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Normalization

↳ process of organising columns & tables to reduce data redundancy (repitition)
↳ ensures optimum structure
↳ ensures atomic data
↳ eliminates data inconsistencies & anomalies (insert, delete, update)
↳ improve data inquiry.

roll#	name	age	book#	sub	price
1	Ankan	20	b1	Net	500
2	Abhi	21	b2	Algo	550
3	Avik	20	b10	DBMS	600
1	Ankan	20	b21	Ecom	506

INF

A relation will be in 1NF if there's no repeating groups at the intersection of row & column. each intersection is atomic.

SID	sname	caddr	Major	CID	CTITLE
111	Anil	208 West	IS	IS11 IS12	DBMS SAD

INF

SID	sname	caddr	Major	CID	CTITLE
111	Anil	208 West	IS	IS11	DBMS
111	Anil	208 West	IS	IS22	SAD

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2NF
↳ if it is in 2NF, then it must be in 1NF and every non key attribute is fully functionally dependent on the primary key. No partial dependency.
some non primary dependent on some primary

1NF Table
↳ insertion anomaly (new course cannot be inserted without admission)
↳ deletion (if student took admission to one course & he left course details are also gone)
↳ updation (one instance gets updated / anomaly does not)

SID → Sname
Caddr Major
CID → Ctitle Iname
Ioc
SID → Grade
CID
Iname → Ioc
partial dependency

2NF Table

SID	Sname	Caddr	Major	CID	Ctitle
111	Anil	208 West	IS	IS11	DBMS
222	Amir	104 East	IT	IS22	

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3NF

A relation will be existing in 3NF if its in 2NF & no transitive dependency is existing.

$\alpha \rightarrow \beta$
$\beta \rightarrow \gamma$
$\alpha \rightarrow \gamma$

SID	Sname	Gender	Major
111	Anil	208west	IS
222	Akhir	104east	IT

4NF

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Boyce Codd Normal Form

A relation schema R is in BCNF with respect to a set F of functional dependencies if for all functional dependencies in the form

$\alpha \rightarrow \beta$ $\alpha, \beta \subseteq R$

& one of the following

$\alpha \rightarrow \beta$ is trivial FD

$\alpha \rightarrow$ superkey for schema R

SID	Major	Advisor
123	Phy	F_1
123	Music	F_2
456	Bio	F_3
789	Phy	F_4
999	Phy	F_1

SID, Major → Advisor

Advisor → Major

SID	Advisor
123	F_1
123	F_2
456	F_3
789	F_4
999	F_1

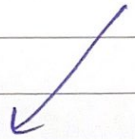
Advisor	Major
f_1	Phy
F_2	Music
F_3	Bio
F_4	Phy
f_1	Phy

__/__/____

4NF

A relation is in 4NF if it is in BCNF & contains no multivalued dependency

Course	Instructor	Textbook
Mgmnt	White	Drucker
	Green	Peters
	Blake	



Course	Instructor
Mgmnt	White
Mgmnt	Green
Mgmnt	Blake

Course	Textbook
Mgmnt	Drucker
Mgmt	Peters

__/__/__

Closure of attribute sets

To test whether a set-α is a superkey we must devise an algo for set of attributes

↳ An algorithm to compute α^+ . . .

Example

$R = (A, B, C, G, H, I)$

$A \rightarrow B$
$A \rightarrow C$
$CG \rightarrow H$
$CG \rightarrow I$
$B \rightarrow H$

$(AG)^+$

$\{A, G\}$
$\{A, B, G\}$ AD $A \rightarrow B$
$\{A, B, C, G\}$ AD $A \rightarrow C$
$\{A, B, C, G, H\}$ AD $CG \rightarrow H$
$\{A, B, C, G, H, I\}$ AD $CG \rightarrow I$

5NF

A relation is in 5NF if it is in 4NF & not having any join dependency ← joining should be lossless

R : R_1, R_2, R_3 $(R_1 \bowtie R_2) \bowtie R_3$

$R_1 \bowtie (R_2 \bowtie R_3)$

Resulting tables can be combined to have/form original table