# **Normalization**

**1. VideoStore Relation**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| TransID | RentDate | CustomerID | CustName | CustPhone | VideoID | VideoTitle | #Copy | ChargePerCopy |
| T001 | 01/12/02 | C1223 | Ai Li Lim | 07-12345678 | V001 | Titanic | 2 | RM2.00 |
| T001 | 01/12/02 | C1223 | Ai Li Lim | 07-12345678 | V006 | The Tuxedo | 1 | RM1.50 |
| T002 | 02/12/02 | C1225 | Aee Sy Go | 07-87654321 | V001 | Titanic | 1 | RM2.00 |
| T002 | 02/12/02 | C1225 | Aee Sy Go | 07-87654321 | V002 | Office Ghosts | 1 | RM1.50 |
| T002 | 02/12/02 | C1225 | Aee Sy Go | 07-87654321 | V008 | The Signs | 1 | RM1.50 |

1. Normalize the above structure to 1NF, 2NF and 3NF by providing meaningful relation names.

**1NF (Remove Repeating Group)**

VideoStore(TransID, RentDate, CustomerID, CustName, CustPhone, VideoID, VideoTitle, #Copy, ChargePerCopy)

|

Transaction(TransID, RentDate, CustomerID, CustName, CustPhone)

VideoStore(TransID\*, VideoID, VideoTitle, #Copy, ChargePerCopy)

**2NF (Remove Partial Dependencies)**

Transaction(TransID, RentDate, CustomerID, CustName, CustPhone)

VideoStore(TransID\*, VideoID\*, #Copy)

Video(VideoID, VideoTitle, ChargePerCopy)

**3NF (Remove Transitive Dependencies)**

Transaction(TransID, RentDate, CustomerID\*)

Customer(CustomerID, CustName, CustPhone)

VideoStore(TransID\*, VideoID\*, #Copy)

Video(VideoID, VideoTitle, ChargePerCopy)

1. The table is susceptible to anomalies. Provide examples of insertion, deletion and modification anomalies.

**Insert Anomaly**

It is not possible to add new video unless that new video is rented by a customer.

**Modification Anomaly**

When we update the Video Title (V001) from Titanic to Titanic II, we have to update the similar video title in another row, if not it will cause inconsistency of data.

**Deletion Anomaly**

When we delete transaction (T001) record we also will delete the video details: Titanic(V001) and The Tuxedo (V006).

1. Based on 3NF, draw an E-R diagram (Crow’s Foot notation).

**2.** A construction company manages several building projects. Each project has its project number, name and employees assigned to the project. Each employee has an employee number, name and job classification. The pay rate is dependent on the employee’s position.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ProjectNumber | ProjectName | EmployeeNumber | EmployeeName | JobClassification | ChargePerHour | Hours |
| PRO3001 | Marianne | E1001  E1002  E1004 | Eric Heng  Gary Chee  Raymond Low | Computer Technology  Electronic Engineering  Computer Technology | 80  75  80 | 18  16  19 |
| PRO3002 | Coast | E1001  E1003 | Eric Heng  Melvin Sim | Computer Technology  Biology Engineering | 80  77 | 13  17 |
| PRO3003 | Satellite | E1004  E1002 | Raymond Low  Gary Chee | Computer Technology  Electronic Engineering | 80  75 | 15  15 |

1. Normalize the above structure to 1NF, 2NF and 3NF by providing meaningful relation names.

1NF

Assign(ProjectNumber,ProjectName,EmployeeNumber,EmployeeName,JobClassification,ChargePerHour,Hours)

|

Project(ProjectNumber,ProjectName)

Assign(ProjectNumber\*,EmployeeNumber,EmployeeName,JobClassification,ChargePerHour,Hours)

2NF

Project(ProjectNumber,ProjectName)

Employee(EmployeeNumber,EmployeeName,JobClassification,ChargePerHour)

ProjectDetail(ProjectNumber\*,EmployeeNumber\*,Hours)

3NF

Project(ProjectNumber,ProjectName)

Employee(EmployeeNumber,EmployeeName,JobClassification\*)

ProjectDetail(ProjectNumber\*,EmployeeNumber\*,Hours)

Job(JobClassification,ChargePerHour)

1. The table is susceptible to anomalies. Provide examples of insertion, deletion and modification anomalies.

INSERTION ANOMALIES

-It is not possible to add new employee unless the new employee is assigned to the project.

MODIFICATION ANOMALIES

-When we update the Job Classification from Computer Technology to Programmer, we have to update the similar Job Classification in another row, otherwise it will cause inconsistency of data.

DELETION ANOMALIES

-When we delete the Project(PRO3002) record, we have to delete the employee detail and Job Classification: Melvin Sim(E1003) and Biology Engineering.

1. Based on 3NF, draw an E-R diagram (Crow’s Foot notation).

**3.** Examine the following relation describing the facial treatment transactions for a beauty therapy saloon.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| CustID | CustName | CustSkinType | TreatmentDate | TreatmentCode | TreatmentDesc | BeauticianID | BeauticianName |
| C1003 | Yee Si Go | Normal | 08/01/2003 | NOF | Normal Facial | B008 | Susan |
| C1003 | Yee Si Go | Normal | 08/01/2003 | ETR | Eye Treatment | B203 | Linda |
| C1003 | Yee Si Go | Normal | 18/01/2003 | NOF | Normal Facial | B108 | Esther |
| C1004 | Ai Li Lim | Dry | 02/01/2003 | NOF | Normal Facial | B108 | Esther |
| C1004 | Ai Li Lim | Dry | 10/01/2003 | NTR | Neck Treatment | B008 | Susan |
| C1005 | Ellen Tan | Oily | 11/01/2003 | NOF | Normal Facial | B203 | Linda |
| C1005 | Ellen Tan | Oily | 11/01/2003 | ETR | Eye Treatment | B203 | Linda |

1. Normalize the above structure to 1NF, 2NF and 3NF by providing meaningful relation names.

**1NF (Remove Repeating Group)**

Treatment(CustID, CustName, CustSkinType, TreatmentDate, TreatmentCode, TreatmentDesc, BeauticianID, BeauticianName)

I

Customer(CustID, CustName, CustSkinType)

Treatment(CustID\* , TreatmentDate, TreatmentCode, TreatmentDesc, BeauticianID, BeauticianName)

**2NF (Remove Partial Dependencies)**

Customer(CustID, CustName, CustSkinType)

Treatment(CustID\* , TreatmentDate, TreatmentCode\*, BeauticianID, BeauticianName)

TreatmentDetail(TreatmentCode, TreatmentDesc)

**3NF (Remove Transitive Dependencies)**

Customer(CustID, CustName, CustSkinType)

Treatment(CustID\* , TreatmentDate, TreatmentCode\*, BeauticianID\*)

TreatmentDetail(TreatmentCode, TreatmentDesc)

Beautician(BeauticianID, BeauticianName)

1. The table is susceptible to anomalies. Provide examples of insertion, deletion and modification anomalies.

**Insertion**

It is not possible to add a new customer unless that new customer receives any treatment.

**Modification**

When we update the treatment description of NOF from Normal Facial to Standard Facial, we have to update the similar treatment description in another row, if not it will cause data inconsistency.

**Deletion**

When we delete the customer named Ai Li Lim (C1004), we have to delete the treatment detail : Neck Treatment (NTR).

1. Based on 3NF, draw an E-R diagram (Crow’s Foot notation).

**4.** The table shown below is the Account table called Account in a banking system.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CustomerName | CustomerAddress | AccountNumber | TransactionCode | TransactionDescription | TransactionDate | Amount |
| Gary Chee | Segamat | A1223 | DEP | Deposit | 08/01/2003 | 1000 |
| Gary Chee | Segamat | A1223 | WDR | Withdraw | 08/01/2003 | 500 |
| Gary Chee | Segamat | A1223 | WDR | Withdraw | 10/01/2003 | 300 |
| Gary Chee | Segamat | A1223 | DEP | Deposit | 30/01/2003 | 1200 |
| Ellen Tan | Bukit Siput | A1224 | WDR | Withdraw | 08/01/2003 | 500 |
| Melvin Sim | Labis | A1225 | DEP | Deposit | 08/01/2003 | 800 |

1. Normalize the above structure to 1NF, 2NF and 3NF by providing meaningful relation names.

**1NF**

**Account(CustomerName,CustomerAddress,AccountNumber,TransactionCode,TransactionDescription,TransactionDate,Amount)**

**I**

**Account(CustomerName,CustomerAddress,AccountNumber)**

**Transaction(AccountNumber\*,TransactionCode,TransactionDescription,TransactionDate,Amount)**

**2NF**

**Account(CustomerName,CustomerAddress,AccountNumber)**

**Transaction(AccountNumber\*,TransactionCode\*,TransactionDate,Amount)**

**TransactionDetail(TransactionCode,TransactionDescription)**

**3NF**

**Account(AccountNumber,CustomerName\*)**

**Customer(CustomerName,CustomerAddress)**

**Transaction(AccountNumber\*,TransactionCode\*,TransactionDate,Amount)**

**TransactionDetail(TransactionCode,TransactionDescription)**

1. The table is susceptible to anomalies. Provide examples of insertion, deletion and modification anomalies.

**Insertion**

It is not possible to add a new customer unless that new customer performs any transaction.

**Modification**

When we update the transaction description of DEP from Deposit to Bank-in, we have to also update the similar transaction description in another row ,otherwise it will cause data inconsistency.

**Deletion**

**When we delete the account (A1225) record, we have to delete the Melvin Sim transaction record.**

1. Based on 3NF, draw an E-R diagram (Crow’s Foot notation).

**5.** The table shown below lists dentist-patient appointment data. A patient is given an appointment at a specific time and date with a dentist located at a particular surgery. On each day of patient appointments, a dentist is allocated to a specific surgery for that day.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| StaffNo | DentistName | PatientNo | PatientName | Appointment Date Time | SurgeryRoomNo | SurgeryRoomDesc |
| S1011 | Gary Chee | P100  P100 | Eddie Koh  Eddie Koh | 12-Sept-02 1.00p.m.  12-Sept-02 4.30p.m. | S15  S15 | Room C  Room C |
| S1024 | Jenny Tay | P108  P110 | Melvin Sim  Alice Go | 12-Sept-02 12.30p.m.  14-Sept-02 12.30p.m. | S10  S10 | Room B  Room B |
| S1032 | Ellen Tan | P105  P110 | Raymand Low  Alice Go | 14-Sept-02 10.00p.m.  15-Sept-02 10.30p.m. | S15  S13 | Room C  Room A |

1. Normalize the above structure to 1NF, 2NF and 3NF by providing meaningful relation names.

**1NF (Remove repeating group)**

Appointment(StaffNo,DentistName,PatientNo,AppoinmentDate,AppoinmentTime,SurgeryRoomNo,SurgeryRoomDesc)

I

Appointment(StaffNo,PatientNo,PatientName,AppointmentDate,AppointmentTime,SurgeryRoomNo,SurgeryRoomDesc)

Staff(StaffNo,DentistName)

**2NF (Remove Partial Dependencies)**

* **No partial dependencies.**

Appointment(StaffNo,PatientNo,PatientName,AppointmentDate,AppointmentTime,SurgeryRoomNo,SurgeryRoomDesc)

Staff(StaffNo,DentistName)

**3NF (Remove Transitive Dependencies)**

Staff(StaffNo,DentistName)

Patient(PatientNo,PatientName)

Appointment(StaffNo,PatientNo\*,AppointmentDate,AppointmentTime,SurgeryRoomNo\*)

SurgeryRoom(SurgeryRoomNo,SurgeryRoomDesc)

1. The table is susceptible to anomalies. Provide examples of insertion, deletion and modification anomalies.

**Insert Anomaly**

It is not possible to add a new patient unless that patient has made an appointment with staff.

**Modification Anomaly**

When we update the surgery room description from Room C to Room C103, we have to update the similar surgery room description in another row, if not it will cause inconsistency of data.

**Deletion Anomaly**

When we delete staff named Ellen Tan(S1032) records, we also will delete the patient details Raymond Low(P105).

c)Based on 3NF, draw an E-R diagram (Crow’s Foot notation).

**6.** Pigeon Healthcare Center provides a free treatment daily for each customer. Each treatment time (in minutes) is recorded.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CustNo | CustName | CustContact | StateCode | StateDesc | TreatDate | TreatID | TreatDesc | TreatTime |
| C1003 | Yee Si Go | 012-22552255 | S01 | Kuala Lumpur | 08/01/2017 | T001 | Electronic Chair | 35 |
| C1004 | Ai Li Lim | 012-33882288 | S02 | Selangor | 08/01/2017 | T001 | Electronic Chair | 30 |
| C1005 | Ellen Tan | 012-55335533 | S01 | Kuala Lumpur | 08/01/2017 | T002 | Foot M.assage | 75 |
| C1003 | Yee Si Go | 012-22552255 | S01 | Kuala Lumpur | 09/01/2017 | T001 | Electronic Chair | 38 |
| C1004 | Ai Li Lim | 012-33882288 | S02 | Selangor | 09/01/2017 | T002 | Foot Massage | 70 |
| C1005 | Ellen Tan | 012-55335533 | S01 | Kuala Lumpur | 09/01/2017 | T003 | Body Slimming | 55 |

1. Normalize the above structure to 1NF, 2NF and 3NF by providing meaningful relation names.

**1NF (Remove Repeating Group)**

Treatment(CustNo,CustName,CustContact,StateCode, StateDesc, TreatDate, TreatID, TreatDesc, TreatTime)

|

Customer(CustNo, CustName, CustContact, StateCode, StateDesc)

Treatment( CustNo\*,TreatDate, TreatID, TreatDesc, TreatTime)

**2NF (Remove Partial Dependencies)**

* **No partial dependencies.**

Customer(CustNo, CustName, CustContact, StateCode, StateDesc)

Treatment( CustNo\*,TreatDate, TreatID, TreatDesc, TreatTime)

**3NF (Remove Transitive Dependencies)**

Customer(CustNo, CustName, CustContact, StateCode\*)

State(StateCode, StateDesc)

Appointment(CustNo,TreatDate, TreatID\*, TreatTime)

Treatment(TreatID, TreatDesc)

1. The table is susceptible to anomalies. Provide examples of insertion, deletion and modification anomalies.

Insertion Anomaly

It is not possible to add a new customer unless that new customer performs any treatment.

Modification Anomaly

When we update the treatment description from Electronic Chair to Massage Chair we have to update the similar treatment description in another row, if not it will cause data inconsistency.

Deletion Anomaly

When we delete the Customer named Ellen Tan(C1005) record we also will delete the treatment details :Body Slimming(T003).

1. Based on 3NF, draw an E-R diagram (Crow’s Foot notation).

**7.** Pigeon Home Estate has three branches that manage a lot of properties within Selangor and Kuala Lumpur. Each property is allocate to one and only one branch and manages by one and only one agent.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BranchNo | BranchName | BranchManager | AgentCode | AgentName | PropertyNo | PropertyAddress | Owner | Rent |
| B001 | Love Pigeon | Eric | A01 | Coco | P0001 | Setapak Ria | Rose | 800 |
| B001 | Love Pigeon | Eric | A02 | Thomas | P0002 | Menara Alpha | May | 1000 |
| B002 | Big Pigeon | Almond | A03 | Jack | P0003 | TAR Villa | Rich | 1200 |
| B003 | Little Pigeon | Justine | A04 | Alice | P0004 | Beta Condo | Mandy | 1300 |
| B003 | Little Pigeon | Justine | A04 | Alice | P0005 | Setapak Ria | Rose | 850 |

1. Normalize the above structure to 1NF, 2NF and 3NF by providing meaningful relation names.

1NF

BranchProperty(BranchNo,BranchName,BranchManager,AgentCode,AgentName,PropertyNo,PropertyAddress,Owner,Rent)

|

Branch(BranchNo,BranchName,BranchManager, AgentCode, AgentName)

BranchProperty(BranchNo\*,PropertyNo,PropertyAddress,Owner,Rent)

2NF

Branch(BranchNo,BranchName,BranchManager, AgentCode, AgentName)

BranchProperty(BranchNo\*, PropertyNo\*,Rent)

Property (PropertyNo,PropertyAddress,Owner)

3NF

Branch(BranchNo,BranchName,BranchManager)

Agent(AgentCode,AgentName, BranchNo\*)

Property(PropertyNo,PropertyAddress,Owner)

BranchProperty(BranchNo\*, PropertyNo\*,Rent)

1. The table is susceptible to anomalies. Provide examples of insertion, deletion and modification anomalies.

INSERTION

It is not possible to add new property unless the new property is allocated to any branch.

MODIFICATION

When we update the Branch Manager of Little Pigeon (B003) from Justine to Alan, we have to update the similar Branch Manager in another row, if not it will cause data inconsistency.

DELETION

When we delete the Branch named Big Pigeon (B002), we have to delete the Branch Manager : Almond.

1. Based on 3NF, draw an E-R diagram (Crow’s Foot notation).

**8.** Consider the following first normal form relation for Travel\_Agency:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Bus\_Plate\_No** | **No\_Of\_Seats** | **Destination\_Code** | **Destination\_Description** | **Customer\_Code** | **Customer\_Name** | **Customer\_Tel\_No** | **Departure\_Date** |
| JBA1234 | 40 | TM1 | Tioman | C001 | Chong PF | 7153918 | 08/11/02 |
| JBA1234 | 40 | TM1 | Tioman | C002 | Fong KA | 6129015 | 08/11/02 |
| WFU3333 | 35 | PK1 | Pangkor | C003 | Liew HW | 7696551 | 08/11/02 |
| JBA1234 | 40 | TM1 | Tioman | C001 | Chong PF | 7153918 | 18/11/02 |
| JBA5678 | 30 | TM1 | Tioman | C003 | Liew HW | 7696551 | 08/12/02 |
| WFU3333 | 35 | PK1 | Pangkor | C003 | Liew HW | 7696551 | 18/12/02 |

1. Normalize the above structure to 1NF, 2NF and 3NF by providing meaningful relation names.

**1NF (Remove Repeating Group)**

Travel\_Agency(Bus\_Plate\_No, No\_Of\_Seats, Destination\_Code, Destination\_Description, Customer\_Code, Customer\_Name, Customer\_Tel\_No, Departure\_Date)

**|**

Bus (Bus\_Plate\_No, No\_Of\_Seats, Destination\_Code, Destination\_Description)

Travel\_Agency(Bus\_Plate\_No\*, Customer\_Code, Customer\_Name, Customer\_Tel\_No, Depature\_Date)

**2NF (Remove Partial Dependencies)**

Bus(Bus\_Plate\_No, No\_Of\_Seats, Destination\_Code, Destination\_Description)

Travel\_Agency(Bus\_Plate\_No\*, Customer\_Code\*, Depature\_Date)

Customer(Customer\_Code,Customer Name,Customer\_Tel\_No)

**3NF (Remove Transitive Dependencies)**

Travel\_Agency(Bus\_Plate\_No\*, Customer\_Code\*, Depature\_Date)

Customer(Customer\_Code,Customer Name,Customer\_Tel\_No)

Bus(Bus\_Plate\_No, No\_Of\_Seats, Destination\_Code\*)

Destination(Destination\_Code, Destination\_Description)

1. examples of insertion, deletion and modification anomalies.

Insertion Anomaly

It is not possible to add a new customer unless that new customer is taking any bus.

Modification Anomaly

When we update the Destination Description of TM1 from Tioman to Tioman Island, we have to update the similar destination description in another row, if not it will cause data inconsistency.

Deletion Anomaly

When we delete the Bus Plate No (JBA1234), we will also delete customer detail : Fong KA(C002)

Based on 3NF, draw an E-R diagram (Crow’s Foot notation).