

# Relational Model

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# Introduction

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- Relational model introduced by Codd in 1970.
- It uses the concept of mathematical relation – concept of set theory and predicate logic
- It represents the database as a collection of relations.

# Relational Model Concepts

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- Relation or table
- Attribute or field or column name
- Tuples or record
- Schema
- Instance
- Domains
- Keys
- **Degree:** The total number of attributes which in the relation is called the degree of the relation.
- **Cardinality:** Total number of rows present in the Table.



## Student Relation

NAME	<u>ROLL_NO</u>	PHONE_NO	ADDRESS	AGE
Ram	14795	7305758992	Noida	24
Shyam	12839	9026288936	Delhi	35
Laxman	33289	8583287182	Gurugram	20
Mahesh	27857	7086819134	Ghaziabad	27
Ganesh	17282	9028293988	Delhi	40

- NAME, ROLL\_NO, PHONE\_NO, ADDRESS, and AGE are the attributes.
- The instance of schema STUDENT has 5 tuples.
- $t_3 = \langle \text{Laxman}, 33289, 8583287182, \text{Gurugram}, 20 \rangle$  is the third tuple in the student table
- ROLL\_NO is primary key in the table
- Degree = 5 (No of Columns)
- Cardinality = 5 (No of Rows)

# Relational Model Concepts Cont....

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## Domain

- It contains a set of permitted atomic values for an attribute in the table.
- We specify domain of attribute while creating a table.
- E.g.,
  - Month of an year can accept all the month name or numbering from 01 to 12.
  - Domain of date can accept of possible dates.



# Relational Model Concepts Cont....

**Domain**

*String shorter than 30 chars*

*yyyy-mm-dd*

*Character  
M or F*

*Integer  
 $400 < x < 80000$*

<i>EMPLOYEE</i>	<i>FNAME</i>	<i>M</i>	<i>LNAME</i>	<i><u>SSN</u></i>	<i>BDATE</i>	<i>ADDRESS</i>	<i>S</i>	<i>SALARY</i>	<i>SUPERSSN</i>	<i>DNO</i>
	Ramesh	K	Narayan	666884444	1962-09-15	...	M	38000	888665555	5
	Joyce	Null	English	453453453	1972-07-31	...	F	38000	888665555	5
	Ahmad	V	Jabbar	987987987	1969-03-29	...	M	25000	888665555	4
	James	Null	Borg	888665555	1937-11-10	...	M	55000	Null	1

# Relational Model Concepts Cont....

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## Keys

- An attribute or set of attributes which can identify the row ( tuple or record ) in the relation uniquely.
- It is used to access the stored data quickly and smoothly
- It is used to create relationship between different tables.



# Relational Model Concepts Cont....

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## Types of Keys:

- Primary Key
- Candidate Key
- Alternate Key
- Super Key
- Composite Key
- Foreign Key
- Unique Key



# Relational Model Concepts Cont....

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## Primary Key (PK)

- It is unique and can not have NULL value
- It is chosen by designer to maintain uniqueness at row level.
- In the Employee table, EID or SSN can be a PK.
- EID is preferable because SSN is PII value and secure.

Employee
<u>EID</u>
Name
SSN
DeptId
DOB

# Relational Model Concepts Cont....

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## Candidate Key (CK)

- All the columns that qualifies for uniqueness of each row.
- It is also called as minimal super keys.
- In the Employee table, EID and SSN are CK.
- We pick one of the CKs as PK.

### Employee

EID

Name

SSN

DeptId

DOB



# Relational Model Concepts Cont....

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## Alternate Key

- Candidate column other than primary column is called Alternate key.
- In the Employee table, SSN is alternate key.

Employee
<u>EID</u>
Name
SSN
DeptId
DOB

# Relational Model Concepts Cont....

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## Super Key

- If we add any other column with candidate key, then it becomes super key.
- One or more attributes are taken collectively to identify all other attributes uniquely.
- In the Employee table, EID+Name, SSN+DeptId are super keys.

Employee
<u>EID</u>
Name
SSN
DeptId
DOB



# Relational Model Concepts Cont....

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## Composite Key

- If a table does not have CKs, then we select two or more columns to uniquely identify each row in a table.
- In the Employee table, Name+DOB can be used as a composite primary key

### Employee

EID

Name

SSN

DeptId

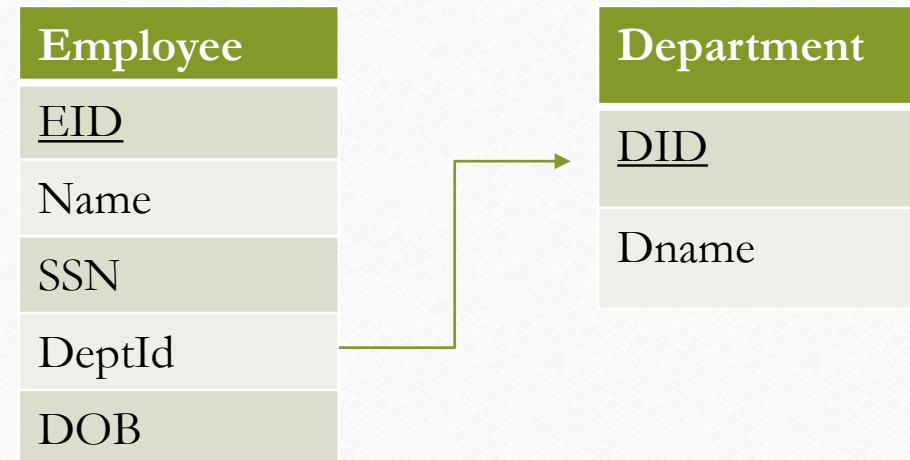
DOB

# Relational Model Concepts Cont....

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## Foreign Key (FK)

- It is an attribute or set of attributes that references to PK of same table or another table.
- DeptId is FK in Employee Table.





# Relational Model Concepts Cont....

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## Unique Key

- It is same as the PK, but the difference is with the existence of NULL value.
- It allows one value as NULL value.

Employee
<u>EID</u>
Name
SSN
DeptId
DOB

# Relational Model Constraints

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- Relational constraints are the restrictions imposed on the database contents and operations.
- They ensure the correctness of data in the database.

## Constraint Types:

- Domain Constraints
- Key Constraints
- Entity Integrity Constraints
- Referential Integrity Constraints



# Relational Model Constraints Cont. ...

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## Domain Constraints:

- Domain constraint defines the domain or set of values for an attribute.
- It specifies that the value taken by the attribute must be the atomic value from its domain.
- In the Student table, value '**A**' is not allowed since only integer values can be taken by the age attribute.

STU_ID	Name	Age
S001	Akshay	20
S002	Abhishek	21
S003	Shashank	20
S004	Rahul	<b>A</b>

# Relational Model Constraints Cont. ...

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## Key Constraints:

- All the values of primary key must be unique.
- This student relation does not satisfy the key constraint as here all the values of primary key are not unique.

STU_ID	Name	Age
<b>S001</b>	Akshay	20
<b>S001</b>	Abhishek	21
S003	Shashank	20
S004	Rahul	21



# Relational Model Constraints Cont. ...

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## Entity Integrity Constraints:

- It specifies that no attribute of primary key must contain a null value in any relation.
- This is because the presence of null value in the primary key violates the uniqueness property.
- This student relation does not satisfy the entity integrity constraint as here the primary key contains a NULL value.

STU_ID	Name	Age
S001	Akshay	20
S002	Abhishek	21
S003	Shashank	20
	Rahul	21

# Relational Model Constraints Cont. ...

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## **Referential Integrity Constraints:**

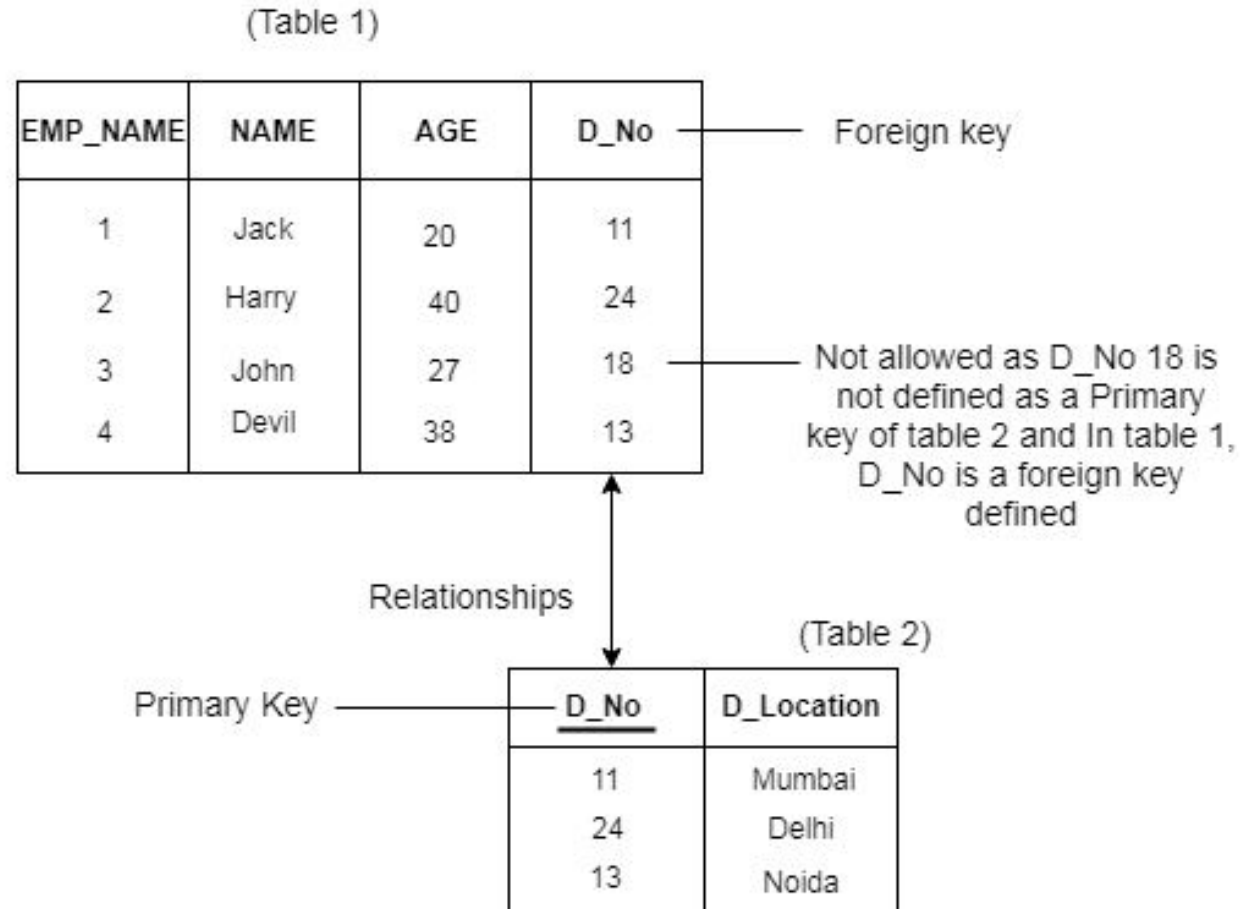
- This constraint is enforced when an FK references the PK of a relation.
- It specifies that all the values taken by the FK must either be available in the relation of the PK or be null.
- We can not insert a record into a referencing relation if the corresponding record does not exist in the referenced relation.
- We can not delete or update a record of the referenced relation if the corresponding record exists in the referencing relation.



# Relational Model Constraints Cont.

## Referential Integrity Constraints:

- It is specified between two tables.
- If an FK in Table 1 refers to the PK of Table 2, then every value of the FK in Table 1 must be null or be available in Table 2.



# Guess under which A is not allowed ??

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ID	NAME	SEMENSTER	AGE
1000	Tom	1 <sup>st</sup>	17
1001	Johnson	2 <sup>nd</sup>	24
1002	Leonardo	5 <sup>th</sup>	21
1003	Kate	3 <sup>rd</sup>	19
1004	Morgan	8 <sup>th</sup>	A

Not allowed. Because AGE is an integer attribute



Guess under which constraint A is not allowed  
??

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ID	NAME	SEMENSTER	AGE
1000	Tom	1 <sup>st</sup>	17
1001	Johnson	2 <sup>nd</sup>	24
1002	Leonardo	5 <sup>th</sup>	21
1003	Kate	3 <sup>rd</sup>	19
1004	Morgan	8 <sup>th</sup>	A

Not allowed. Because AGE is an integer attribute





# References

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