Police Case Management System

Minimal FD set and Proof that Relations are in BCNF

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1. CrimeRegister

Attributes: (CrimeID, StationID, DateOfCrime, TimeOfCrime, DateOfReport, CrimeType, Challan, Status, Description, OfficerID)

Minimal FD set:
CrimeID -> StationID
CrimeID -> DateOfCrime
CrimeID -> TimeOfCrime
CrimeID -> DateOfReport
CrimeID -> CrimeType
CrimeID -> Challan
CrimeID -> Status
CrimeID -> Description
CrimeID -> OfficerID

Closure of CrimeID:
CrimeID+ = {StationID, DateOfCrime, TimeOfCrime, DateOfReport, CrimeType, Challan, Status, Description, OfficerID}

Here Every element is functionally depended on CrimeID directly, therefore **key** is CrimeID.

Hence, Relation is in BCNF.

2. OfficerID

Attributes: (OfficerID, Fname, Minit, Lname, Email, Res_Contact, MobileNo, DoB, DateofJoin, Rank, Salary, Gender, StationID)

Minimal FD set:
OfficerID -> Fname
OfficerID -> Minit
OfficerID -> Lname
OfficerID -> Email
OfficerID -> Res_Contact
OfficerID -> MobileNo
OfficerID -> DoB
OfficerID -> DateofJoin
OfficerID -> Rank
OfficerID -> Salary
OfficerID -> Gender

OfficerID -> StationID

Closure of OfficerID:
OfficerID+ = {Fname, Minit, Lname, Email, Res_Contact, MobileNo, DoB, DateofJoin, Rank, Salary, Gender, StationID}

Here, every attribute of Officer is functionally dependent on OfficerID, therefore **key** is OfficerID.

Hence, Relation is in BCNF.

3. Station
Attributes: (StationID, StationName, Location, DSP_ID)

Minimal FD set:
StationID -> StationName
StationID -> Location
StationID -> DSP_ID

Closure of StationID:
StationID+ = {StationName, Location, DSP_ID}

Here, every attribute is functionally dependent on StationID, therefore StationID is the **key**.

Hence, Relation is in BCNF.

4. Complainer
Attributes: (Name, Address, DoB, Gender, Phone, IDType, IDNumber, CrimeID)

Minimal FD set:
{Name, CrimeID} -> Minit
{Name, CrimeID} -> Lname
{Name, CrimeID} -> Address
{Name, CrimeID} -> DoB
{Name, CrimeID} -> Gender
{Name, CrimeID} -> Phone
{Name, CrimeID} -> IDType
{Name, CrimeID} -> IDnumber

Closure of {Fname, CrimeID}:
{Name, CrimeID}+ = {Name, Minit, Lname, Address, DoB, Gender, Phone, IDType, IDNumber, CrimeID}

Here, Complainer is a weak entity. And its **key** is {Name, CrimeID}. And every attribute of relation is directly depended on key.

Therefore, Relation is in BCNF.

5. Accused

Attributes: (AccusedID, Fname, Minit, Lname, Phone, Gender, DoB, IDType, IDNumber, Address)

Minimal FD set:
AccusedID -> Fname
AccusedID -> Minit
AccusedID -> Lname
AccusedID -> Phone
AccusedID -> DoB
AccusedID -> Gender
AccusedID -> IDType
AccusedID -> IDNumber
AccusedID -> Address

Closure of AccusedID:
AccusedID+ = {Fname, Minit, Lname, Phone, Gender, DoB, IDType, IDNumber, Address}

Here, every attribute of Accused is functionally dependent on AccusedID, therefore **key** is AccusedID.

Hence, Relation is in BCNF.

6. Victim
Attributes: (VictimID, Fname, Minit, Lname, Phone, Gender, DoB, IDType, IDNumber, Address)

Minimal FDs:
VictimID-> Fname
VictimID-> Minit
VictimID-> Lname
VictimID-> Phone
VictimID-> DoB
VictimID-> Gender
VictimID-> IDType
VictimID-> IDNumber
VictimID-> Address

Closure of VictimID:
VictimID+ = {Fname, Minit, Lname, Phone, Gender, DoB, IDType, IDNumber, Address}

Here, every attribute of Victim is functionally dependent on VictimID, therefore **key** is VictimID.

Hence, Relation is in BCNF.

7. Arrested
Attributes: (ArrestID, Fname, Minit, Lname, Contact, BailStatus, Amount, BailBy, ReleaseDate, StationID, CrimeID)

Minimal FD set:
ArrestID -> Fname
ArrestID -> Minit

ArrestID -> Lname
ArrestID -> Contact
ArrestID -> BailStatus
ArrestID -> Amount
ArrestID -> BailBy
ArrestID -> ReleaseDate
ArrestID -> StationID
ArrestID -> CrimeID

Closure of ArrestID:
ArrestID+ = {Fname, Minit, Lname, Contact, BailStatus, Amount, BailBy, ReleaseDate, StationID, CrimeID}

Here, every attribute of Arrested is functionally dependent on ArrestID, therefore **key** is ArrestID.

Hence, Relation is in BCNF.

8. Equipment

Attributes: (EquipID, EquipName, EquipType, LastIssueDate, Status, Condition)

Minimal FD set:
EquipID -> EquipName
EquipID -> EquipType
EquipID -> LastIssueDate
EquipID -> Status
EquipID -> Condition

Closure of EquipID:
EquipID+ = { EquipName, EquipType, LastIssueDate, Status, Condition}

Here, every attribute of Equipment is functionally dependent on EquipID, therefore **key** is EquipID.

Hence, Relation is in BCNF.

9. Evidence

Attributes: (EvidenceID, CrimeID, StationID, EvidenceType, Description)

Minimal FDs:
EvidenceID -> CrimeID
EvidenceID -> StationID
EvidenceID -> EvidenceType
EvidenceID -> Description

Closure of EvidenceID:
EvidenceID+ = {CrimeID, StationID, EvidenceType, Description}

Here, every attribute of Evidence is functionally dependent on EvidenceID, therefore **key** is EvidenceID.

Hence, Relation is in BCNF.

10. Witness

Attributes: (CrimeID, witnessName, Contact, IDType, IDNumber, Statement)

Minimal FD set:
{witnessName, CrimeID} -> contact
{witnessName, CrimeID} -> IDType
{witnessName, CrimeID} -> IDNumber
{witnessName, CrimeID} -> Statement

Closure or witnessName:
witnessName+ = {witnessName}

Closure of {witnessName, CrimeID}:
{witnessName, CrimeID}+ = { Contact, IDType, IDNumber, Statement}

Here, every attribute of Witness is functionally dependent on {witnessName, CrimeID}, therefore **key** is {witnessName, CrimeID}.

Hence, Relation is in BCNF.

11. Section

Attributes: (SectionID, Description)

Minimal FD set:
SectionID -> Description

Here, every attribute of Section is functionally dependent on SectionID, therefore **key** is SectionID.

Also, any relation with only two attributes is always in BCNF, Therefore this relation is also in BCNF.

12. Arrested_Under

Attributes: (ArrestID, SectionID)

Here both combined are the primary key and include no other attribute.
Therefore **key** is {ArrestID, SectionID}

Also, any relation with only two attributes is always in BCNF, Therefore this relation is also in BCNF.

13. Crime_Lies_Under

Attributes: (CrimeID, SectionID)

Here both combined are the primary key and include no other attribute.
Therefore **key** is {CrimeID, SectionID}

Also, any relation with only two attributes is always in BCNF, Therefore this relation is also in BCNF.

14. Accused_Partof
Attributes: (AccusedID, CrimeID)

Here both combined are the primary key and include no other attribute.
Therefore **key** is {AccusedID, CrimeID}

Also, any relation with only two attributes is always in BCNF, Therefore this relation is also in BCNF.

15. Victim_Partof
Attributes: (VictimID, CrimeID)

Here both combined are the primary key and include no other attribute.
Therefore **key** is {VictimID, CrimeID}

Also, any relation with only two attributes is always in BCNF, Therefore this relation is also in BCNF.

16. Has_issued
Attributes: (officerID, EquipID, issueDate)

Minimal FD set:
{officerID, EquipID} -> issueDate

Here, every attribute of Has_issued is functionally dependent on {officerID, EquipID, therefore **key** is {officerID, EquipID.

Hence, Relation is in BCNF.