

Normalization Practice

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.

type of normalization:

1NF (First Normal Form):

- All columns contain atomic (indivisible) values.
- Each column contains only values of a single type.
- Each column has a unique name.
- The order in which data is stored does not matter

2NF (Second Normal Form): Builds on 1NF by We need to remove redundant data from a table that is being applied to multiple rows. and placing them in separate tables. It requires all non-key attributes to be fully functional on the primary key.

- It is in 1NF.
- All non-key attributes are fully functionally dependent on the primary key.

3NF (Third Normal Form): Extends 2NF by ensuring that all non-key attributes are not only fully functional on the primary key but also independent of each other. This eliminates transitive dependency.

- It is in 2NF.
- No transitive dependencies exist; that is, non-key attributes do not depend on other non-key attributes.

De-Normalization:

is a technique used to improve database performance by adding redundant data. This process can enhance query speed and reduce the need for complex joins between tables. Denormalization plays a crucial role in database design, especially when optimizing read performance.

Case1: Company system – UNF table:

EmployeeID	EmployeeName	Department	Projects	Manager
E001	Ahmed	IT	P101:Website, P102:Mobile App	Eng. Khalid
E002	Salim	HR	P103:Recruitment	Ms. Amal
E003	Aisha	IT	P102:Mobile App, P104:Database Upgrade	Eng. Khalid

Step 1: First Normal Form (1NF)

EmployeeID	EmployeeName	Department	Projects	Manager
E001	Ahmed	IT	P101:Website	Eng. Khalid
E001	Ahmed	IT	P102:Mobile App	Eng. Khalid
E002	Salim	HR	P103:Recruitment	Ms. Amal
E003	Aisha	IT	P102:Mobile App	Eng. Khalid
E003	Aisha	IT	P104:Database Upgrade	Eng. Khalid

Step 2: Second Normal Form (2NF)

Employee table:

project table:

EmployeeID	EmployeeName	Department
E001	Ahmed	IT
E001	Ahmed	IT
E002	Salim	HR
E003	Aisha	IT
E003	Aisha	IT

EmployeeID	Projects	Manager
E001	P101:Website	Eng. Khalid
E001	P102:Mobile App	Eng. Khalid
E002	P103:Recruitment	Ms. Amal
E003	P102:Mobile App	Eng. Khalid
E003	P104:Database Upgrade	Eng. Khalid

Step 3: Third Normal Form (3NF)

Employee table:

EmployeeID	EmployeeName	Department
E001	Ahmed	IT
E001	Ahmed	IT
E002	Salim	HR
E003	Aisha	IT
E003	Aisha	IT

Project Table:

Projects	Manager
P101:Website	Eng. Khalid
P102:Mobile App	Eng. Khalid
P103:Recruitment	Ms. Amal
P102:Mobile App	Eng. Khalid
P104:Database Upgrade	Eng. Khalid

Project Assignment Table:

EmployeeID	Projects
E001	P101:Website
E001	P102:Mobile App
E002	P103:Recruitment
E003	P102:Mobile App
E003	P104:Database Upgrade

Case2: University system – UNF table:

StudentID	StudentName	Department	Courses Enrolled	Advisor
S001	Reem	CS	C101:DB, C102:AI	Dr. Omar
S002	Tariq	Business	C103:Marketing	Dr. Sarah
S003	Noura	CS	C101:DB, C104:Cybersecurity	Dr. Omar

Step 1: First Normal Form (1NF)

StudentID	StudentName	Department	Courses Enrolled	Advisor
S001	Reem	CS	C101:DB	Dr. Omar
S001	Reem	CS	C102:AI	Dr. Omar
S002	Tariq	Business	C103:Marketing	Dr. Sarah
S003	Noura	CS	C101:DB	Dr. Omar
S003	Noura	CS	C104:Cybersecurity	Dr. Omar

Step 2: Second Normal Form (2NF)

student table:

Student ID	Student Name	Department
S001	Reem	CS
S001	Reem	CS
S002	Tariq	Business
S003	Noura	CS
S003	Noura	CS

course table:

StudentID	Courses Enrolled	Advisor
S001	C101:DB	Dr. Omar
S001	C102:AI	Dr. Omar
S002	C103:Marketing	Dr. Sarah
S003	C101:DB	Dr. Omar
S003	C104:Cybersecurity	Dr. Omar

Step 3: Third Normal Form (3NF)

student table:

Student ID	Student Name	Department
S001	Reem	CS
S001	Reem	CS
S002	Tariq	Business
S003	Noura	CS
S003	Noura	CS

course table:

Courses Enrolled	Advisor
C101:DB	Dr. Omar
C102:AI	Dr. Omar
C103:Marketing	Dr. Sarah
C101:DB	Dr. Omar
C104:Cybersecurity	Dr. Omar

course Enrolled table:

StudentID	Courses Enrolled
S001	C101:DB
S001	C102:AI
S002	C103:Marketing
S003	C101:DB
S003	C104:Cybersecurity

Case 3: Airline System – UNF Table

BookingID	PassengerName	Flights	SeatNumbers	PaymentMethod
B001	Salem	F101:Muscat-Dubai, F102:Dubai-London	12A, 14C	Credit Card
B002	Fatma	F103:Muscat-Istanbul	10B	PayPal
B003	Zayed	F104:Istanbul-Paris, F105:Paris-Oslo	9A, 13A	Credit Card

Step 1: First Normal Form (1NF)

BookingID	PassengerName	Flights	SeatNumbers	PaymentMethod
B001	Salem	F101:Muscat-Dubai	12A	Credit Card
B001	Salem	F102:Dubai-London	14C	Credit Card
B002	Fatma	F103:Muscat-Istanbul	10B	PayPal
B003	Zayed	F104:Istanbul-Paris	9A	Credit Card
B003	Zayed	F105:Paris-Oslo	13A	Credit Card

Step 2: Second Normal Form (2NF)

booking table:

BookingID	PassengerName	PaymentMethod
B001	Salem	Credit Card
B001	Salem	Credit Card
B002	Fatma	PayPal
B003	Zayed	Credit Card
B003	Zayed	Credit Card

flight table:

BookingID	Flights	SeatNumbers
B001	F101:Muscat-Dubai	12A
B001	F102:Dubai-London	14C
B002	F103:Muscat-Istanbul	10B
B003	F104:Istanbul-Paris	9A
B003	F105:Paris-Oslo	13A

Case 4: Hotel System – UNF Table

ReservationID	GuestName	RoomNumbers	ServicesUsed	CheckInDate	StaffAssigned
R001	Nasser	101, 102	Spa, Breakfast	2025-05-01	Mariam Al-Raisi
R002	Hind	103	Breakfast	2025-05-02	Saleh Al-Balushi
R003	Ahmed	104, 105	Spa, Dinner, Laundry	2025-05-03	Mariam Al-Raisi

Step 1: First Normal Form (1NF)

ReservationID	GuestName	RoomNumbers	ServicesUsed	CheckInDate	StaffAssigned
R001	Nasser	101	Spa	2025-05-01	Mariam Al-Raisi
R001	Nasser	102	Breakfast	2025-05-01	Mariam Al-Raisi
R002	Hind	103	Breakfast	2025-05-02	Saleh Al-Balushi
R003	Ahmed	104	Spa	2025-05-03	Mariam Al-Raisi
R003	Ahmed	105	Dinner	2025-05-03	Mariam Al-Raisi
R003	Ahmed		Laundry	2025-05-03	Mariam Al-Raisi

Step 2: Second Normal Form (2NF)

Reservation Table

ReservationID	GuestName	CheckInDate	StaffAssigned
R001	Nasser	2025-05-01	Mariam Al-Raisi
R001	Nasser	2025-05-01	Mariam Al-Raisi
R002	Hind	2025-05-02	Saleh Al-Balushi
R003	Ahmed	2025-05-03	Mariam Al-Raisi
R003	Ahmed	2025-05-03	Mariam Al-Raisi
R003	Ahmed	2025-05-03	Mariam Al-Raisi

Service Table

ReservationID	RoomNumbers	ServicesUsed
R001	101	Spa
R001	102	Breakfast
R002	103	Breakfast
R003	104	Spa
R003	105	Dinner
R003		Laundry

Step 3: Third Normal Form (3NF)

Reservation Table

ReservationID	GuestName	CheckInDate
R001	Nasser	2025-05-01
R001	Nasser	2025-05-01
R002	Hind	2025-05-02
R003	Ahmed	2025-05-03
R003	Ahmed	2025-05-03
R003	Ahmed	2025-05-03

Service Table

ReservationID	RoomNumbers	ServicesUsed
R001	101	Spa
R001	102	Breakfast
R002	103	Breakfast
R003	104	Spa
R003	105	Dinner
R003		Laundry

Case 5: Bank System – UNF Table

CustomerID	CustomerName	Accounts	Branch	RelationshipManager
C001	Latifa	A001:Savings, A002:Credit	Seeb	Mr. Jamal
C002	Khalid	A003:Current	Mutrah	Ms. Huda
C003	Rania	A004:Savings, A005:Loan, A006:Card	Seeb	Mr. Jamal

Step 1: First Normal Form (1NF)

CustomerID	CustomerName	Accounts	Branch	RelationshipManager
C001	Latifa	A001:Savings	Seeb	Mr. Jamal
C001	Latifa	A002:Credit	Seeb	Mr. Jamal
C002	Khalid	A003:Current	Mutrah	Ms. Huda
C003	Rania	A004:Savings	Seeb	Mr. Jamal
C003	Rania	A005:Loan	Seeb	Mr. Jamal
C003	Rania	A006:Card	Seeb	Mr. Jamal

Step 2: Second Normal Form (2NF)

customer Table

account Table

CustomerID	CustomerName	RelationshipManager
C001	Latifa	Mr. Jamal
C001	Latifa	Mr. Jamal
C002	Khalid	Ms. Huda
C003	Rania	Mr. Jamal
C003	Rania	Mr. Jamal
C003	Rania	Mr. Jamal

CustomerID	Accounts	Branch
C001	A001:Savings	Seeb
C001	A002:Credit	Seeb
C002	A003:Current	Mutrah
C003	A004:Savings	Seeb
C003	A005:Loan	Seeb
C003	A006:Card	Seeb

Case 6: Freelancing System – UNF Table

FreelancerID	FreelancerName	Skills	Projects	ClientName	PaymentMode
F001	Yousuf	Web Dev, UI Design	P201:Website, P202:Landing Page	SamTech	Bank Transfer
F002	Mariam	Data Entry	P203:Survey, P204:Form Upload	QuickData	PayPal
F003	Khalfan	Web Dev, SEO, Marketing	P202:Landing Page, P205:SEO Report	SamTech, WebGo	Credit Card

Step 1: First Normal Form (1NF)

FreelancerID	FreelancerName	Skills	Projects	ClientName	PaymentMode
F001	Yousuf	Web Dev	P201:Website	SamTech	Bank Transfer
F001	Yousuf	UI Design	P202:Landing Page	SamTech	Bank Transfer
F002	Khalid	Data Entry	P203:Survey	QuickData	PayPal
F002	Rania	Data Entry	P204:Form Upload	QuickData	PayPal
F003	Khalfan	Web Dev	P202:Landing Page	SamTech	Credit Card
F003	Khalfan	SEO	P205:SEO Report	WebGo	Credit Card
F003	Khalfan	Marketing			Credit Card

Step 2: Second Normal Form (2NF)

freelancer Table

FreelancerID	FreelancerName	PaymentMode
F001	Yousuf	Bank Transfer
F001	Yousuf	Bank Transfer
F002	Khalid	PayPal
F002	Rania	PayPal
F003	Khalfan	Credit Card
F003	Khalfan	Credit Card
F003	Khalfan	Credit Card

freelancer skill Table

FreelancerID	Skills
F001	Web Dev
F001	UI Design
F002	Data Entry
F002	Data Entry
F003	Web Dev
F003	SEO
F003	Marketing

freelancer project Table

FreelancerID	Projects	ClientName
F001	P201:Website	SamTech
F001	P202:Landing Page	SamTech
F002	P203:Survey	QuickData
F002	P204:Form Upload	QuickData
F003	P202:Landing Page	SamTech
F003	P205:SEO Report	WebGo

Case 7: Payment System – UNF Table

TransactionID	CustomerName	PaymentMethods	PurchaseItems	BillingAddress	PaymentDetails
T001	Aisha	Credit Card, Wallet	P001:Phone, P002:Charger	Seeb, Oman	PM001:\$300:2025-05-01, PM002:\$20:2025-05-01
T002	Salim	Bank Transfer	P003:Laptop	Bousher, Oman	PM003:\$900:2025-05-02
T003	Reem	Credit Card, Cash	P004:Tablet, P005:Stylus, P006:Cover	Mutrah, Oman	PM004:\$400:2025-05-03, PM005:\$50:2025-05-03, PM006:\$30:2025-05-03

Step 1: First Normal Form (1NF)

TransactionID	CustomerName	PaymentMethods	PurchaseItems	BillingAddress	PaymentDetails
T001	Aisha	Credit Card	P001:Phone	Seeb	PM001:\$300:2025-05-01
T001	Aisha	Wallet	P002:Charger	Oman	PM002:\$20:2025-05-01
T002	Salim	Bank Transfer	P003:Laptop	Bousher	PM003:\$900:2025-05-02
T002	Salim	Bank Transfer	P003:Laptop	Oman	PM003:\$900:2025-05-02
T003	Reem	Credit Card	P004:Tablet	Mutrah	PM004:\$400:2025-05-03
T003	Reem	Cash	P005:Stylus	Oman	PM005:\$50:2025-05-03
T003	Reem		P006:Cover		PM006:\$30:2025-05-03

Step 2: Second Normal Form (2NF)

Transaction Table

TransactionID	CustomerName	BillingAddress
T001	Aisha	Seeb
T001	Aisha	Oman
T002	Salim	Bousher
T002	Salim	Oman
T003	Reem	Mutrah
T003	Reem	Oman

PaymentMethods Table

TransactionID	PaymentMethods
T001	Credit Card
T001	Wallet
T002	Bank Transfer
T002	Bank Transfer
T003	Credit Card
T003	Cash

PurchaseItems Table

TransactionD	PurchaseItems
T001	P001:Phone
T001	P002:Charger
T002	P003:Laptop
T002	P003:Laptop
T003	P004:Tablet
T003	P005:Stylus
T003	P006:Cover

Payment Detail Table

TransactionID	PaymentMethods	PaymentDetails
T001	Credit Card	PM001:\$300:2025-05-01
T001	Wallet	PM002:\$20:2025-05-01
T002	Bank Transfer	PM003:\$900:2025-05-02
T002	Bank Transfer	PM003:\$900:2025-05-02
T003	Credit Card	PM004:\$400:2025-05-03
T003	Cash	PM005:\$50:2025-05-03
T003		PM006:\$30:2025-05-03