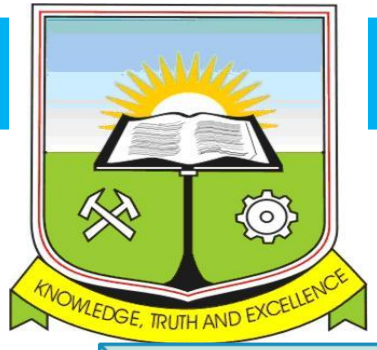

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NORMALIZATION

BY: DR ERIC AFFUM

Read the following materials

CHAPTER 6

Coronel, C. and Morris, S. (2018), Database Systems: Design, Implementation, &
Management, Cengage Learning, Boston, U.S.A., 13th Edition, 816 pp

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Database Normalization

- **Normalization** - It is the process of removing redundant data from tables in a given database in order to improve storage efficiency, data integrity.

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Database Normalization

There are currently five normal forms that have been defined and these are:

- First Normal Form(1NF)
- Second Normal Form(2NF)
- Third Normal Form(3NF)
- Boyce-Codd Normal Form(4NF)
- Domain-key Normal Form (5NF)

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1NF

- Eliminate duplicative columns from the same table.
- Every table should have a primary key

OR

- A relation R is in first normal form (1NF) if and only if all underlying domains contain atomic values only

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Four basic rules to achieve 1st normal form

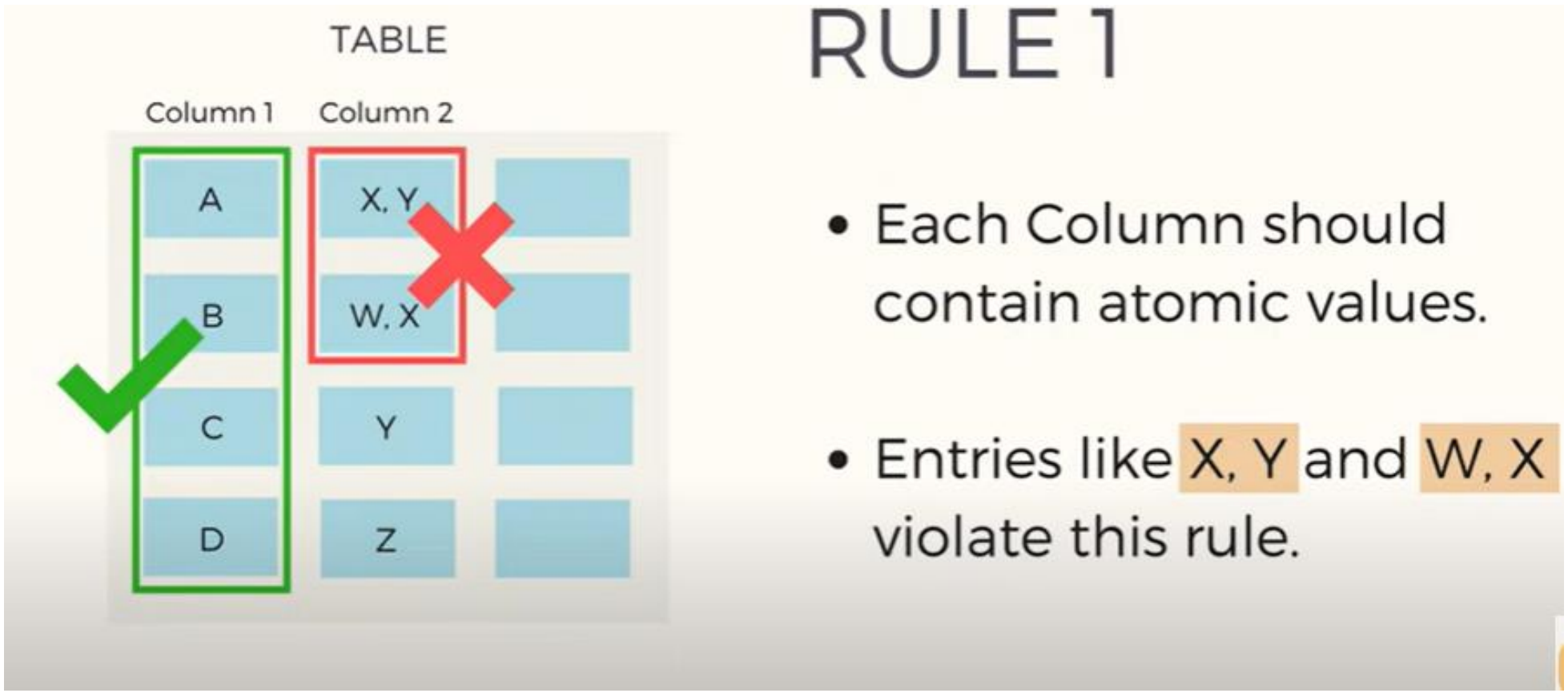
TABLE

Column 1	Column 2	
A	X, Y	
B	W, X	
C	Y	
D	Z	

RULE 1

- Each Column should contain atomic values.
- Entries like X, Y and W, X violate this rule.

Four basic rules to achieve 1st normal form



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Four basic rules to achieve 1st normal form

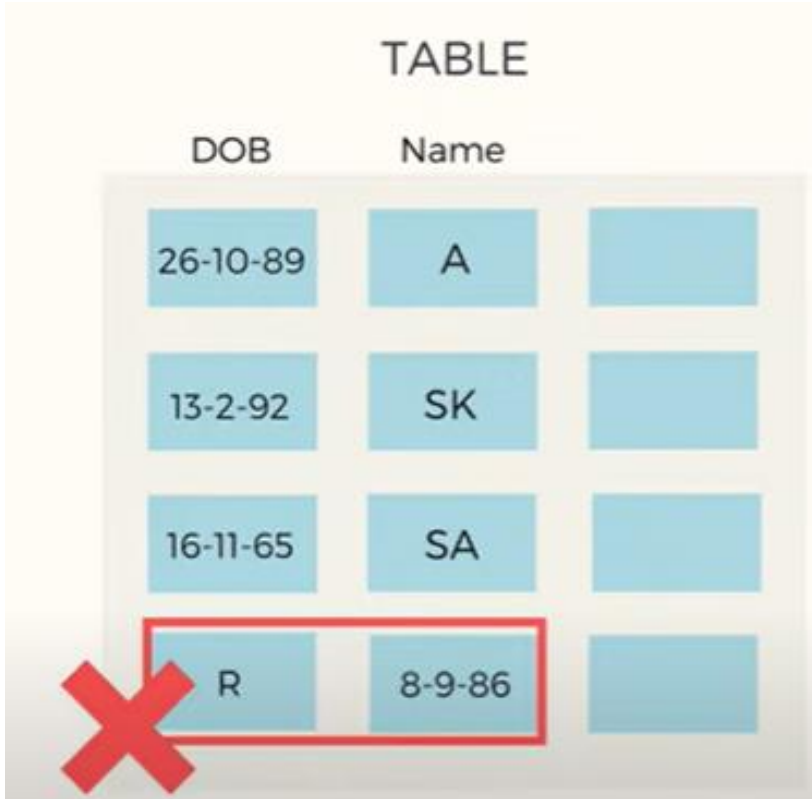
TABLE

DOB	Name	
26-10-89	A	
13-2-92	SK	
16-11-65	SA	
R	8-9-86	

RULE 2

- A Column should contain values that are of the same type.
- Do not inter-mix different types of values in any column.

Four basic rules to achieve 1st normal form



RULE 2

- A Column should contain values that are of the same type.
- Do not inter-mix different types of values in any column.

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Four basic rules to achieve 1st normal form

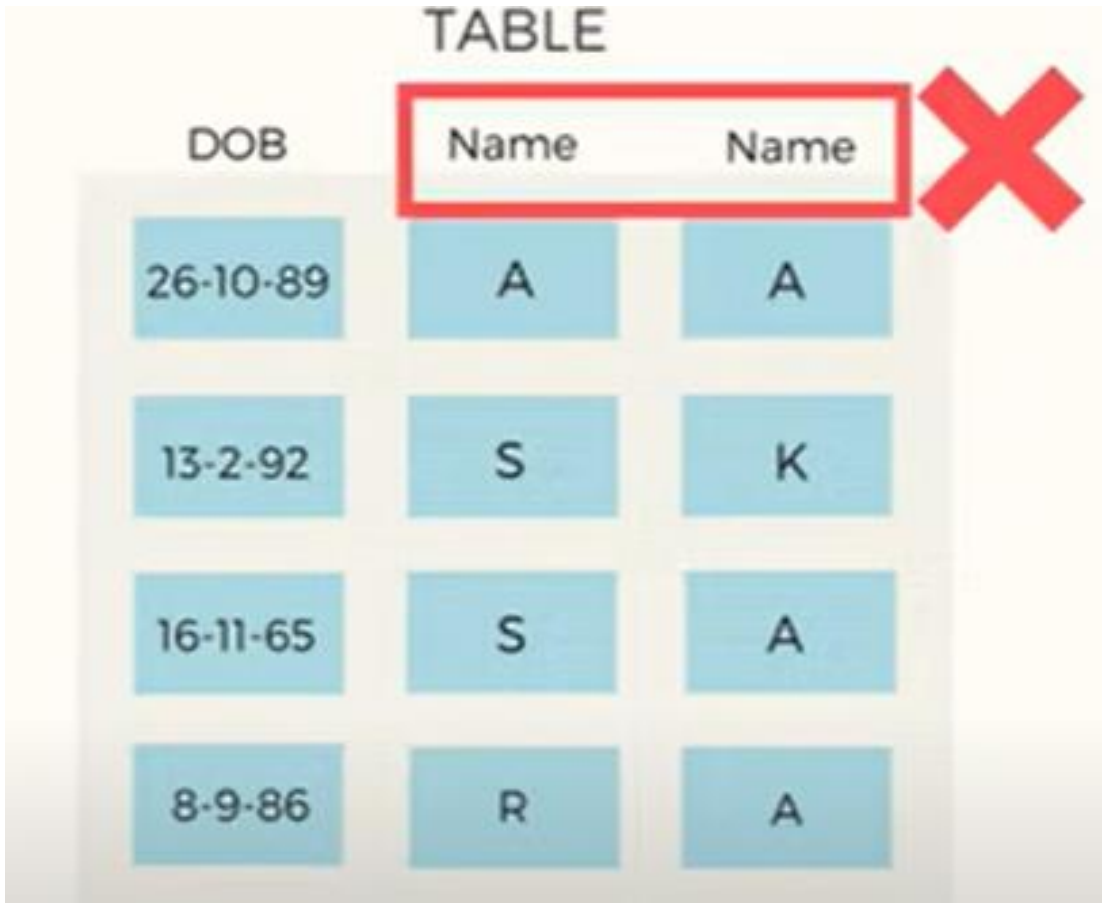
TABLE

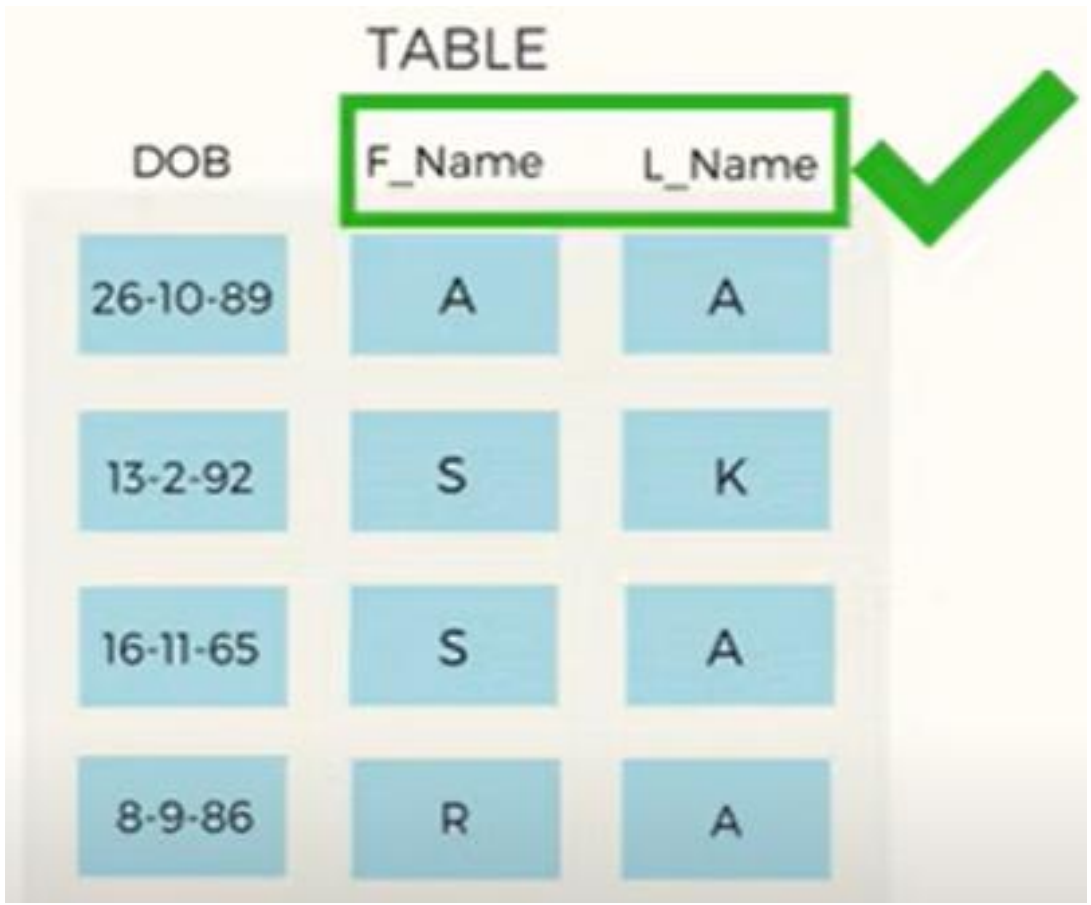
DOB	Name	Name
26-10-89	A	A
13-2-92	S	K
16-11-65	S	A
8-9-86	R	A

RULE 3

- Each column should have a unique name.
- Same names leads to confusion at the time of data retrieval

Four basic rules to achieve 1st normal form





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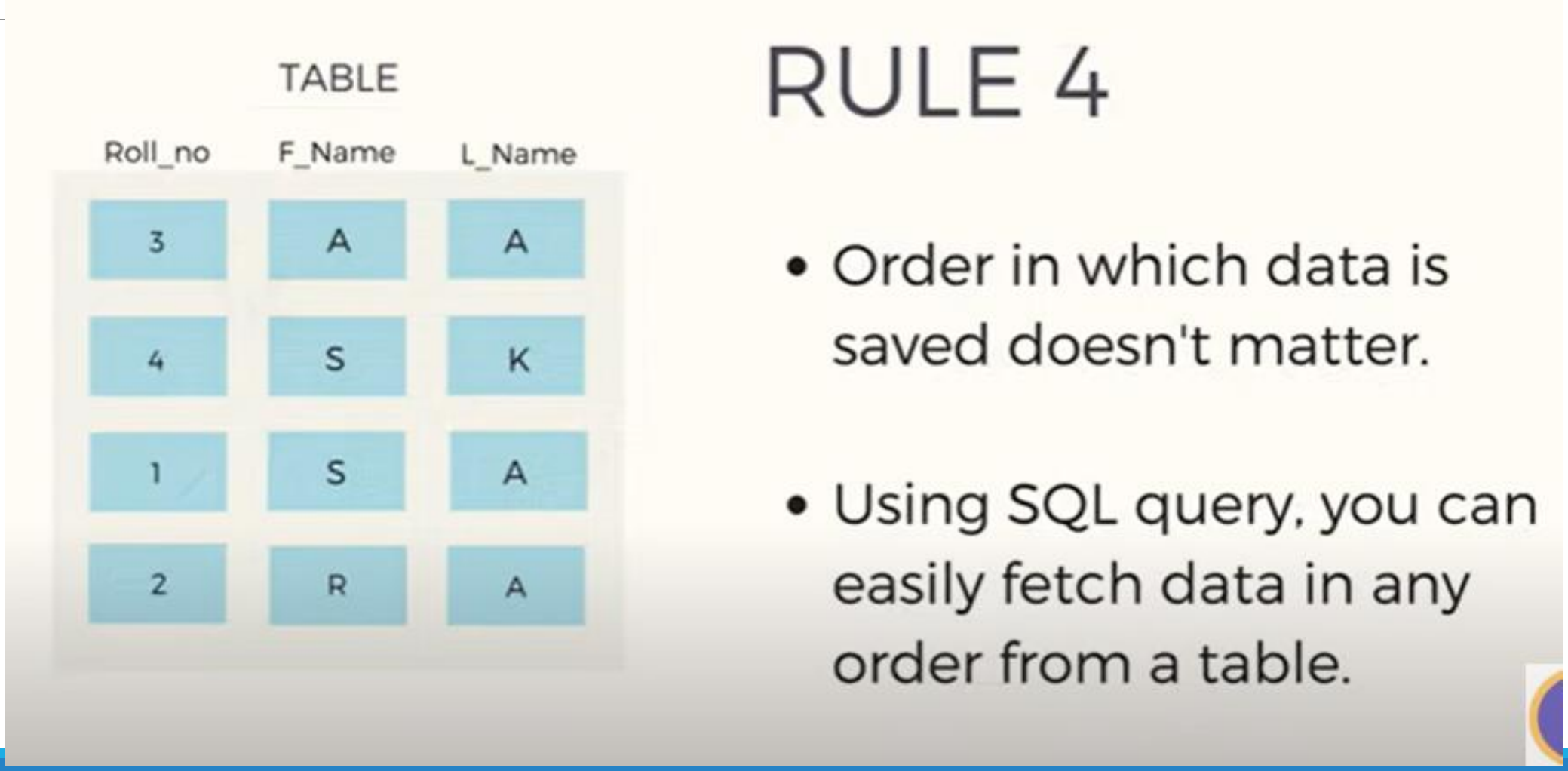
Four basic rules to achieve 1st normal form



Four basic rules to achieve 1st normal form

STUDENTS TABLE

rollno	name	subject
101	Akon	OS, CN
103	Ckon	JAVA
102	Bkon	C, C++

How to solve this?

Violation of 1 NF

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Four basic rules to achieve 1st normal form

How to solve this?

STUDENTS TABLE

rollno	name	subject
101	Akon	OS
101	Akon	CN
103	Ckon	JAVA
102	Bkon	C
102	Bkon	C++

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2NF

- Meet all the requirements of the first normal form.
- A relation R is in second normal form (2NF) if and only if it is in 1NF and every non-key attribute is fully dependent on the primary key

2NF

STUDENTS TABLE

student_id	name	reg_no	branch	address
1	Akon	CSE-18	CSE	TN
2	Akon	IT-18	IT	AP
3	Bkon	CSE-18	CSE	HR
4	Ckon	CSE-18	CSE	MH

As the student_id in this table will be unique, it can be used easily to fetch any data.

2NF

STUDENTS TABLE

student_id	name	reg_no	branch	address
10	Akon	CSE-18	CSE	TN

This is Dependency or Functional Dependency

2NF

SCORE TABLE

score_id	student_id	subject_id	marks	teacher
1	10	1	82	Mr. J
2	2	2	77	Mr. C++
3	3	3	85	Mr. J
4	4	4	82	Mr. C++
5	5	5	95	Mr. P

teacher column only depends on subject and not on student.

2NF

SCORE TABLE

score_id	student_id	subject_id	marks	teacher
1	10	1	82	Mr. J
2	2	2	77	Mr. C++
3	3	3	85	Mr. J
4	4	4	82	Mr. C++
5	5	5	95	Mr. P

teacher column only depends on subject and not on student.

This is partial dependency

2NF

SCORE TABLE

score_id	student_id	subject_id	marks	teacher
1	10	1	82	Mr. J
2	2	85	77	Mr. C++
3	3	82	85	Mr. J
4	4	2	82	Mr. C++
5	11	4	95	Mr. P

SUBJECT TABLE

subject_id	subject_name
1	Java
2	C++
3	C#
4	Php

Move teacher column to Subject table

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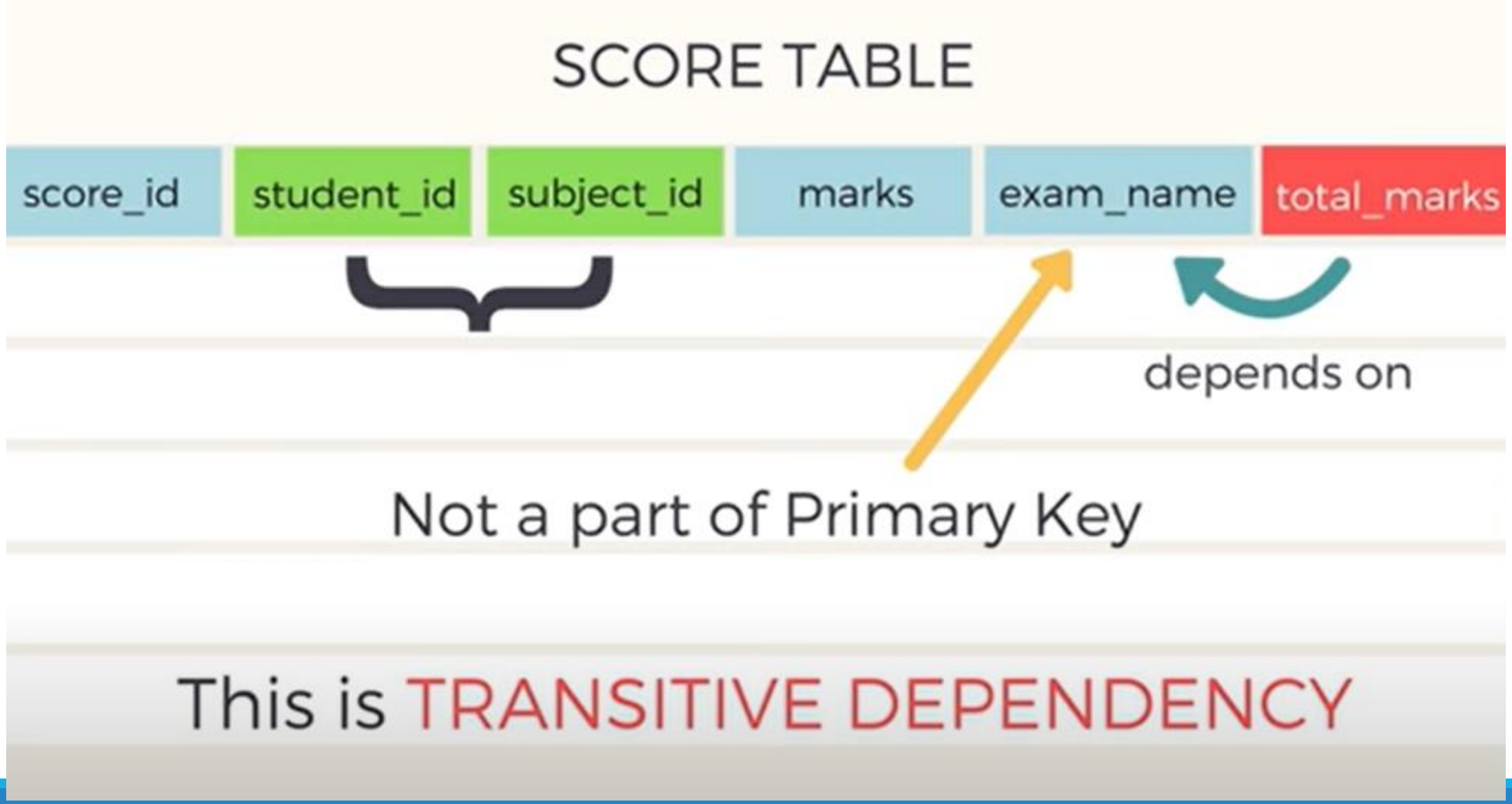
3NF

There are two basic requirements for a database to be in third normal form:

- Already meet the requirements of both 1NF and 2NF
- Remove columns that are not fully dependent upon the primary key

3NF


SCORE TABLE
score_id
student_id
subject_id
marks
exam_name
total_marks
depends on
Not a part of Primary Key
This is TRANSITIVE DEPENDENCY

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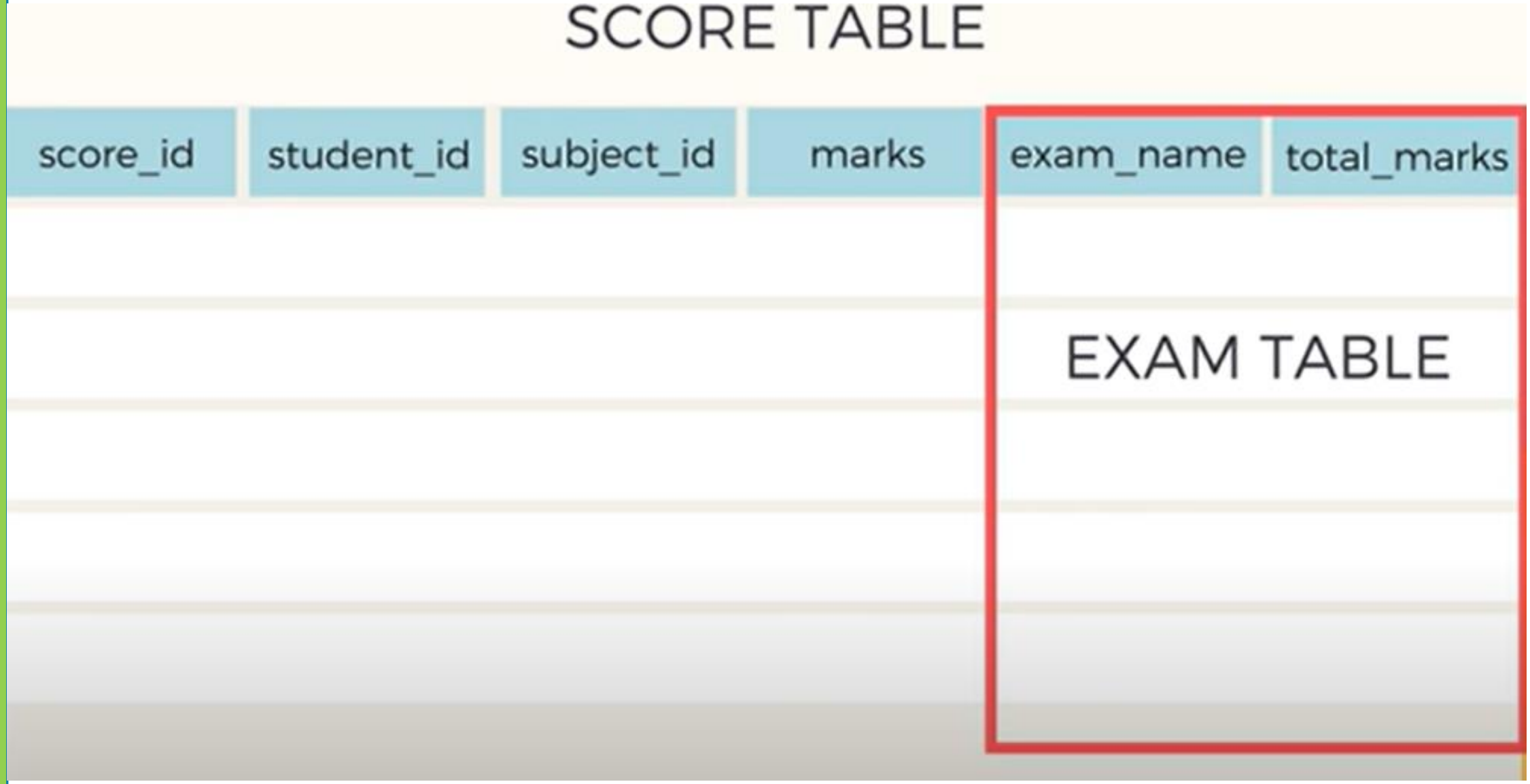
3NF



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3NF

Thanks