**Quesition#1[10]**

Normalize up to 3rd NF.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **OID** | **ODATE** | **CID** | **CNAME** | **CSTATE** | **PID** | **PDESC** | **PPRICE** | **QTY** |
| 1006 | 40110 | 2 | APEX | NC | 7,5,4 | TABLE,  DSEK, CHAIR | 800,325,200 | 1,1,5 |
| 1007 | 40111 | 6 | ACME | GA | 11,4 | DRESSER,  CHAIR | 500,200 | 4,6 |

**In First Normal Form**

By removing repeating group

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| OID | ODATE | CID | CNAME | CSTATE | PID | PDESC | PPRICE | QTY |
| 1006 | 40110 | 2 | APEX | NC | 7 | TABLE | 800 | 1 |
| 1006 | 40110 | 2 | APEX | NC | 5 | DESK | 325 | 1 |
| 1006 | 40110 | 2 | APEX | NC | 4 | CHAIR | 200 | 5 |
| 1007 | 40111 | 6 | ACME | GA | 11 | DRESSER | 500 | 4 |
| 1007 | 40111 | 6 | ACME | GA | 4 | CHAIR | 200 | 6 |

**In 2nd Normal Form**

By removing partial depency

OID,PID 🡪 QTY

PID 🡪 PDESC, PPRICE

OID 🡪 ODATE, CID, CNAME, CSTATE

|  |  |  |
| --- | --- | --- |
| OID | CID | QTY |
| 1006 | 2 | 1 |
| 1006 | 2 | 1 |
| 1006 | 2 | 5 |
| 1007 | 6 | 4 |
| 1007 | 6 | 6 |

|  |  |  |
| --- | --- | --- |
| PID | PDESC | PPRICE |
| 7 | TABLE | 800 |
| 5 | DESK | 325 |
| 4 | CHAIR | 200 |
| 11 | DRESSER | 500 |
| 4 | CHAIR | 200 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| OID | ODATE | CID | CNAME | CSTATE |
| 1006 | 40110 | 2 | APEX | NC |
| 1006 | 40110 | 2 | APEX | NC |
| 1006 | 40110 | 2 | APEX | NC |
| 1007 | 40111 | 6 | ACME | GA |
| 1007 | 40111 | 6 | ACME | GA |

**In 3rd Normal Form**

By removing transitive depency

CID 🡪 CNAME, CSTATE

|  |  |  |
| --- | --- | --- |
| OID | ODATE | CID |
| 1006 | 40110 | 2 |
| 1006 | 40110 | 2 |
| 1006 | 40110 | 2 |
| 1007 | 40111 | 6 |
| 1007 | 40111 | 6 |

|  |  |  |
| --- | --- | --- |
| CID | CNAME | CSTATE |
| 2 | APEX | NC |
| 2 | APEX | NC |
| 2 | APEX | NC |
| 6 | ACME | GA |
| 6 | ACME | GA |

**So Total Tables In 3rd Normal form**

QUANTITY (OID, PID, QTY)

PRODUCT (PID, PDESC, PPRICE)

ORDER (OID, ODATE, CID)

CUSTOMER (CID, CNAME, CSTATE)

**Quesition#2 [10]**

Normalize up to BCNF.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Visit No.** | **VisitDate** | **PatNo** | **PatAge** | **PatCity** | **ProvNo** | **ProvSpecialty** | **Diagnosis** |
| V10020 | 1/13/2007 | P1 | 35 | DENVER | D1 | INTERNIST | EAR  INFECTION |
| V10020 | 1/13/2007 | P1 | 35 | DENVER | D2 | NURSE  PRACTIONER | INFLUENZZ |
| V93030 | 1/202007 | P3 | 17 | ENGLEWOOD | D2 | NURSE  PRACTIONER | PREGNANCY |
| V82110 | 1/18/2007 | P2 | 60 | BOULDER | D3 | CARDIOLOGIST | MURMUR |

**In First Normal Form**

There is no repeating group so it is already in 1st normal form

**In 2nd Normal Form**

By removing partial dependency

**VisitNo 🡪 VisitDate, PatNo, PatAge, PatCity**

**ProvNo 🡪 ProvSpeciality**

VISIT (**VisitNo**, VisitDate, PatNo, PatAge, PatCity)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| VisitNo | VisitDate | PatNo | PatAge | PatCity |
| V10020 | 1/13/2007 | P1 | 35 | DENVER |
| V82110 | 1/18/2007 | P2 | 60 | BOULDER |
| V93093 | 1/20/2007 | P3 | 17 | ENGLEWOOD |

PRIVIDER (**ProvNo**, ProvSpeciality)

|  |  |
| --- | --- |
| ProvNo | ProvSpeciality |
| D1 | INTERNIST |
| D2 | NURSE PRACTIONER |
| D3 | CARDIOLOGIST |

VisitProvDiagnosis(**VisitNo**, **ProvNo**, Diagnosis)

|  |  |  |
| --- | --- | --- |
| VisitNo | ProvNo | Diagnosis |
| V10020 | D1 | EAR INFECTION |
| V10020 | D2 | INFLUENZZ |
| V93093 | D2 | PREGNANCY |
| V82110 | D3 | MURMUR |

**In 3rd Normal Form**

By removing transitive depency

**PatNo 🡪 PatAge, PatCity**

PATIENT(**PatNo**, PatAge, PatCity)

|  |  |  |
| --- | --- | --- |
| PatNo | PatAge | PatCity |
| P1 | 35 | DENVER |
| P2 | 60 | BOULDER |
| P3 | 17 | ENGLEWOOD |

VISIT(**VisitNo**. VisitDate, PatNo)

|  |  |  |
| --- | --- | --- |
| VisitNo | VisitDate | PatNo |
| V10020 | 1/13/2007 | P1 |
| V82110 | 1/18/2007 | P2 |
| V93093 | 1/20/2007 | P3 |

**So Total Tables In 3rd Normal form**

PATIENT(**PatNo**, PatAge, PatCity)

VISIT(**VisitNo**, VisitDate, PatNo)

PRIVIDER (**ProvNo**, ProvSpeciality)

VisitProvDiagnosis(**VisitNo**, **ProvNo**, Diagnosis)

**As there is no overlapping of candidate key these tables are also in BCNF.**

**Quesition#4 [15]**

Book B: Problem 4.57

1. **Functional dependencies**

Primary key= TransactionID, CustomerID

**Partial Dependency:**

**TransactionID** 🡪 , CustomerID, CustomerName, CustomerEmail, TransactionDate, TransactionTime,TransactionTotalAmount, TransactionTax

**ProductID** 🡪 ProductDescription, ProductCategory, ProductManufacturerID, ManufacturerName, ProductListPrice, ProductPurchasePrice, ProductQuantity, TransactionProductTotal

**Transitive Dependency:**

**CustomerID** 🡪 CustomerName, CustomerEmail

**ProductManufacturerID** 🡪 ManufacturerName



Table is not in 2nd and 3rd normal form because there exist partial and transitive dependencies respectively

As there is no repeating group in the table, it is in 1st Normal form

**Quesition#5 [15]**

Book B: Problem 4.58

1. **Functional dependencies**

Primary key= RouteID , DriverID

**Partial Dependency:**

**RouteID** 🡪 RouteStartPoint, RouteEndPoint, RouteStandardDrivingTime

**DriverID** 🡪 DriverFName, DriverLName, DateDriverJoinedCompany, DriverDOB VehicleID, VehicleMake, VehicleModel, VehiclePassangerCapacity, DriverCertStartDate, DriverCertEndDate

**Transitive Dependency:**

**VehicleID** 🡪 VehicleMake, VehicleModel, VehiclePassangerCapacity, DriverCertStartDate, DriverCertEndDate

**B.**

Table is not in 2nd and 3rd normal form because there exist partial and transitive dependencies respectively

As there is no repeating group in the table, it is in 1st Normal form

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Quesition#6 [15]**

Book C: Problem 14.19

1. **Functional dependencies**

flatNo 🡪 flatAddress

placeNo 🡪 flatNo

leaseNo 🡪 bannerID, placeNo, startDate, finishDate

bannerID 🡪 fNAME, lName

**Primary key :** leaseNo

1. The table is not in 3rd normal form because there exist following transitive dependencies

**bannerID** 🡪 fNAME, lName

**placeNo** 🡪 flatNo

**flatNo** 🡪 flatAddress

**Quesition#7 [10]**

F = {Z Y, Y Z , X Y ,X V, VW X}.

1. Find the X-closure of all the attributes A,B,C,D, and E

W+ = W

V+ = V

X+ = VXYZ

Y+ = YZ

Z+ = YZ

b. Find all candidate keys.

XW+ = VWXYZ

VW+ = VWXYZ using F{VW  X, } and X+ = VXYZ

Candidate Key = { XW, VW}

**Quesition#8 [15]**

**You are given the below functional dependencies for relation R(A,B,C,D,E),**

**F = {AB C ,AB D, D A, BC D, BC E}.**

1. **Find all candidate keys.**

AB+ = ABCDE using AB AB , AB CD , AB BC E= AB E

BC+ = ABCDE using BC DE , BC BC , BC D A = BC A

Candidate Key = {AB, BC}

1. **Identify the best normal form that R satisfies (1NF, 2NF, 3NF, or BCNF).**

Ans: 3NF

1. **Is this relation is in BCNF? If not, show all dependencies that violate it**.

Ans:

As there is overlapping of candidate key {AB, BC} this relation is not in BCNF.

1. **Is this relation in 3NF? If not, show all dependencies that violate it.**

This is in 3rd NF.

**Quesition#9 [15]**

You are given the below set of functional dependencies for a relation R(A,B,C,D,E,F,G),

F = {AD BF ,CD EGC, BD F ,E D, F C, D F}.

1. **Find all candidate keys**.

Candidate Key = {AD, AE}

1. **Find F-closure.**

AA, BB, CC, DD, EE, FF, GG using reflexive property

AD B, AD F, CD E, CD G, CD C using decomposition property

D CDEFG Using D 🡪 F, F 🡪 C, CD🡪EGC

E🡪CDEFG Using E🡪D, D 🡪 F, F 🡪 C, CD🡪EGC

F🡪CF Using F 🡪 C

AD🡪ABCDEFG Using AD🡪 B , AD🡪AD , D CDEFG

CD🡪 CDEFG Using CD🡪EGC

BD🡪 BCDEFG Using BD🡪F, F 🡪 C, CD🡪EGC

AE🡪 ABCDEFG Using Augmentation, AE AD B = AE  B

1. **Find the minimal cover for the above set of functional dependencies.**

F = {AD🡪BF, D🡪E, D🡪F, D🡪G, E🡪D, F🡪C}