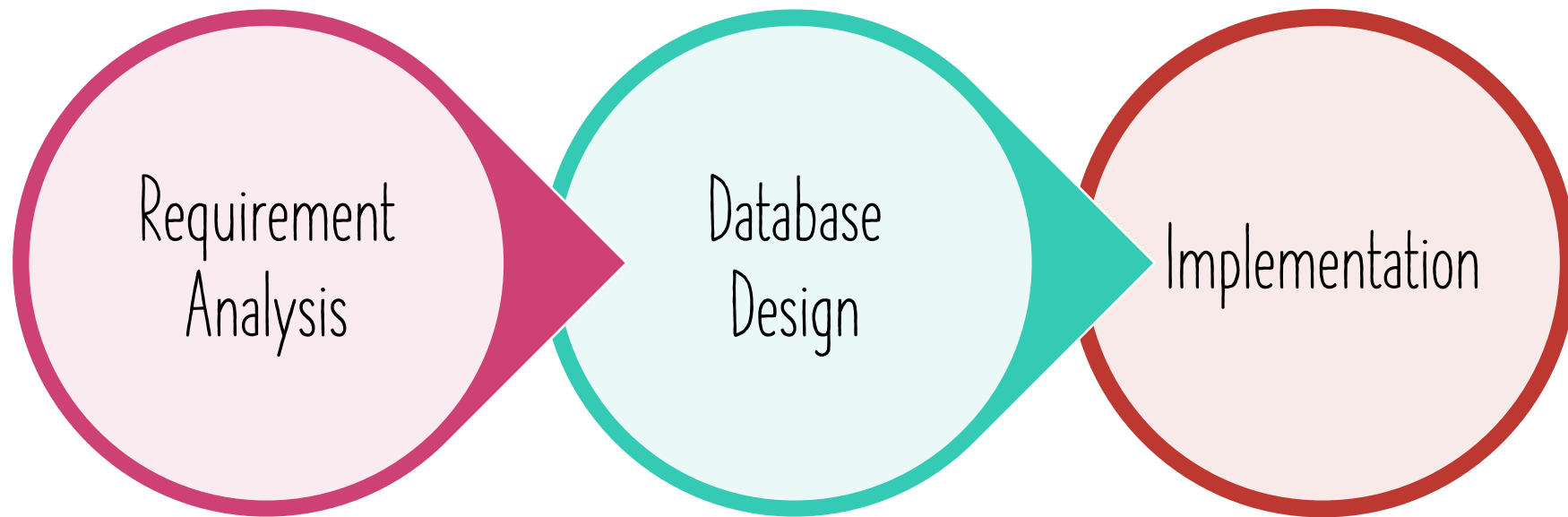
Why Database Design is Important ?

- It helps produce database systems
  1. That meet the requirements of the users
  2. Have high performance.

Database development life cycle

Requirements analysis

- Planning
  - Planning of entire Database Development Life Cycle.
- System definition
  - Defines the scope and boundaries of the proposed database system.

Logical-Model

Physical-Model

- Data conversion and loading

- Testing

Two Types of Database Techniques

Normalization

ER Modeling

Normalization

Database Normal Forms
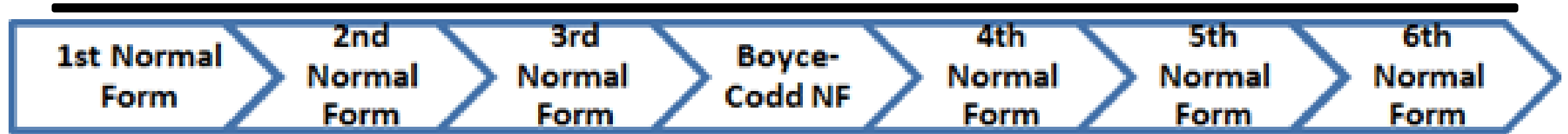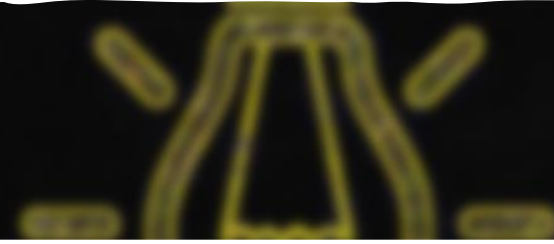
| 1st Normal Form | 2nd Normal Form | 3rd Normal Form | Boyce-Codd NF | 4th Normal Form | 5th Normal Form | 6th Normal Form |

FULL NAMES	PHYSICAL ADDRESS	MOVIES RENTED	SALUTATION
Janet Jones	First Street Plot No 4	Pirates of the Caribbean, Clash of the Titans	Ms.
Robert Phil	3rd Street 34	Forgetting Sarah Marshal, Daddy's Little Girls	Mr.
Robert Phil	5th Avenue	Clash of the Titans	Mr.

Here you see Movies Rented column has multiple values. Now let's move into 1st Normal Forms:

1NF (First Normal Form) Rules

- Each table cell should contain a single value.

- Each record needs to be unique.

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.

What is a Primary 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

What is a Primary Key?

- A primary key cannot be NULL

- A primary key value must be unique

- The primary key values should rarely be changed

- The primary key must be given a value when a new record is inserted.

What is Composite Key?

- A composite key is a primary key composed of multiple columns used to identify a record uniquely
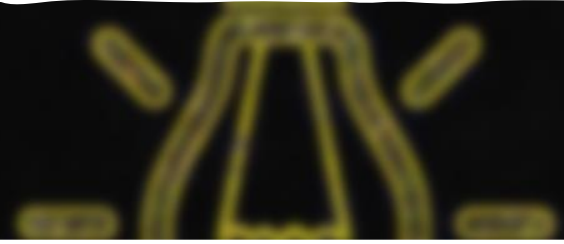

- In our database, we have two people with the same name Robert Phil, but they live in different places.

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

2NF (Second Normal Form) Rules

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

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.

2NF (Second Normal Form) Rules
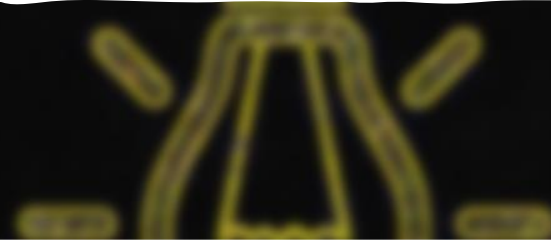
MEMBERSHIP ID	FULL NAMES	PHYSICAL ADDRESS	SALUTATION
1	Janet Jones	First Street Plot No 4	Ms.
2	Robert Phil	3rd Street 34	Mr.
3	Robert Phil	5th Avenue	Mr.

Table 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

Table 2

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

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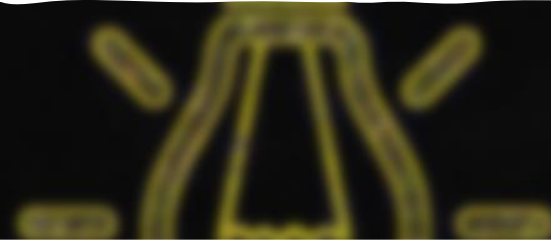
- Foreign Key references the primary key of another Table! It helps connect your Tables

- 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 – Foreign Key

Foreign Key

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

Foreign Key references Primary Key
Foreign Key can only have values present in primary key
It could have a name other than that of Primary Key

Primary Key

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.

What are functional dependencies?

- When changing a non-key column, might cause any of the other non-key columns to change

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*

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

3NF (Third Normal Form) Rules

- Rule 1- Be in 2NF

- 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.

Summary

- Database designing is critical to the successful implementation of a database management system that meets the data requirements of an enterprise system.

- Normalization Process in DBMS helps produce database systems that are cost-effective and have better security models.

- Functional dependencies are a very important component of the normalize data process

- Most database systems are normalized database up to the third normal forms.

- A primary key uniquely identifies are record in a Table and cannot be null

- A foreign key helps connect table and references a primary key