IT - 214

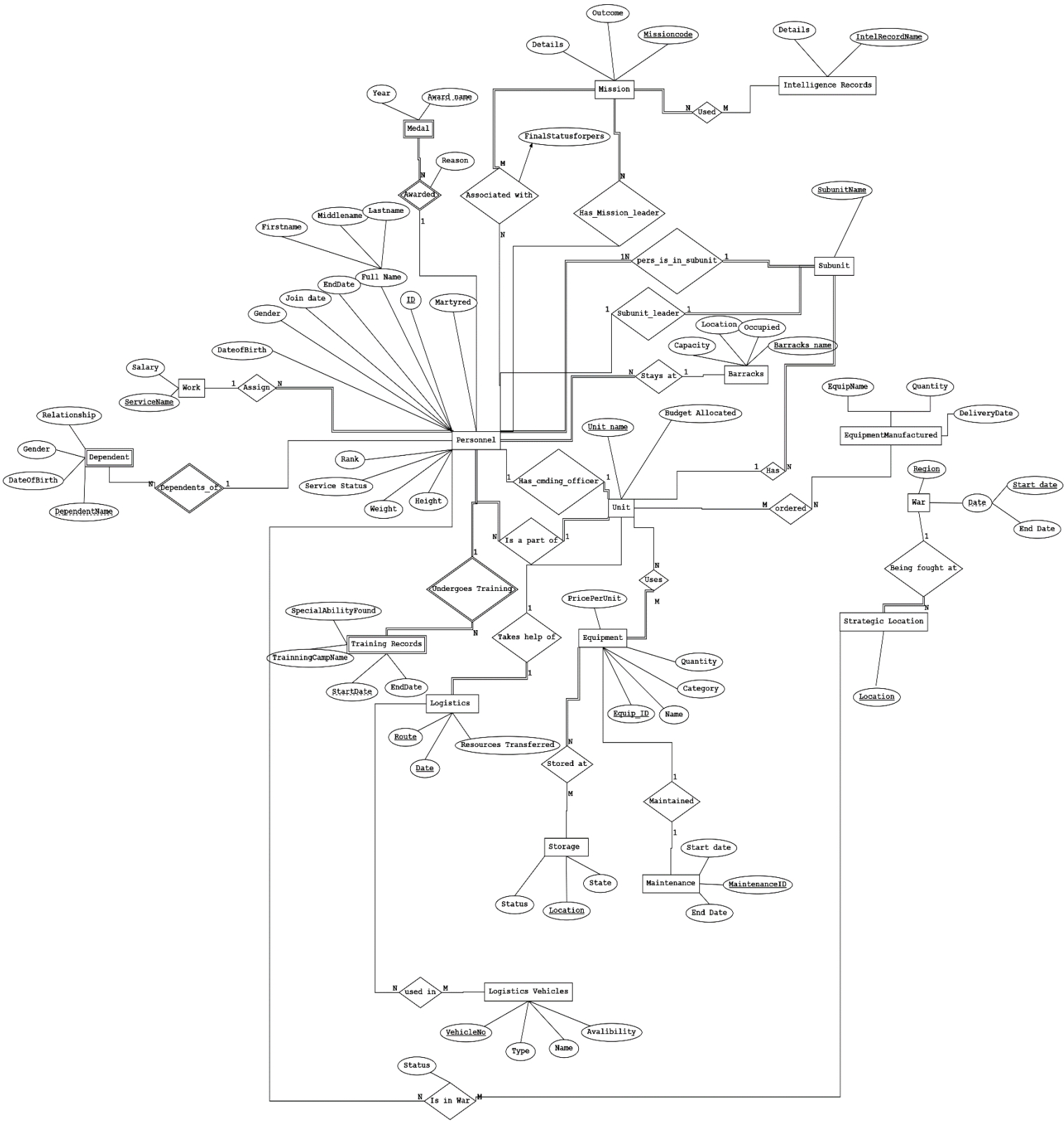
DATABASE MANAGEMENT SYSTEMS

Title : - Military Database

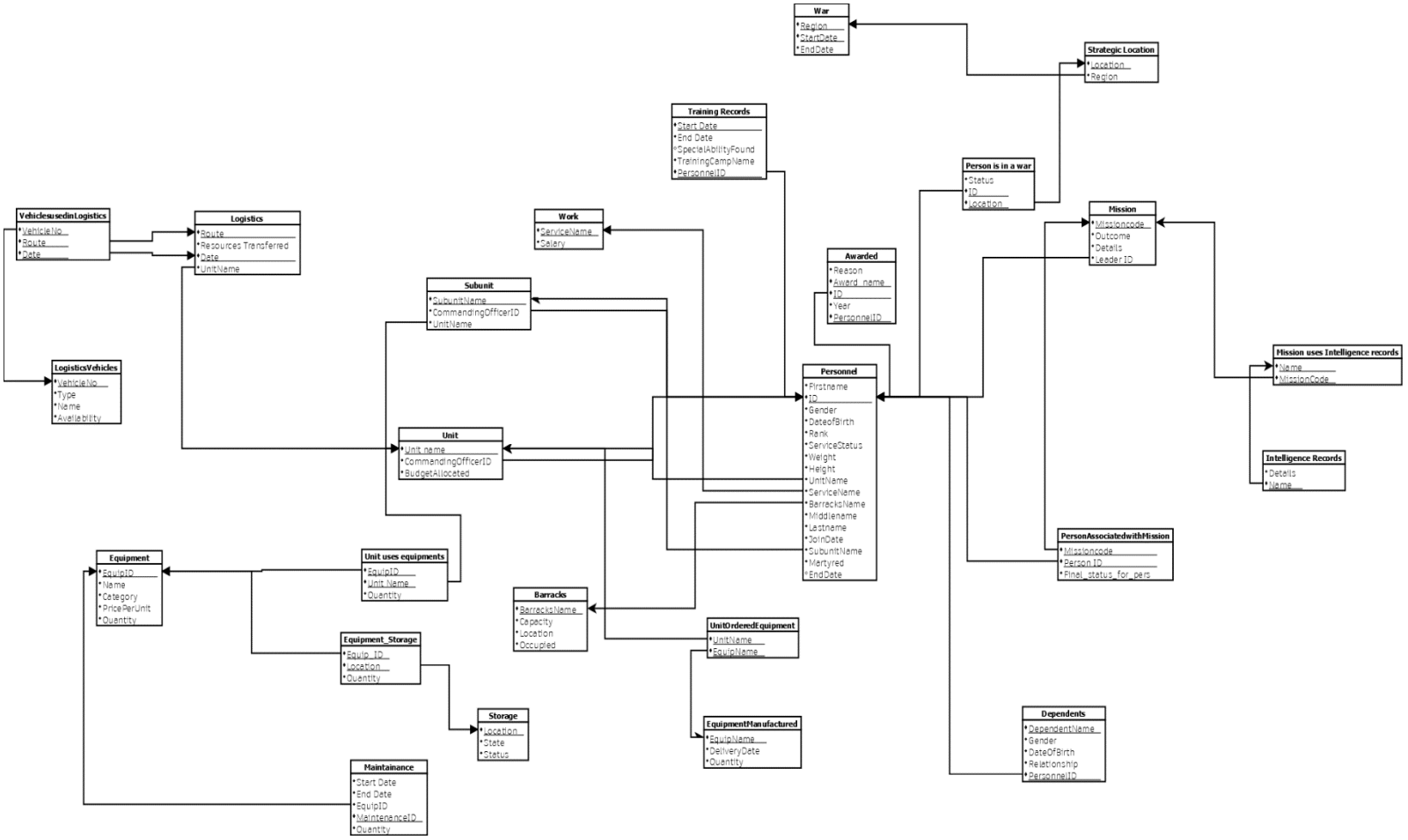
ERD and Relational Schema with Functional Dependencies and normalization proofs.

Group Details

Name	ID
Chirag Chaudhari	202201219
Hemal Ravrani	202201235
Harsh Bosamiya	202201243
Marmik Vasava	202201252
Saumya Vasa	202201254


Outcome
Details
Missioncode
Mission
Details
IntelRecordName
Intelligence Records
Used
Year
Award name
Medal
FinalStatusforpers
Reason
Awarded
Associated with
Has_Mission_leader
SubunitName
Middlename
Lastname
Firstname
Full Name
pers_is_in_subunit
Subunit
EndDate
Join date
ID
Martyred
Gender
Subunit_leader
Location
Occupied
Capacity
Barracks name
DateofBirth
Salary
Work
Assign
ServiceName
Stays at
Barracks
EquipName
Quantity
Relationship
Budget Allocated
DeliveryDate
Unit name
EquipmentManufactured
Gender
Dependent
Personnel
Rank
Has_cmding_officer
Has
Region
DateOfBirth
Dependents_of
Service Status
Weight
Height
Unit
ordered
War
Start date
Date
End Date
DependentName
Is a part of
Being fought at
Undergoes Training
Uses
SpecialAbilityFound
PricePerUnit
Strategic Location
Training Records
Takes help of
Equipment
TrainningCampName
Quantity
StartDate
EndDate
Category
Logistics
Equip_ID
Name
Route
Resources Transferred
Stored at
Maintained
Date
Storage
Start date
State
Maintenance
MaintenanceID
Status
Location
End Date
used in
Logistics Vehicles
VehicleNo
Avalibility
Type
Name
Status
Is in War

RELATIONAL SCHEMA



Functional Dependencies:

ID → Gender

ID → DateOfBirth

ID → Rank

ID → Service Status

ID → Weight

ID → Height

ID → UnitName

ID → ServiceName

ID → BarracksName

ID → FirstName

ID → MiddleName

ID → LastName

ID → JoinDate

ID → SubunitName

ID → ServiceName

ID → Martyred

ID → EndDate

UnitName → CommandingOfficerID

UnitName → BudgetAllocated

SubunitName → CommandingOfficerID

SubunitName → UnitName

(PersonnelID, AwardName) → Reason

(PersonnelID, AwardName) → Year

(PersonnelID, StartDate) → EndDate

(PersonnelID, StartDate) → SpecialAbilityFound

(PersonnelID, StartDate) → TraninigCampName

ServiceName → Salary

BarracksName → Capacity

BarracksName → Location

BarracksName → Occupied

EquipmentID → Name

EquipmentID → Category

EquipmentID → PriceperUnit

(StartDate, EquipmentID) → EndDate

(StartDate, EquipmentID) → Quantity

Location → State

Location → Status

(Location, EquipID) → Quantity

(UnitName, EquipID) → Quantity

(Route, Date) → ResourcesTransferred

(Route, Date) → UnitName

VehicleNo → Type

VehicleNo → Name

VehicleNo → Availability

(VehicleNo, Route, Data) → (VeicleNo, Route, Data)

EquipName → DeliveryDate

EquipName → Quantity

(UnitName, EquipName) → (UnitName, EquipName)

IntelRecordName → Details

MissionCode → Outcome

MissionCode → Details

MissionCode → LeaderID

(MissionCode, PersonnelID) → FinalStatusforpers

(Missioncode, Name) → (Missioncode, Name)

(Region, StartDate) → (EndDate)

Location → Region

ID → Status

ID → Location

(PersonnelID ,DependentName) → DateOfBirth

(PersonnelID ,DependentName) → Gender

(PersonnelID ,DependentName) → Relationship

Proof that relations are in Boyce-Codd Normal Form

1. ‘Personnel’ relation :

- **Attributes :**

  Personnel{ID, Gender, DateOfBirth, FirstName, MiddleName, LastName, ServiceStatus, Rank, Weight, Height, UnitName, WorkID, BarracksName, JoinDate, SubunitName}

- **Functional Dependencies :**

  ID → Gender

  ID → DateOfBirth

  ID → Rank

  ID → Service Status

  ID → Weight

  ID → Height

  ID → UnitName

  ID → ServiceName

  ID → BarracksName

  ID → FirstName

  ID → MiddleName

  ID → LastName

  ID → JoinDate

  ID → SubunitName

  ID → ServiceName

  ID → Martyred

ID ➞ EndDate

Let **X = ID**

X^+ = {ID, Gender, DateOfBirth, FirstName, MiddleName, LastName, ServiceStatus, Rank, Weight, Height, UnitName, ServiceName, BarracksName, JoinDate, SubunitName, ServiceName, EndDate, Martyred}

Thus, **Primary key = ID**

The left side of all the FDs in minimal set of FDs for the relation 'Personnel' is ID, which is the primary key of this relation, so **"Personnel" is in BCNF.**

2. 'Unit' relation :

- **Attributes :**

  Unit{UnitName, CommandingOfficerID, BudgetAllocated}

- **Functional Dependencies :**

  UnitName ➞ CommandingOfficerID

  UnitName ➞ BudgetAllocated

Let **X = UnitName**

X^+ = {UnitName, CommandingOfficerID, BudgetAllocated}

Thus, **Primary key = UnitName**

The left side of all the FDs in minimal set of FDs for the relation 'Unit' is UnitName, which is the primary key of this relation, so **"Unit" is in BCNF.**

3. ‘Subunit’ relation :

- **Attributes :**

  Subunit{SubunitName, CommandingOfficerID, UnitName}

- **Functional Dependencies :**

  SubunitName → CommandingOfficerID

  SubunitName → UnitName

Let **X = SubunitName**

X^+ = {SubunitName, CommandingOfficerID, UnitName}

Thus, **Primary key = SubunitName**

The left side of all the FDs in minimal set of FDs for the relation ‘Subunit’ is SubunitName, which is the primary key of this relation, so **“Subunit” is in BCNF.**

4. ‘Awarded’ relation :

- **Attributes :**

  Awarded{AwardName, Reason, PersonnelID, Year}

- **Functional Dependencies :**

  (PersonnelID, AwardName) → Reason

  (PersonnelID, AwardName) → Year

Let **X** = (PersonnelID, AwardName)

X^+ = {AwardName, Reason, PersonnelID, Year}

Thus, **Primary key =** (PersonnelID, AwardName)

The left side of all the FDs in minimal set of FDs for the relation 'Awarded' is (PersonnelID, AwardName) , which is the primary key of this relation, so **"Awarded" is in BCNF.**

5. 'TrainingRecords' relation :

- **Attributes :**

  TrainingRecords{PersonnelID, StartDate, EndDate, TrainingCampName, SpecialAbilityFound}

- **Functional Dependencies :**

  (PersonnelID, StartDate) ➞ EndDate

  (PersonnelID, StartDate) ➞ SpecialAbilityFound

  (PersonnelID, StartDate) ➞ TraninigCampName

Let **X =** (PersonnelID, StartDate)

$\mathbf{X}^{+}$ = {PersonnelID, StartDate, EndDate, TrainingCampName, SpecialAbilityFound}

Thus, **Primary key =** (PersonnelID, StartDate)

The left side of all the FDs in minimal set of FDs for the relation 'TrainingRecords' is (PersonnelID, StartDate) , which is the primary key of this relation, so **"TrainingRecords" is in BCNF.**

6. 'Work' relation :

- **Attributes :**

  Work{ServiceName, Salary}

- **Functional Dependencies :**

  ServiceName ⟶ Salary

Let **X =** ServiceName

X^+ = {ServiceName, Salary}

Thus, **Primary key =** ServiceName

The left side of all the FDs in minimal set of FDs for the relation 'Work' is ServiceName , which is the primary key of this relation, so **"Work" is in BCNF.**

7. 'Barracks' relation :

- **Attributes :**

  Barracks{BarracksName, Capacity, Location, Occupied}

- **Functional Dependencies :**

  BarracksName ⟶ Capacity

  BarracksName ⟶ Location

  BarracksName ⟶ Occupied

Let **X =** BarracksName

X^+ = {BarracksName, Capacity, Location, Occupied}

Thus, **Primary key =** BarracksName

The left side of all the FDs in minimal set of FDs for the relation 'Barracks' is BarracksName , which is the primary key of this relation, so **"Barracks" is in BCNF.**

8. ‘Equipment’ relation :

- **Attributes :**

  Equipments{EquipID, Name, Category, Priceperunit}

- **Functional Dependencies :**

  EquipmentID → Name

  EquipmentID → Category

  EquipmentID → PriceperUnit

Let **X** = EquipID

$\mathbf{X}^{+}$ = {EquipID, Name, Category, Priceperunit}

Thus, **Primary key =** EquipID

The left side of all the FDs in minimal set of FDs for the relation ‘Equipment’ is EquipID , which is the primary key of this relation, so **“Equipment” is in BCNF.**

9. ‘Maintenance’ relation :

- **Attributes :**

  Maintenance{StartDate, EndDate, EquipID, Quantity}

- **Functional Dependencies :**

  (StartDate, EquipmentID) → EndDate

  (StartDate, EquipmentID) → Quantity

Let **X =** (StartDate, EquipID)

X^+ = {StartDate, EndDate, EquipID, Quantity}

Thus, **Primary key =** (StartDate, EquipID)

The left side of all the FDs in minimal set of FDs for the relation 'Maintenance' is (StartDate, EquipID) , which is the primary key of this relation, so **"Maintenance" is in BCNF.**

10. 'Storage' relation :

- **Attributes :**

  Storage{Location, State, Status}

- **Functional Dependencies :**

  Location ⟶ State

  Location ⟶ Status

Let **X =** Location

X^+ = {Location, State, Status}

Thus, **Primary key =** Location

The left side of all the FDs in minimal set of FDs for the relation 'Storage' is Location , which is the primary key of this relation, so **"Storage" is in BCNF.**

11. 'EquipmentStorage' relation :

- **Attributes :**

  EquipmentStorage{Location, EquipID, Quantity

- **Functional Dependencies :**

(Location, EquipID) ➞ Quantity

Let **X =** (Location, EquipID)

X^+ = {Location, EquipID}

Thus, **Primary key =** (Location, EquipID)

The left side of all the FDs in minimal set of FDs for the relation ‘EquipmentStorage’ is (Location, EquipID) , which is the primary key of this relation, so **“EquipmentStorage” is in BCNF.**

12. ‘UnitusesEquipment’ relation :

- **Attributes :**

  UnitusesEquipment{UnitName, EquipID, Quantity}

- **Functional Dependencies :**

  (UnitName, EquipID) ➞ Quantity

Let **X =** (UnitName, EquipID)

X^+ = {UnitName, EquipID, Quantity}

Thus, **Primary key =** (UnitName, EquipID)

The left side of all the FDs in minimal set of FDs for the relation ‘UnitusesEquipment’ is (UnitName, EquipID) , which is the primary key of this relation, so **“UnitusesEquipment” is in BCNF.**

13. ‘Logistics’ relation :

- **Attributes :**

  Logistics{Route, ResourcesTransferred, Date, Unitname}

- **Functional Dependencies :**

  (Route, Date) ⟶ ResourcesTransferred

  (Route, Date) ⟶ UnitName

Let **X** = (Route, Date)

$\mathbf{X}^{+}$ = {Route, ResourcesTransferred, Date, Unitname}

Thus, **Primary key** = (Route, Date)

The left side of all the FDs in minimal set of FDs for the relation 'Logistics' is (Route, Date), which is the primary key of this relation, so **"Logistics" is in BCNF.**

14. 'LogisticsVehicles' relation :

- **Attributes :**

  LogisticsVehicles{VeicleNo, Name, Type, Availability}

- **Functional Dependencies :**

  VehicleNo ⟶ Type

  VehicleNo ⟶ Name

  VehicleNo ⟶ Availability

Let **X** = VehicleNo

$\mathbf{X}^{+}$ = {VeicleNo, Name, Type, Availability}

Thus, **Primary key** = VehicleNo

The left side of all the FDs in minimal set of FDs for the relation ‘LogisticsVehicles’ is VehicleNo, which is the primary key of this relation, so **“LogisticsVehicles” is in BCNF.**

15. ‘VehiclesusedinLogistics’ relation :

- **Attributes :**

  VehiclesusedinLogistics{VehicleNo, Route, Date}

- **Functional Dependencies :**

  (VehicleNo, Route, Date) ⟶ (VeicleNo, Route, Date)

Let **X** = (VehicleNo, Route, Date)

$\mathbf{X}^{+}$ = {VehicleNo, Route, Date}

Thus, **Primary key** = (VehicleNo, Route, Date)

The left side of all the FDs in minimal set of FDs for the relation ‘VehiclesusedinLogistics’ is (VehicleNo, Route, Data), which is the primary key of this relation, so **“VehiclesusedinLogistics” is in BCNF.**

16. ‘EquipmentManufactured’ relation :

- **Attributes :**

  EquipmentManufactured{EquipName, DeliveryDate, Quantity}

- **Functional Dependencies :**

  EquipName ⟶ DeliveryDate

  EquipName ⟶ Quantity

Let **X** = EquipName

$\mathbf{X}^{+}$ = {EquipName, DeliveryDate, Quantity}

Thus, **Primary key** = EquipName

The left side of all the FDs in minimal set of FDs for the relation ‘EquipmentManufactured’ is EquipName, which is the primary key of this relation, so **“EquipmentManufactured” is in BCNF.**

17. ‘UnitOrderedEquipment’ relation :

- **Attributes :**

  UnitOrderedEquipment{UnitName, EquipName}

- **Functional Dependencies :**

  (UnitName, EquipName) ➞ (UnitName, EquipName)

Let **X** = UnitName, EquipName

$\mathbf{X}^{+}$ = {UnitName, EquipName}

Thus, **Primary key** = UnitName, EquipName

The left side of all the FDs in minimal set of FDs for the relation ‘UnitOrderedEquipment’ is UnitName, EquipName, which is the primary key of this relation, so **“UnitOrderedEquipment” is in BCNF.**

18. ‘IntelligenceRecords’ relation :

- **Attributes :**

  IntelligenceRecords{Details, IntelRecordName}

- **Functional Dependencies :**

  IntelRecordName ➞ Details

Let **X =** IntelRecordName

X^+ = {Details, IntelRecordName}

Thus, **Primary key =** IntelRecordName

The left side of all the FDs in minimal set of FDs for the relation 'IntelligenceRecords' is IntelRecordName which is the primary key of this relation, so **"IntelligenceRecords" is in BCNF**

19. 'Mission' relation :

- **Attributes :**

  Mission{Missioncode, Details, Outcome, LeaderID}

- **Functional Dependencies :**

  MissionCode → Outcome

  MissionCode → Details

  MissionCode → LeaderID

Let **X =** Missioncode

X^+ = {Missioncode, Details, Outcome, LeaderID}

Thus, **Primary key =** MissionCode

The left side of all the FDs in minimal set of FDs for the relation 'Mission' is Missioncode which is the primary key of this relation, so **"Mission" is in BCNF**

20. 'PersonAssociatedwithMission' relation :

- **Attributes :**

PersonAssociatedwithMission{Missioncode, FinalStatusforpers, PersonnelID}

- **Functional Dependencies :**

(MissionCode, PersonnelID) ➞ FinalStatusforpers

Let **X** = (MissionCode, PersonnelID)

$\mathbf{X}^{+}$ = {Missioncode, FinalStatusforpers, PersonnelID}

Thus, **Primary key** =(MissionCode, PersonnelID)

The left side of all the FDs in minimal set of FDs for the relation 'PersonAssociatedwithMission' is (MissionCode, PersonnelID) which is the primary key of this relation, so **"PersonAssociatedwithMission" is in BCNF**

21. 'MissionUsesIntelligence' relation :

- **Attributes :**

MissionUsesIntellligence{Missioncode, Name}

- **Functional Dependencies :**

(Missioncode, Name) ➞ (Missioncode, Name)

Let **X** = Missioncode, Name

$\mathbf{X}^{+}$ = {Missioncode, FinalStatusforpers, PersonnelID}

Thus, **Primary key = (**Missioncode, Name)

The left side of all the FDs in minimal set of FDs for the relation 'MissionUsesIntellligence' is (Missioncode, Name) which is the primary key of this relation, so **"MissionUsesIntelligence" is in BCNF**

22. ‘War’ relation :

- **Attributes :**

  War{Region, StartDate, EndDate}

- **Functional Dependencies :**

  (Region, StartDate) ⟶ (EndDate)

Let **X** = Region, StartDate

$\mathbf{X}^{+}$ = {Region, StartDate, EndDate}

Thus, **Primary key = (**Region, StartDate)

The left side of all the FDs in minimal set of FDs for the relation ‘War’ is (Region, StartDate) which is the primary key of this relation, so **“War” is in BCNF.**

23. ‘StrategicLocation’ relation :

- **Attributes :**

  StrategicLocation{Location, Region }

- **Functional Dependencies :**

  Location ⟶ Region

Let **X** = Location

$\mathbf{X}^{+}$ = {Region, Location}

Thus, **Primary key = Location**

The left side of all the FDs in minimal set of FDs for the relation ‘StrategicLocation’ is Location which is the primary key of this relation, so **“StrategicLocation” is in BCNF.**

24. ‘pers_is_inawar’ relation :

- **Attributes :**

  pers_is_inawar{Status, ID, Location }

- **Functional Dependencies :**

  ID ⟶ Status

  ID ⟶ Location

Let **X** = ID

X^+ = { Status, ID, Location }

Thus, **Primary key = ID**

The left side of all the FDs in minimal set of FDs for the relation ‘pers_is_inawar’ is Location which is the primary key of this relation, so **“**pers_is_inawar**” is in BCNF.**

25. ‘Dependents’ relation :

- **Attributes :**

  Dependents{DependentName, DateOfBirth,Gender, Relationship, PersonnelID }

- **Functional Dependencies :**

  (PersonnelID ,DependentName) ⟶ DateOfBirth

  (PersonnelID ,DependentName) ⟶ Gender

  (PersonnelID ,DependentName) ⟶ Relationship

Let **X** =(PersonnelID ,DependentName)

X^+ = {DependentName, DateOfBirth,Gender, Relationship, PersonnelID }

Thus, **Primary key =** (PersonnelID ,DependentName)

The left side of all the FDs in minimal set of FDs for the relation ‘Dependents’ is (PersonnelID ,DependentName) which is the primary key of this relation, so “Dependents” **is in BCNF.**