Q1) Normalizing Employee Information

Unnormalized Form (UNF) initial table structure:

EmployeeID	EmployeeName	Department	Manager ID	Salary	HireDate
1	John Smith	HR	101	50000	2022-01-15
2	Alice Brown	IT	102	60000	2022-02-20
3	Mark Johnson	Sales	101	55000	2022-03-10

1st Normal Form (1NF)
EmployeeID is identified as the primary key as it uniquely identifies each employee.
Addressing Atomicity: No multivalued or composite attributes observed.

2nd Normal Form (2NF)
Removing Partial Dependencies AND making it more efficient:
Department is partially dependent on EmployeeID and ManagerID. To resolve this, you split the tables to:

a. Employees (EmployeeID [PK], EmployeeName, Salary, HireDate,DepartmentID[FK])

EmployeeID	EmployeeName	Salary	HireDate	Department ID
1	John Smith	50000	2022-01-15	D1
2	Alice Brown	60000	2022-02-20	D2
3	Mark Johnson	55000	2022-03-10	D3

b. Departments (DepartmentID[PK],Department,ManagerID[FK])

DepartmentID	Department	ManagerID
D1	HR	101
D2	IT	102
D3	Sales	101

3rd Normal Form (3NF)

Eliminating Transitive Dependencies:

Each manager (identified by ManagerID) is associated with an EmployeeID from the Employee table, which contains details about the employees, including their respective departments. Create another table to resolve this dependency.

New tables:

a. Employees (EmployeeID[PK], EmployeeName, Salary, HireDate,DeparmentID[FK])

EmployeeID	EmployeeName	Salary	HireDate	Department ID
1	John Smith	50000	2022-01-15	D1
2	Alice Brown	60000	2022-02-20	D2
3	Mark Johnson	55000	2022-03-10	D3

b. Departments (DepartmentID[PK], Department)

DepartmentID	Department
D1	HR
D2	IT
D3	Sales

c. Managers (ManagerID[PK], EmployeeID[FK])

ManagerID	EmployeeID
101	1
102	2
101	3

Q2) Normalizing Training Programs

Unnormalized Form (UNF) initial table structure:

Program ID	ProgramName	Trainer	Department	EmployeeID	EmployeeName	Date
1	Java Fundamentals	John Smith	IT	101	Alice Brown	2022-03-01
2	Project Management	Sarah White	HR	102	Bob Green	2022-03-10
3	Sales Techniques	Mark Johnson	Sales	103	Charlie Black	2022-03-20

1st Normal Form (1NF)
Identifying Primary Key:
ProgramID can serve as the primary key as it uniquely identifies each program.
Addressing Atomicity: No multivalued or composite attributes observed.

2nd Normal Form (2NF)

- Removing partial dependency

ProgramID	ProgramName	Trainer
1	Java Fundamentals	John Smith
2	Project Management	Sarah White
3	Sales Techniques	Mark Johnson

ProgramID	Department	EmployeeID	EmployeeName	Date
1	IT	101	Alice Brown	2022-03-01
2	HR	102	Bob Green	2022-03-10

3	Sales	103	Charlie Black	2022-03-20

3rd Normal Form (3NF)

- Removing Transitive dependency

EmployeeID	**EmployeeName**
101	Alice Brown
102	Bob Green
103	Charlie Black

ProgramID	**ProgramName**	**Trainer**
1	Java Fundamentals	John Smith
2	Project Management	Sarah White
3	Sales Techniques	Mark Johnson

ProgramID	**Department**	**EmployeeID**	**Date**
1	IT	101	2022-03-01
2	HR	102	2022-03-10
3	Sales	103	2022-03-20

Making it more efficient -

Program Table:

ProgramID	**ProgramName**	**Trainer**
1	Java Fundamentals	John Smith
2	Project Management	Sarah White

3	Sales Techniques	Mark Johnson

Employee Table:

EmployeeID	**EmployeeName**
101	Alice Brown
102	Bob Green
103	Charlie Black

Program-employee mapping:

ProgramID	**DepartmentID**	**EmployeeID**	**Date**
1	D101	101	2022-03-01
2	D102	102	2022-03-10
3	D103	103	2022-03-20

Department Table:

DepartmentID	**Department**
D101	HR
D102	IT
D103	Sales

Q3) Normalizing Customer orders

Unnormalized Form (UNF) initial table structure:

Order ID	**CustomerName**	**Product ID**	**ProductName**	**Qty**	**UnitPrice**	**TotalAmount**	**OrderDate**
1	John Doe	101	Laptop	2	800	1600	2022-01-15

2	Jane Smith	102	Smartphone	1	500	500	2022-02-20
3	John Doe	103	Printer	1	200	200	2022-03-10

1st Normal Form (1NF)
Identifying Primary Key:
OrderID can serve as the primary key as it uniquely identifies each order.
Addressing Atomicity: No multivalued or composite attributes observed.

2nd Normal Form (2NF)
Removing Partial Dependencies:
ProductName, UnitPrice seems dependent on ProductID, which is not solely dependent on the primary key.
Create a separate table for Products to eliminate this partial dependency.
New tables:
a. Orders (OrderID [PK], CustomerName, ProductID [FK],Qty, UnitPrice, TotalAmount, OrderDate)

Order ID	**CustomerName**	**Product ID**	**Qty**	**TotalAmount**	**OrderDate**
1	John Doe	101	2	1600	2022-01-15
2	Jane Smith	102	1	500	2022-02-20
3	John Doe	103	1	200	2022-03-10

b. Products (ProductID [PK], ProductName,UnitPrice)

ProductID	**ProductName**	**UnitPrice**
101	Laptop	800
102	Smartphone	500

103	Printer	200

3rd Normal Form (3NF)

Eliminating Transitive Dependencies:

Resolves the transitive dependency by separating individual items within an order. ItemID, ProductID, and Qty details are directly associated with OrderID, avoiding indirect relationships and ensuring each item relates specifically to an order.

New tables:

A. Orders (OrderID [PK], CustomerName, TotalAmount, OrderDate).

Order ID	**CustomerName**	**TotalAmount**	**OrderDate**
1	John Doe	1600	2022-01-15
2	Jane Smith	500	2022-02-20
3	John Doe	200	2022-03-10

B. Items(ItemID[PK], ProductID[FK], Qty, OrderID[FK])

ItemID	**ProductID**	**Qty**	**OrderID**
IT1	101	2	1
IT2	102	1	2
IT3	103	1	3

C. Products (ProductID [PK], ProductName,Unit Price)

ProductID	**ProductName**	**UnitPrice**
101	Laptop	800

102	Smartphone	500
103	Printer	200

Q4) Normalizing Stress management

Unnormalized Form (UNF) initial table structure:

EmployeeID	FirstName	LastName	StressLevel	HoursOf Work	Breaks Taken	Physical Activity	Counseling Sessions
101	Sarah	White	Moderate	45	3	Yoga	2
102	Bob	Green	High	50	2	Jogging	1
103	Charlie	Black	Low	40	4	Meditation	3
104	David	Miller	High	48	1	Gym	2
105	Jane	Doe	Moderate	42	3	Walking	1

1st Normal Form (1NF)
Identifying Primary Key:
EmployeeID can serve as the primary key as it uniquely identifies each employee.
Addressing Atomicity: No multivalued or composite attributes observed.

2nd Normal Form (2NF)
Removing Partial Dependencies:
By splitting the original table into three separate tables, each containing attributes directly related to the respective primary keys
New tables:
a. Employees (EmployeeID [PK], FirstName, LastName, StressLevel)

EmployeeID	FirstName	LastName	StressLevel
101	Sarah	White	Moderate
102	Bob	Green	High

103	Charlie	Black	Low
104	David	Miller	High
105	Jane	Doe	Moderate

b. WorkDetails(EmployeeID [FK], HoursOfWork, BreaksTaken)

EmployeeID	HoursOfWork	BreaksTaken
101	45	3
102	50	2
103	40	4
104	48	1
105	42	3

c. Activities (EmployeeID [FK], PhysicalActivity, CounselingSessions)

Employee ID	PhysicalActivity	Counseling Sessions
101	Yoga	2
102	Jogging	1
103	Meditation	3
104	Gym	2
105	Walking	1

3rd Normal Form (3NF)
Eliminating Transitive Dependencies: StressLevel and HoursOfWork have no transitive dependencies. The table structure remains unchanged.

Q5) Normalising Flee Market

Unnormalized Form (UNF) initial table structure:

ItemID	Seller Name	ItemName	Category	Price	Quantity	Description	Condition	Location	DateListed
101	John's Treasures	Vintage Chair	Furniture	50.00	2	Beautiful vintage chair, excellent condition, Like New	Excellent	Booth 15, Section A	2022-01-15
102	Alice's Finds	Antique Clock	Home Decor	80.00	1	Authentic antique clock with Roman numerals	Good	Stall 8, Section B	2022-02-20
103	Mark's Collectibles	Vinyl Records	Music	15.00	10	Various artists and genres, in good condition	Used	Booth 20, Section C	2022-03-10
104	Emma's Treasures	Vintage Jewelry	Accessories	35.00	5	Assorted vintage jewelry pieces, unique designs	Excellent	Stall 12, Section D	2022-04-05
105	Robert's Finds	Retro Camera	Electronics	60.00	1	Vintage Polaroid camera with original case	Good	Booth 5, Section A	2022-05-15

1st Normal Form (1NF)

Identifying Primary Key:

ItemID can serve as the primary key as it uniquely identifies each item.

Addressing Atomicity: No multivalued or composite attributes observed.

2nd Normal Form (2NF)

Removing Partial Dependencies: The Items table contains attributes solely dependent on the ItemID, while the Seller table attributes relate directly to SellerID, avoiding partial dependencies by linking each detail explicitly to its primary key.

New tables:

a. Items (ItemID [PK], ItemName,Category, Price, Description)

ItemID	ItemName	Category	Price	Description
101	Vintage Chair	Furniture	50.00	Beautiful vintage chair, excellent condition, Like New
102	Antique Clock	Home Decor	80.00	Authentic antique clock with Roman numerals
103	Vinyl Records	Music	15.00	Various artists and genres, in good condition
104	Vintage Jewelry	Accessories	35.00	Assorted vintage jewelry pieces, unique designs
105	Retro Camera	Electronics	60.00	Vintage Polaroid camera with original case

b. Seller (SellerID[PK], ItemID [FK], SellerName, Quantity, Condition, Location, DateListed)

SellerID	ItemID	SellerName	Quantity	Condition	Location	DateListed
S1	101	John's Treasures	2	Excellent	Booth 15, Section A	2022-01-15
S2	102	Alice's Finds	1	Good	Stall 8, Section B	2022-02-20

S3	103	Mark's Collectibles	10	Used	Booth 20, Section C	2022-03-10
S4	104	Emma's Treasures	5	Excellent	Stall 12, Section D	2022-04-05
S5	105	Robert's Finds	1	Good	Booth 5, Section A	2022-05-15

3rd Normal Form (3NF)
Eliminating Transitive Dependencies:

Location details are separated into a dedicated Locations Table, ensuring each attribute solely depends on LocationID without transitive dependencies.

a. Items (ItemID [PK], ItemName,Category, Price, Description)

ItemID	ItemName	Category	Price	Description
101	Vintage Chair	Furniture	50.00	Beautiful vintage chair, excellent condition, Like New
102	Antique Clock	Home Decor	80.00	Authentic antique clock with Roman numerals
103	Vinyl Records	Music	15.00	Various artists and genres, in good condition
104	Vintage Jewelry	Accessories	35.00	Assorted vintage jewelry pieces, unique designs
105	Retro Camera	Electronics	60.00	Vintage Polaroid camera with original case

b. Seller (SellerID[PK], ItemID [FK], SellerName, Quantity, Condition, LocationID[FK], DateListed)

SellerID	ItemID	SellerName	Quantity	Condition	LocationID	DateListed
S1	101	John's Treasures	2	Excellent	L1	2022-01-15
S2	102	Alice's Finds	1	Good	L2	2022-02-20
S3	103	Mark's Collectibles	10	Used	L3	2022-03-10
S4	104	Emma's Treasures	5	Excellent	L4	2022-04-05
S5	105	Robert's Finds	1	Good	L5	2022-05-15

C. Locations(LocationID [PK], Location)

LocationID	Location
L1	Booth 15, Section A
L2	Stall 8, Section B
L3	Booth 20, Section C
L4	Stall 12, Section D
L5	Booth 5, Section A

Q6) Normalising Learning Management System

Unnormalized Form (UNF) initial table structure:

CID	CourseName	Instructor	Department	Credits	EnrolledStudents	StartDate	EndDate	Location	Availability
101	Introduction to Biology	Prof. Smith	Science	3	25	2022-01-15	2022-05-10	Room 101	Open
102	Programming in Python	Prof. Brown	Computer Science	4	30	2022-02-20	2022-06-15	Lab 3, Building B	Closed
103	Financial Accounting	Prof. Green	Finance	3	20	2022-03-10	2022-07-05	Room 201	Open
104	English Literature	Prof. White	Humanities	3	22	2022-04-05	2022-08-20	Room 301	Open
105	Web Development Fundamentals	Prof. Black	IT	4	28	2022-05-15	2022-09-25	Lab 2, Building A	Closed

1st Normal Form (1NF)
Identifying Primary Key:
CID (Course ID) can serve as the primary key as it uniquely identifies each course.
Addressing Atomicity: No multivalued or composite attributes observed.

2nd Normal Form (2NF)
Removing Partial Dependencies: In the 2nd Normal Form (2NF), each table is organized to ensure all attributes within them are solely dependent on the primary key. The Courses table holds

course-specific details, while the Department and Instructor tables separate departmental and instructor information respectively, avoiding partial dependencies by linking each detail directly to the Course ID (CID) primary key.
New tables:
a. Courses (CID [PK], CourseName, Instructor , Credits, EnrolledStudents, StartDate, EndDate, Location, Availability)

CID	Course Name	Credits	Enrolled Students	StartDate	EndDate	Location	Availability
101	Introduction to Biology	3	25	2022-01-15	2022-05-10	Room 101	Open
102	Programming in Python	4	30	2022-02-20	2022-06-15	Lab 3, Building B	Closed
103	Financial Accounting	3	20	2022-03-10	2022-07-05	Room 201	Open
104	English Literature	3	22	2022-04-05	2022-08-20	Room 301	Open
105	Web Development Fundamentals	4	28	2022-05-15	2022-09-25	Lab 2, Building A	Closed

b. Department (DepartmentID[PK], CID [FK], Department)

Department ID	CID	Department
D1	101	Science

D2	102	Computer Science
D3	103	Finance
D4	104	Humanities
D5	105	IT

c. Instructor(InstructorID [PK], CID[FK] , Instructor)

InstructorID	CID	Instructor
IN01	101	Prof. Smith
IN02	102	Prof. Brown
IN03	103	Prof. Green
IN04	104	Prof. White
IN05	105	Prof. Black

3rd Normal Form (3NF)

Eliminating Transitive Dependencies: No transitive dependencies observed.
