DBMS - 3

1 - Database funda.

2 - ERD + Data integ.

3 - Data Normalisation
- Anomalies
- Functional Deps
- Normal Forms

}

Transaction
- Intro
- ACID properties

}

1	John	1	Sherlock
2	Mary	1	Sherlock
3	Kilvish	2	Shakti
4	NULL	3	Rebellion
5	Tantia	NULL	NULL

How can I add a student w/o a batch ✗

① Cannot  batch w/o student

② Cannot Create student w/o batch

Insertion anomaly

issues

① missing data (batch w/o student)

② FK constraints (student w/o batch)

Deletion anomaly

ID	Name	Batch
1	John	Sherlock

Name	psd	Agency

Deletion anomaly

↳ Bad design

Updation Anomaly

ID	Name	BID	BName
→ 1	John	1	Sherlock

→	2	Mony	1	Sherlock
→	3	Mycroft	1	Sherlock

Update Sherlock to Sherlock
Season 6

Failure

- manual
- automated

Inconsistent data

Common issues in DB

→ bad design

Insertion

↳ missing data

↳ FK constraints

Deletion

↳ Tightly couple

Updation

↳ errors or partial failures

Good design — Normalisation

Functional dependencies

CAR

VIN → Engine Capacity

VIN → Model

Engine Capacity → VIN

Functional dependency

ID	NAME	PHONE	BATCH_ID	B_NAME

- ID → Name
- ID → Phone
- ID → { ... }

BATCH_ID → BATCH_NAME

NAME → ID

Not Unique

Phone → ID

Sele phone from STU where ID=4

ID → Phone

ID → Batch ID

rating, feedback

Session (Queries)

StudentID	Module ID	SessionID	rating	feedback
1	1	1		

1	1	2			
2	1	3			
2	1	4			

PK

PK - StudentID, MentorID, SessionID

FD 1 Student can only have 1 mentor

StudentID → MentorID

{ StudentID, MentorID, SID }

→ rating

→ feedback

Normalisation

Multiple tables

↳ reduce data redundancy

↳ remove anomalies

→ reduce redundancy

→ improve data integrity

Normal Forms (Relational DB)

- 1NF Strictness
- 2NF

Denormalisation

2 NF to 3NF

Set of rules to normalise your database

1 NF

2NF - 1NF + new rules

1 NF

Rule — All your values should be atomic

ER model

— multivalued

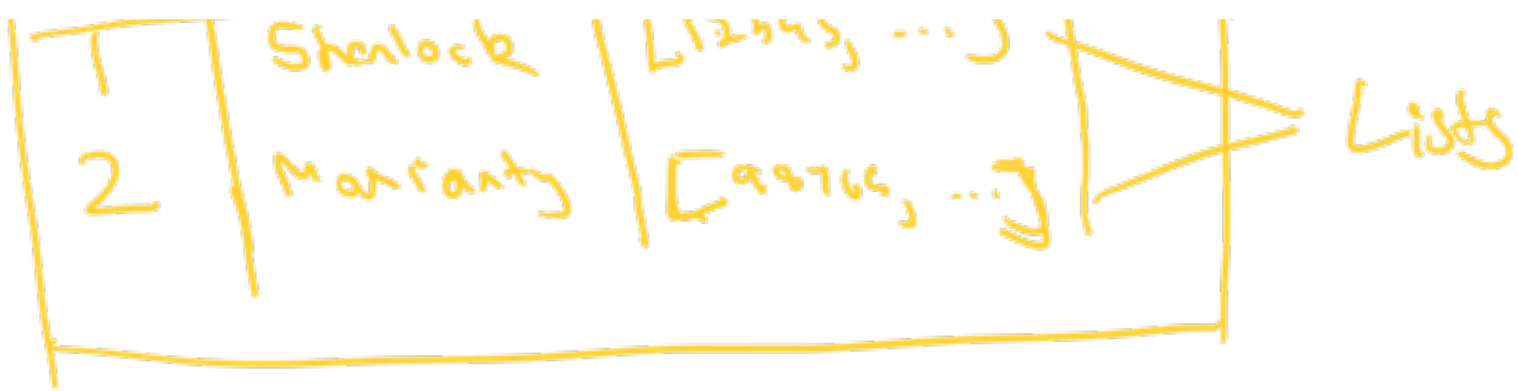
— Composite

MySql 5.7

1NF — X collections

ID	NAME	PHONE_NOS

X 1NF



① Multiple columns

ID	NAME	Phone #1	Phone #2	... #5
1	Sherlock	1234	9876 ...	

1NF ✓

③

① We don't know the upper bound

② Efficient
↳ Find a student by Phone
→ All phone no.

③ Sparse ✗

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② Multiple rows

1NF ✓

ID	Name	phone
1	Sherlock	12345
1	Sherlock	98765..
2	Jon	12345..

✗

2 | John | 9876 5...

① redundant data (n-1)

2 bx

② PK - ID + Phone

CSV a,b,c

Phone

"12345;98765;"

("123,987,..") — Varchar

Search user when no = 123

Complicated solution

join on phone
deleting

Occom's Razor

Simplest solution

KISS

Simplest — Create a new table

New Table

SID	Name	Email

Student

Phone #

SID	Phone numbu
1	12 345
1	987654 ..

Normalise

User

ID	NAME	[] Interests]
1	Tony	[DBMS] +20 30

Normal forms

1 NF → atomic values

→ Multiple columns ✓

→ Multiple Rows ✓

→ Multiple values

ID	Phone No
1	123
1	987

→ Create a new table

Students

Phone numbers

MC	User ID	Name	Interest 1	Interest 2

Separate table

Student ID	Interest
1	DBMS
1	Books
1	Memes

User interest

- 1 table (User)
- 4 tables
  - → performance issue
  - → optimisation

6:12 | 6:17

10:42 | 10:47

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4 sessions

6 sessions

4 Sessions
— Theory

5th → Queries

6th → Transactions
→ Joins
→ Views
→ Triggers
→ Procedures

2:30

Transaction

→ window

→ Query optimization

2NF

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SQL Fiddle

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2 NF

1. 1 NF
2. No partial dependency

A b

A -> X

ID | NAME | BATCH_ID | B_NAME | psp

ID → NAME

One user can be part of multiple batches

ID	Name	bID	bName	PSP
1	Sherlock	1	Season1	90%
1	Sherlock	2	Season2	100%

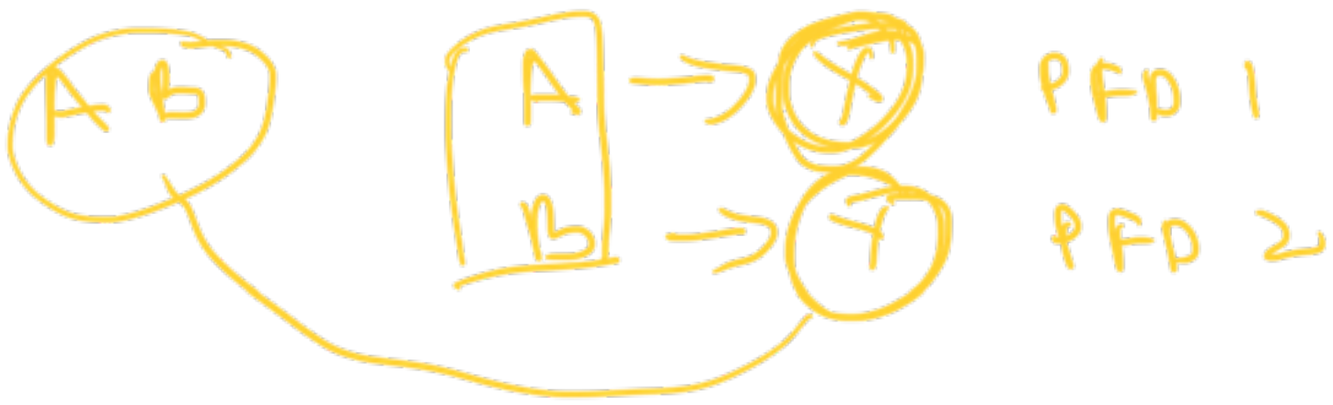
PK → {ID + bID}

{ID, bID} → PSP ✓ Functional dep.

↳ part of a composite key

Partial dependency

Parts of CPK on LHS



2 NF

→ Not have partial FD

→ Every non-candidate key attribute should depend on the whole candidate key & just not a part of it

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2 NF - Composite

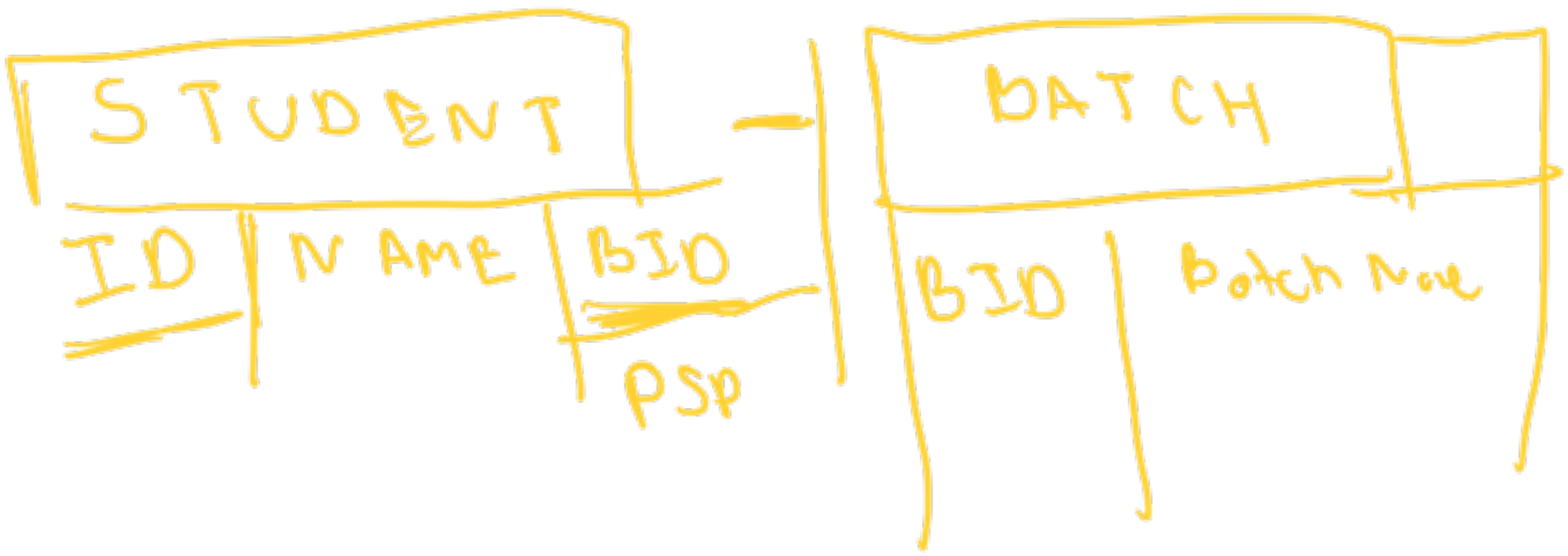
1 NF + single PK = 2NF

→ composite = PFD

ID	NAME	BID	BNAME	PSP
1	Tony			
			X	Y

BID → BNAME — PFD

PK ⇒ ID , BID



2 NF — Composite key

Partial Functional Dependency

(A B)

A → X
B → Y
} PFD

How to fix)

Create a new table
with duplicate values

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(1) Student can be part of multiple batches

IDEAL

STUDENT | ID | BID | psp

1	2	90
1	1	100

BID → BNAME →

ID → NAME

↳ User info

3NF

- 2NF
- It should not contain transitive dependencies

Transitivity

a = b b = c

a = c

$X \to Y \quad Y \to Z$

$\boxed{X \to Z}$ X

ID	BID	BNAME	NAME

ID → batch ID → batch Name

X 3NF

$X \to Y$

Y → prime attribute

each part of Y

X → Super key

Should be in a
Candidate

ID	NAME	PHONE	BID	BNAME

✓

(ID) → NAME

(Phone) → ID

(BID) → BNAME ✗

3NF

① No transitive dependency

ID → BID → BNAME ✗

② X → Y → (A)(B) prime attribute

X ↓ Super key

3NF → No transitive dependency

A → C

ID | NAME | BID | BID | BNAME

3 NF

BCNF

Boyce Codd NF

Relational model

3.5 NF

X → Y

X BC NF

Primary key

FD

X (Not PK)

ID	Phone	Name	Batch ID

ID → PK → Name

X → Y

Phone → PK X → Name → ID

BCNF

Phone — SK, CK, PK (ID)

BCNF → 3NF

n NF → (n-1) NF

→ [illegible]

ID	NAME	Phone	BID	BNAME

Student

ID	NAME	BID	SID	Phone No.
1	Tony		1	123

① → ③

BID	BName

Normalization

→ Check if rules are met

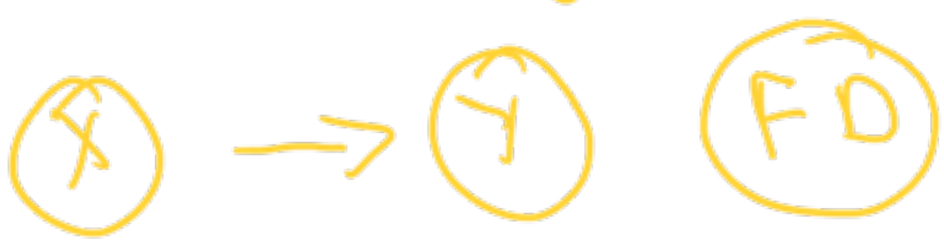
→ If not, create new table

- Data anomalies
  - → Insertion
  - → Deletion
  - → Updation

  → loss of data → errors

    inconsistent

- Functional Dependency



ID → NAME

→ Partial Dependency

Composite key (A B)

A → X
B → Y

→ Transitive

a = b = c

a = c

X → Y Y → Z

X → Z

id → BID → BNAME

1 Nf — Atomic

2 NF — No PFD

3 NF — No TFD

BCNF — Only PK on LHS of FD

Create a separate table

- Transactions + ACID
- Indexes

NF — (redundancy)

— Inconsistency

ID | Phone →

SNF → Transitive FD

(1) X should be a super key

(2) Y should be a prime attribute

Y = (A) (B)

X (A) Z B

StudentID, batchId → a prime attribute

X

{StudentID}

{phone}

{studentID, phone}

{phone}

prime attribute

3NF $X \to SK$

$Y \to PA$

{StudentID, Phone}

Present in a candidate key

{SID, Name} + PA

SID → PK

→ CK

CK ✗

S {STD, Phone}

CK → CK1

CK — Prime Attribute

3NF

- x → SK
- y → PA

SID — PK

— PA

PA — None

CK ⊆ y

id → None

CK - {X, Y} → X

{A, B, C}

{A, B} → A

3 NF → 1 FD

BCNF - 3.5 NF

X → Y

→ PK

ID | NAME | Phone

PK

ID → None

ID → Phone

Phone → ID

Phone → None

X BCNF

ID | NAME

ID | PHONE