

INVENTION MANAGEMENT SYSTEM

GROUP – 10

PHASE – 3 – NORMALIZATION

NORMALIZATION

- Normalization is a database design technique that reduces data redundancy and eliminates undesirable characteristics like Insertion, Update and Deletion Anomalies.
- Normalization rules divides larger tables into smaller tables and links them using relationships.
- The purpose of Normalization in SQL is to eliminate redundant (repetitive) data and ensure data is stored logically.
- The most commonly used normal forms are
 - First normal form(1NF)
 - Second normal form(2NF)
 - Third normal form(3NF)
 - Boyce & Codd normal form (BCNF)

FIRST NORMAL FORM (1NF)

- In first normal form, an attribute (column) of a table cannot hold multiple values.
- It should hold only atomic values.
- Each record needs to be unique.

inventor_id [PK] character	inventor_name character varying	invention_id [PK] character	invention_name character varying (30)	award_id [PK] character va	award_name character varying (30)	award_category character varying (30)	panel_id character vai	jury_id character va
IN001	STEPHANIE	I001	KEVLAR	A001	ENTERPRISE TROPHY	SCIENTIFIC	P001	J001,J002
IN002	CAMILLO	I002	STEMCELL DIABETES CURE	A002	SPIRIT OF INNOVATION	RESEARCH	P002	J003
IN003	PAUL	I003	THE ARTIFICIAL HEART	A003	INNOVATION IN HEALTH	MEDICINE	P003	J004,J005
IN004	NIKOLA	I004	WIRELESS ELECTRICITY	A004	EDISON AWARD	NEURAL NETWORK	P004	J006
IN005	MARTIN	I005	MOBILE PHONE	A005	DONALD MACHAY	TECHNOLOGY	P005	J007,J008

- This relation is not in 1 NF because the attribute **Jury_Id** contains multiple values.
- So, in order to make it 1 NF we have to create new tuples for all multiple values so that each tuple will have only one value.

inventor_id character var	inventor_name character varying	invention_id character varyi	invention_name character varying (30)	award_id character varyin	award_name character varying (30)	award_category character varying (30)	panel_id character vai	jury_id character va
IN001	STEPHANIE	I001	KEVLAR	A001	ENTERPRISE TROPHY	SCIENTIFIC	P001	J001
IN001	STEPHANIE	I001	KEVLAR	A001	ENTERPRISE TROPHY	SCIENTIFIC	P001	J002
IN002	CAMILLO	I002	STEMCELL DIABETES CURE	A002	SPIRIT OF INNOVATION	RESEARCH	P002	J003
IN003	PAUL	I003	THE ARTIFICIAL HEART	A003	INNOVATION IN HEALTH	MEDICINE	P003	J004
IN003	PAUL	I003	THE ARTIFICIAL HEART	A003	INNOVATION IN HEALTH	MEDICINE	P003	J005
IN004	NIKOLA	I004	WIRELESS ELECTRICITY	A004	EDISON AWARD	NEURAL NETWORK	P004	J006
IN005	MARTIN	I005	MOBILE PHONE	A005	DONALD MACHAY	TECHNOLOGY	P005	J007
IN005	MARTIN	I005	MOBILE PHONE	A005	DONALD MACHAY	TECHNOLOGY	P005	J008

- Now this relation is in 1 NF.

SECOND NORMAL FORM (2NF)

- A table is said to be in 2NF if both the following conditions hold:
 - ❖ Table is in 1NF (First normal form)
 - ❖ There should not be any partial dependency.
- **Partial Dependency** occurs when a non-prime attribute is functionally dependent on part of a candidate key.
- All the non-primary key columns in the table should depend on the entire primary key.

- No partial dependency of primary key is allowed but a non-prime attribute can depend on non-prime attribute
- An attribute that is not part of any candidate key is known as non-prime attribute.

inventor_id character varying	inventor_name character varying	invention_id character varying	invention_name character varying (30)	award_id character varying	award_name character varying (30)	award_category character varying (30)	panel_id character varying	jury_id character varying
IN001	STEPHANIE	I001	KEVLAR	A001	ENTERPRISE TROPHY	SCIENTIFIC	P001	J001
IN001	STEPHANIE	I001	KEVLAR	A001	ENTERPRISE TROPHY	SCIENTIFIC	P001	J002
IN002	CAMILLO	I002	STEMCELL DIABETES CURE	A002	SPIRIT OF INNOVATION	RESEARCH	P002	J003
IN003	PAUL	I003	THE ARTIFICIAL HEART	A003	INNOVATION IN HEALTH	MEDICINE	P003	J004
IN003	PAUL	I003	THE ARTIFICIAL HEART	A003	INNOVATION IN HEALTH	MEDICINE	P003	J005
IN004	NIKOLA	I004	WIRELESS ELECTRICITY	A004	EDISON AWARD	NEURAL NETWORK	P004	J006
IN005	MARTIN	I005	MOBILE PHONE	A005	DONALD MACHAY	TECHNOLOGY	P005	J007
IN005	MARTIN	I005	MOBILE PHONE	A005	DONALD MACHAY	TECHNOLOGY	P005	J008

- Here the functional dependencies are,
 - ❖ INVENTOR_ID --> INVENTOR_NAME
 - ❖ INVENTION_ID --> INVENTION_NAME
 - ❖ AWARD_ID --> AWARD_NAME
 - ❖ AWARD_ID --> AWARD_CATEGORY
 - ❖ JURY_ID --> PANEL_ID
 - ❖ PANEL_ID --> AWARD_ID
- The FD [INVENTOR_ID --> INVENTOR_NAME] is a partial dependency.
- Non-prime attribute shouldn't dependent on the subset of the candidate key.
- So, we have to create separate tables for sets of values that apply to multiple records and relate these tables with a foreign key.

- This relation has a composite primary key,

❖ Invention_Id

❖ Inventor_Id

❖ Award_Id

❖ Jury_Id

- The non-prime attributes are,

❖ Invention_Name

❖ Inventor_Name

❖ Award_name

❖ Award_category

❖ Panel_Id

invention_id character varying (30)	invention_name character varying (30)
I001	KEVLAR
I002	STEMCELL DIABETES CURE
I003	THE ARTIFICIAL HEART
I004	WIRELESS ELECTRICITY
I005	MOBILE PHONE

inventor_id character varying (20)	inventor_name character varying (30)
IN001	STEPHANIE
IN002	CAMILLO
IN003	PAUL
IN004	NIKOLA
IN005	MARTIN

inventor_id character varying (20) 🔒	invention_id character varying (30) 🔒	award_id character varying (20) 🔒
IN001	I001	A001
IN002	I002	A002
IN003	I003	A003
IN004	I004	A004
IN005	I005	A005

jury_id character varying (20) 🔒	panel_id character varying (20) 🔒	award_id character varying (20) 🔒	award_name character varying (30) 🔒	award_category character varying (30) 🔒
J001	P001	A001	ENTERPRISE TROPHY	SCIENTIFIC
J002	P001	A001	ENTERPRISE TROPHY	SCIENTIFIC
J003	P002	A002	SPIRIT OF INNOVATION	RESEARCH
J004	P003	A003	INNOVATION IN HEALTH	MEDICINE
J005	P003	A003	INNOVATION IN HEALTH	MEDICINE
J006	P004	A004	EDISON AWARD	NEURAL NETWORK
J007	P005	A005	DONALD MACHAY	TECHNOLOGY
J008	P005	A005	DONALD MACHAY	TECHNOLOGY

- Now after creating separate tables for sets of values that apply to multiple records and relating these tables with a foreign key the table is now in 2 NF.

THIRD NORMAL FORM (3NF)

- The relation is said to be in 3 NF if it follows two rules.
 - ❖ The table must be in 2NF.
 - ❖ No non-prime attribute must define another non-prime attribute.

- A Transitive Functional Dependency is when a non-key column is Functionally Dependent on another non-key column, which is Functionally Dependent on the Primary Key.

jury_id character varying (20)	panel_id character varying (20)	award_id character varying (20)	award_name character varying (30)	award_category character varying (30)
J001	P001	A001	ENTERPRISE TROPHY	SCIENTIFIC
J002	P001	A001	ENTERPRISE TROPHY	SCIENTIFIC
J003	P002	A002	SPIRIT OF INNOVATION	RESEARCH
J004	P003	A003	INNOVATION IN HEALTH	MEDICINE
J005	P003	A003	INNOVATION IN HEALTH	MEDICINE
J006	P004	A004	EDISON AWARD	NEURAL NETWORK
J007	P005	A005	DONALD MACHAY	TECHNOLOGY
J008	P005	A005	DONALD MACHAY	TECHNOLOGY

- In this relation, Award_Id \rightarrow Jury_Id and Jury_Id \rightarrow Panel_Id which in turn signifies that Award_Id \rightarrow Panel_Id.
- So, this relation is not in 3 NF.
- In order to make it in 3 NF, we have to split this relation into two where the first relation have the attributes Panel_Id \rightarrow Award_Id, Award_Name, Award_Category and second relation have the attributes Jury_Id \rightarrow Panel_Id.

panel_id character varying (20)	award_id character varying (20)	award_name character varying (30)	award_category character varying (30)
P001	A001	ENTERPRISE TROPHY	SCIENTIFIC
P002	A002	SPIRIT OF INNOVATION	RESEARCH
P003	A003	INNOVATION IN HEALTH	MEDICINE
P004	A004	EDISON AWARD	NEURAL NETWORK
P005	A005	DONALD MACHAY	TECHNOLOGY

panel_id character varying (20) 🔒	jury_id character varying (20) 🔒
P001	J001
P001	J002
P002	J003
P003	J004
P003	J005
P004	J006
P005	J007
P005	J008

invention_id character varying (30) 🔒	invention_name character varying (30) 🔒
I001	KEVLAR
I002	STEMCELL DIABETES CURE
I003	THE ARTIFICIAL HEART
I004	WIRELESS ELECTRICITY
I005	MOBILE PHONE

inventor_id character varying (20) 🔒	inventor_name character varying (30) 🔒
IN001	STEPHANIE
IN002	CAMILLO
IN003	PAUL
IN004	NIKOLA
IN005	MARTIN

inventor_id character varying (20) 🔒	invention_id character varying (30) 🔒	award_id character varying (20) 🔒
IN001	I001	A001
IN002	I002	A002
IN003	I003	A003
IN004	I004	A004
IN005	I005	A005

- Now the relation is in 3 NF.

BOYCE CODD NORMAL FORM (BCNF)

- Boyce and Codd Normal Form is a higher version of the Third Normal form which deals with certain type of anomaly that is not handled by 3NF.
- A 3NF table which does not have multiple overlapping candidate keys is said to be in BCNF.
- For a table to be in BCNF, following conditions must be satisfied:
 - ❖ R must be in 3rd Normal Form
 - ❖ For each functional dependency ($X \rightarrow Y$), X should be a super Key.
- This relation is already in BCNF.

THANKYOU !!

GROUP 10

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