Mumbai Dabbawala Database

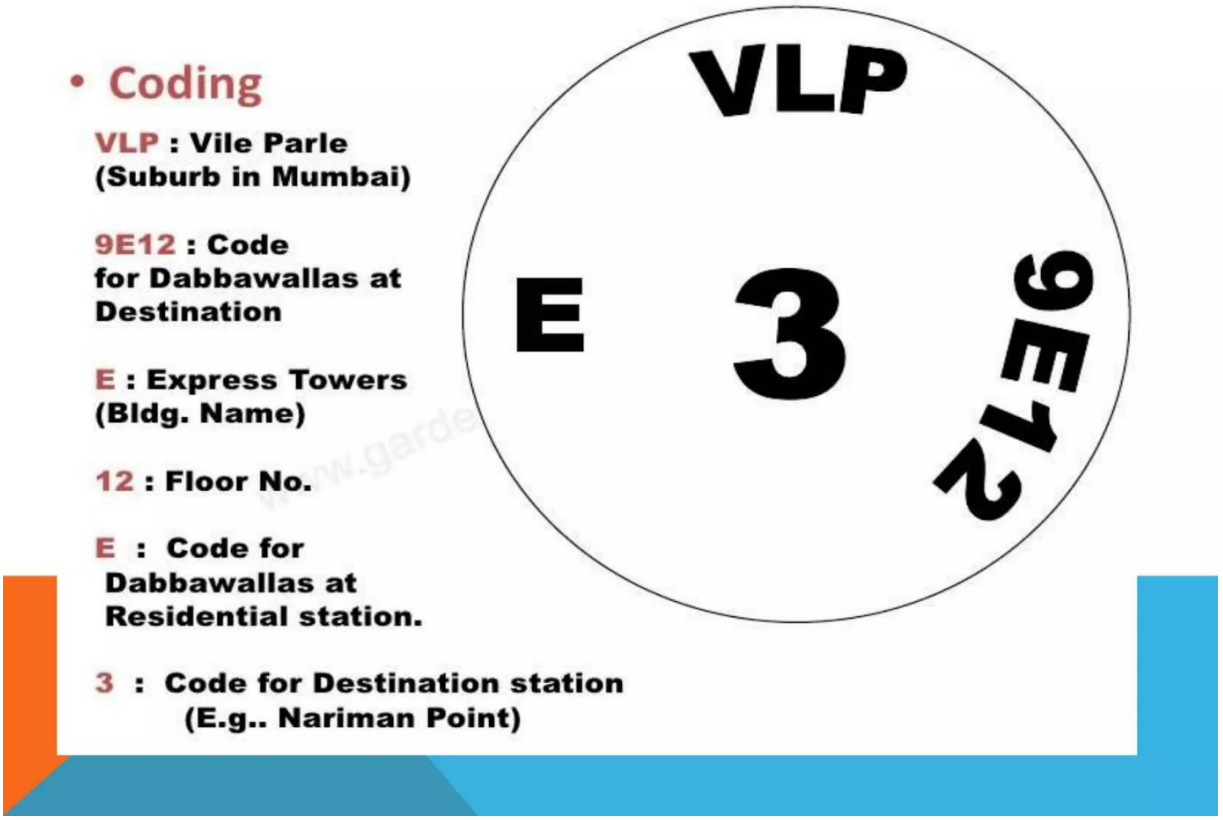
Scope of Database:

Preserves and manipulates records of all details of dabbawala: Name, age, address, phone number, employeeID. Details of sender and receiver: Name, Residential address, Phone number, Destination address, senderID, receiverID. Details of dabbas: DabbaID, Fine Source Area Code, Destination area code, Source railway station, Destination railway station, Receiver area ID, Receiver floor and building.

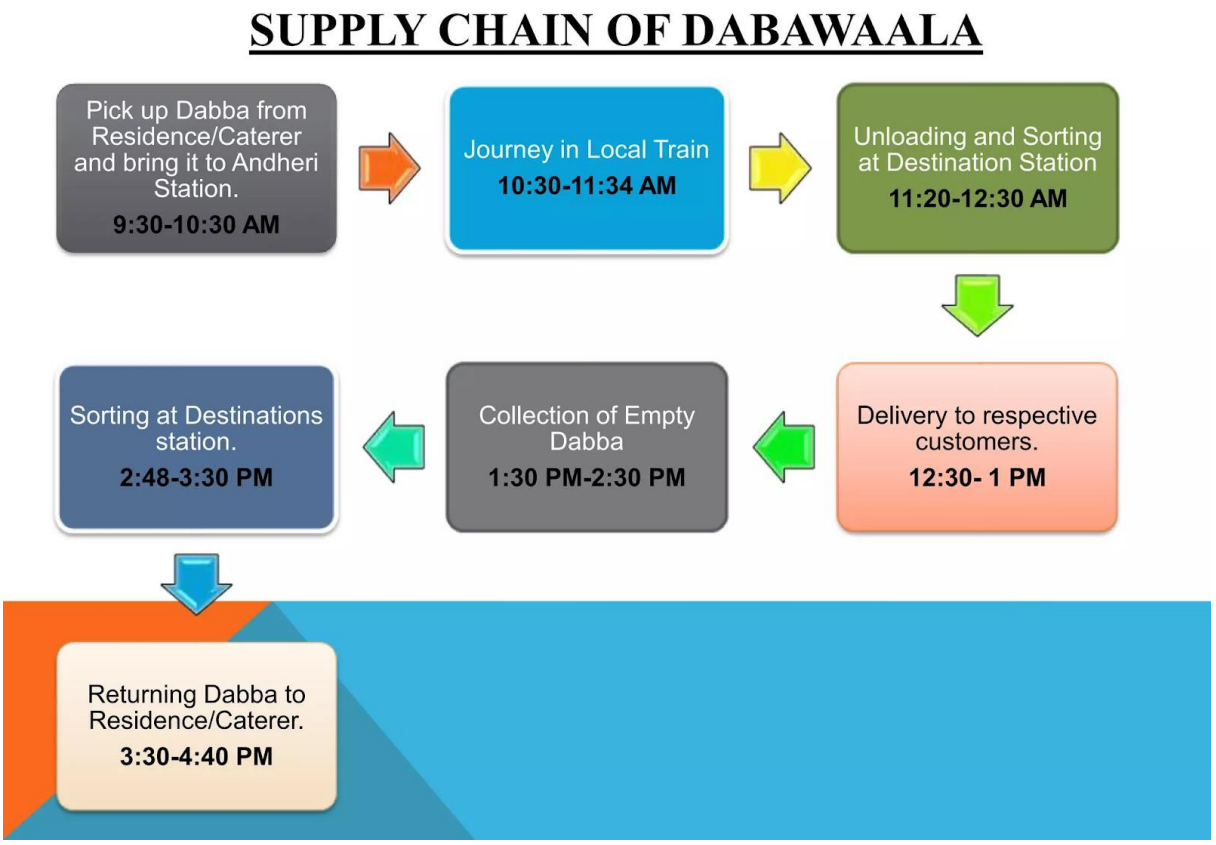
Description:

- The Dabbawalas run their food delivery service on four fundamental pillars. These are the organization, management, process, and culture.
- They constitute a lunchbox delivery and return system that delivers hot lunches from homes and restaurants to people at work in Mumbai.
- Mumbai's 5000 plus Dabbawalas are world famous for their impeccable service standards. They pick up lunch boxes/ tiffin carriers from over 2,00,000+ homes/ apartments, deliver them to some 80,000+ destinations and again ensure their safe return to those homes/ apartments – all on the same day with each lap of journey enroute accomplished within the specified time limits
- The lunchboxes are collected in the late morning, mostly delivered by local trains and bicycles, and then dropped off empty in the afternoon.

- Only one dabbawala visits a particular area and collects the tiffins from different senders. A collecting dabbawala, usually on bicycle, collects dabbas either from a worker's home or from the dabba makers
- As many of the carriers are of limited literacy (the average literacy of Dabbawalas is that of 8th grade), the dabbas (boxes) have some sort of distinguishing mark on them, such as a colour or group of symbols.

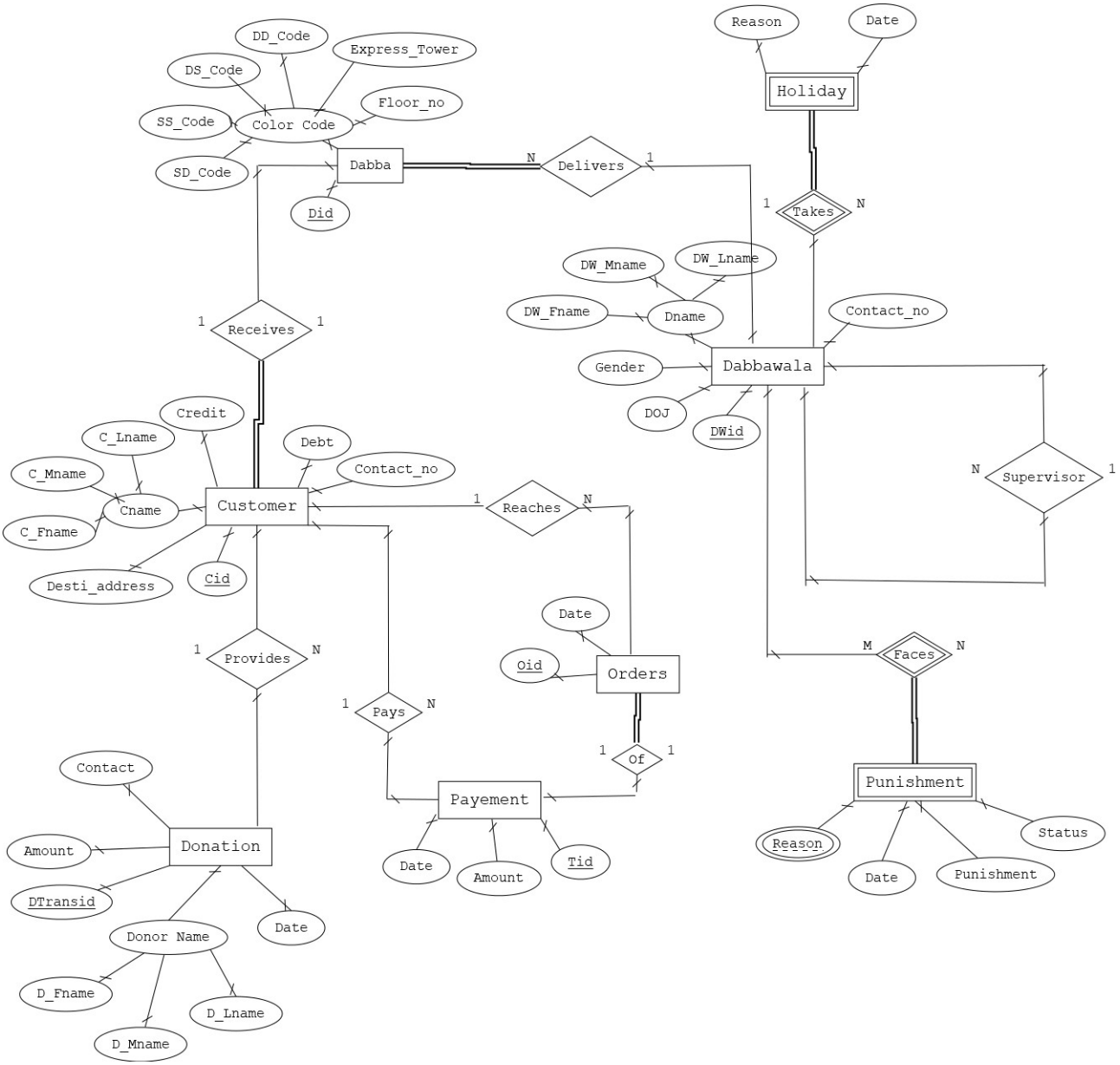


- A dabbawala can be either a foreman, *mukadam*, or a simple delivery man, *gaddi*. Workers with more than 10 years of experience serve as supervisors, or *muqaddams.* Every group has one or more muqaddams, who supervise the coding, sorting, and loading and unloading of dabbas and are responsible for resolving disputes, overseeing collections, and troubleshooting. They also pick up and deliver dabbas themselves.



- **They have Six Sigma accuracy in the delivery process that means there's only 1 in 6 million chances of mistake.**
- Each dabbawala is required to contribute a minimum capital in kind, in the form of two bicycles, a wooden crate for the tiffins, white cotton kurta-pyjamas, and the white Gandhi cap (topi). Each month there is a division of the earnings of each unit. All the workers get the same earning be it a group leader or a director or anyone else. All work for same duration of time to deliver the tiffins on time.
- Fines and punishments are imposed on dabbawalas for alcohol, tobacco, out-of-uniform, and absenteeism.

ER diagram:


DD_Code
Express_Tower
DS_Code
Floor_no
SS_Code
Color Code
SD_Code
Dabba
Did
N
Delivers
1
Reason
Date
Holiday
1
Takes
N
DW_Mname
DW_Lname
DW_Fname
Dname
Contact_no
Gender
Dabbawala
DOJ
DWid
1
Receives
1
Credit
C_Lname
Debt
C_Mname
Contact_no
Cname
Customer
C_Fname
Desti_address
Cid
1
Reaches
N
N
Supervisor
1
Date
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Orders
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Amount
Donation
DTransid
Donor Name
Date
D_Fname
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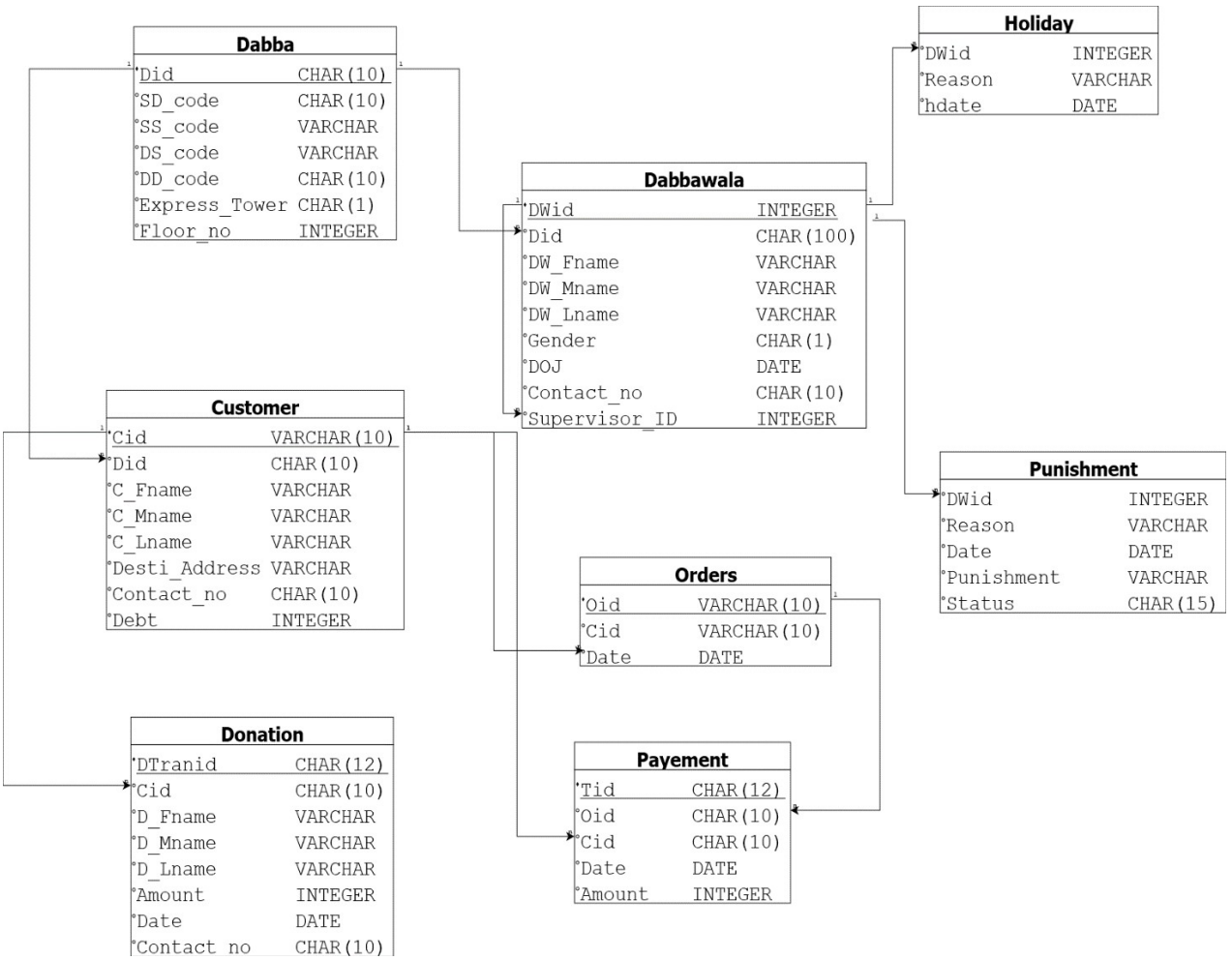
Reason
Date
Punishment
Status

Relational diagram:



Tables:

1) Dabba:

Dabba represents a delivery container or a dabba which is used for transmitting lunchboxes from one location to another. Information such as Did (Dabba id), SD_Code (source dabbawala code), SS_Code (source station code), DS_Code (destination dabba code), DD_Code (destination dabbawalla code), Express_Tower, Floor_no, Is stored in the table which describe where the dabba should be dropped.

2) Dabbawala:

The Dabbawala table represents information about dabbawalas, including their unique DWid (Dabbawala id), names (DW_Fname, DW_Mname, DW_Lname), gender, contact number, and joining date. This table is essential for managing employee records, including personal details and contact information. The supervisor id represents the id's for the mukkadam, who is an experienced dabbawala managing other dabbawalas.

3) Customer:

The Customer table stores information about customers, including their unique Cid (customer id), customer names (C_Fname, C_Mname, C_Lname), destination address, and contact number. This table is essential for managing customer records and tracking customer details for delivery services. The Did indicates the specific dabba (Did) assigned to each customer.

4) Orders:

The Orders table is designed to track customer orders (Oid) placed within the dabbawala service. Each order is associated with a specific customer (Cid), allowing order management and tracking the customer's order. This table contains essential details of each order, such as the order date and current status.

5) Payment:

The Payment table is used to track payment transactions id (Tid) made by customers for their orders. Each payment is linked to a specific order (Oid) and customer (Cid). This table contains important details of each payment transaction, such as the payment date and the payment amount.

6) Donation:

The Donation table is used to track donation transactions id (DTranid) made by customers. Each donation is linked to a specific customer (Cid), enabling the tracking of donations made by customers. The Donation table captures details about the donor, including donor's first name (D_Fname), middle name (D_Mname), last name (D_Lname), and contact number. It also stores the date a particular transaction was made.

7) Holiday:

The Holiday table is designed to track holidays or leaves taken by dabbawalas (DWid). Each record in this table represents a holiday taken by a dabbawala on a specific date, along with the reason for the holiday (e.g., a medical emergency, vacation, family function,etc).

8) Punishment:

The Punishment table is used to record and track punishments taken by the dabbawalas (DWid). Each record in this table represents a specific instance of punishment, including details such as the date of the incident, the reason for the punishment, and the type of punishment imposed.

Minimal FD

A minimal cover of a set of functional dependencies α is a minimal set of dependencies F that is equivalent to β.

A set of functional dependencies is said to be minimal if it follows the following conditions –

- Every dependency in α has a single attribute for its right-hand side.
- We cannot replace any dependency X->A in α with a dependency Y->A, where Y is a proper subset of X, and still have a set of dependencies that is equivalent to α.
- We cannot remove any dependency from α and still have a set of dependencies that are equivalent to α.

BCNF (Boyce – Codd normal form)

Boyce-Codd normal form (BCNF) is a normal form used in database normalization. It is a slightly rigid version of the third normal form (3NF).

BCNF was developed in 1974 by Raymond F. Boyce and Edgar F. Codd to address certain types of anomalies not dealt with by 3NF as originally defined.

A relation is in BCNF if every determinant α is a candidate key. A determinant is any attribute whose value determines other values within a row. A candidate key is a minimal set of attributes that can uniquely identify each tuple in a relation.

1) Orders:

R(Oid,Cid,Date)

Minimal FDs:

Oid→Cid
Oid→Date

(Oid)+=R(Oid,Cid,Date)
Hence Oid is the key

BCNF Proof:

-No multivalue or composite attribute.
-No transitive dependency
-No partial dependency
-Oid is the super key

Oid is the super key present on the left side of each FD, hence the relation is in BCNF.

2) Dabba:

R(Did,SScode,SDcode,DScode,DDcode,Express_tower,Florr_no)

Minimal FDs:

Did→SScode
Did→SDcode
Did→DScode
Did→DDcode
Did→Express_tower
Did→Florr_no

(Did)+=R(Did,SScode,SDcode,DScode,DDcode,Express_tower, Floor_no)
Hence Did is the Key.

BCNF Proof:

-No multivalue or composite attribute.
-No transitive dependency
-No partial dependency
-Did is the super key

Did is the super key present on the left side of each FD, hence the relation is in BCNF.

3) Dabbawala:

R(Dwid,Did,D_Fname,D_Mname,D_Lname,Gender,DOJ,Contact_no)

Minimal FDs:

Dwid→Dw_Fname
Dwid→
Dw_Mname
Dwid→
Dw_Lname
Dwid→ Gender
Dwid→ DOJ
Dwid→
Contact_no

(Dwid,did)+=R(Dwid,Did,D_Fname,D_Mname,D_Lname,Gender,DOJ, contact_no)
Hence Dwid,did is the key.

BCNF Proof:

-Did was a multivalue attribute so we split it in different tuples during insertion.
-No transitive dependancies
-No partial dependency
-Dwid,Did is the candidate key

In every FD the left side attribute is a super key so the table is in BCNF.

4) Customer

R(Cid,C_Fname,C_Mname,C_Lname,Did,Desti_address, Contact_no,credit,debt)

Minimal FDs:

Cid→C_Fname
Cid→C_Mname
Cid→C_Lname
Cid→Did
Cid→Desti_addres
s Cid→Contact_no
Cid→credit
Cid→debt

(Cid)+=R(Cid,C_Fname,C_Mname,C_Lname,Did,Desti_address, Contact _no,credit,debt)
Hence Cid is the key.

BCNF Proof:

-No multivalue or composite attribute.
-No transitive dependency
-No partial dependency
-Cid is the super key

Cid is the super key present on the left side of each FD, hence the relation is in BCNF.

5) Payment

R(Tid,Oid,Date,Amount,Cid)

Minimal FDs:

Tid→Oid
Tid→Date
Tid→Amount
Tid→Cid
Oid→Tid

(Tid,Oid)+=R(Tid,Oid,Date,Amount,Cid)
Hence Tid,Oid are the keys.

BCNF Proof:

-No multivalue or composite attribute.
-No transitive dependency
-No partial dependency
-Cid is the super key

Cid is the super key present on the left side of each FD, hence the relation is in BCNF.

6) Donation

R(DTranid,Cid,D_Fname,D_Mname,D_Lname,Amount,Date, Contact_no)

Minimal FDs: Dtranid→Cid Dtranid→D_Fname Dtranid→D_Mname Dtranid→D_Lname Dtranid→Amount Dtranid→Date Dtranid→Contact_no
(Dtranid)+=R(DTranid,Cid,D_Fname,D_Mname,D_Lname,Amount, Date,Contact_no) Hence Dtranid is the key
BCNF Proof: -No multivalue or composite attribute. -No transitive dependency -No partial dependency -Dtranid is the super key Dtranid is the super key present on the left side of each FD, hence the relation is in BCNF

7) Holiday

R(Dwid,Reason,hdate)

Minimal FDs: (DWid,Reason,hdate) → DWid (DWid,Reason,hdate) → Reason (DWid,Reason,hdate) → hdate
(DWid,Reason,hdate)$^{+}$=R(DWid,reason.hdate) Hence DWid,hdate are the candidate keys.
BCNF Proof: **-** No multivalue or composite attributes -No transitive dependancies -No partial dependency -Dwid,hdate is the candidate key In every FD the left side attribute is a super key so the table is in BCNF.

8) Punishment

R(Dwid,Reason,Punishment,Date,Status)

Minimal FDs: (Dwid,Reason,date) → punishment (Dwid,Reason,date) → status
(Dwid,Reason,date)+=R(Dwid,Reason,Punishment,Date,Status) Hence Dwid,Reason and date together is the composite key.
BCNF Proof: -Reason was a multivalue attribute so we split it in different tuples during insertion. -No transitive dependancies -No partial dependency -Dwid,Reason,date is the candidate key In every FD the left side attribute is a super key so the table is in BCNF.