**Overview of Implementation:**

**Implementation Details:**

**Challenges Encountered:**

**Testing:**

**Relational Model:**

Location:

Location(Name: STRING, PRIMARY KEY (Name))

Functional Dependencies (FDs):

Name -> (All attributes) (trivial FD)

Normalization:

In BCNF, as there are no partial or transitive dependencies.

Station:

Station(Code: CHAR(3), Name\*: STRING, PRIMARY KEY (CODE), FOREIGN KEY (Name) REFERENCES Location(Name))

Functional Dependencies:

Code -> Name (Each station code uniquely determines a location)

Normalization:

BCNF, as Code is the primary key and there are no partial dependencies.

Train:

Train(TrainId: STRING, LocomotiveType: STRING, PRIMARY KEY (TrainId))

Functional Dependencies:

TrainId -> LocomotiveType

Normalization:

BCNF, as TrainId is the sole determinant.

Carriage:

Carriage(CarriageId: STRING, TrainId\*: STRING, CarriageOrder: INT, PRIMARY KEY (CarriageId), FOREIGN KEY (TrainId) REFERENCES Train(TrainId))

FunctionalDependencies:

CarriageID -> TrainID, CarriageOrder

Normalization:

BCNF, as CarriageID is the only determinant.

Feature:

Feature(FeatureName: STRING, Description: STRING, PRIMARY KEY (FeatureName))

Functional Dependencies:

FeatureName -> Description

Normalization:

BCNF, as FeatureName is the only determinant.

Service:

Service(HeadCode: STRING, StartDate: DATE, EndDate: DATE, DaysOfWeek: STRING, TrainID\*: STRING, Origin\*: STRING, Destination\*: STRING, PRIMARY KEY (HeadCode), FOREIGN KEY (TrainID) REFERENCES Train(TrainID), FOREIGN KEY (Origin) REFERENCES Location(Name), FOREIGN KEY (Destination) REFERENCES Location(Name))

Functional Dependencies:

HeadCode -> (All attributes)

Normalization:

BCNF, as HeadCode is the only determinant.

Schedule:

Schedule(ScheduleLocation: STRING, PRIMARY KEY (ScheduleLocation))

Normalization:

BCNF, as there are no partial or transitive dependencies.

ServiceStop:

ServiceStop(HeadCode\*: STRING, Location\*: STRING, LocationOrder: INT, Platform: STRING, ArrivalTime: TIME, DepartureTime: TIME, StopType: STRING, PRIMARY KEY (HeadCode, Location), FOREIGN KEY (HeadCode) REFERENCES Service(HeadCode), FOREIGN KEY (Location) REFERENCES Location(Name))

Functional Dependencies:

(HeadCode, Location) -> (LocationOrder, Platform, ArrivalTime, DepartureTime, StopType)

Normalization:

BCNF, as the composite key fully determines all other attributes.

**Normalization Analysis**

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| Table | BCNF | Justification |
| Location | Yes | Name is the primary key, no partial dependencies |
| Station | Yes | Code is the primary key, uniquely determines Name |
| Train | Yes | TrainID is the primary key, uniquely determines LocomotiveType |
| Carriage | Yes | CarriageID is the primary key, uniquely determines TrainID, CarriageOrder |
| Feature | Yes | FeatureName is the primary key, uniquely determines Description |
| Service | Yes | HeadCode is the primary key, uniquely determines all other attributes |
| Schedule | Yes | ScheduleLocation is the primary key |
| ServiceStop | Yes | Composite key (HeadCode, Location) uniquely determines all attributes |

This model is in Boyce-Codd Normal Form. All functional dependencies have determinants that are candidate keys. There are no partial dependencies (as all non-key attributes fully depend on the primary key). There are no transitive dependencies.