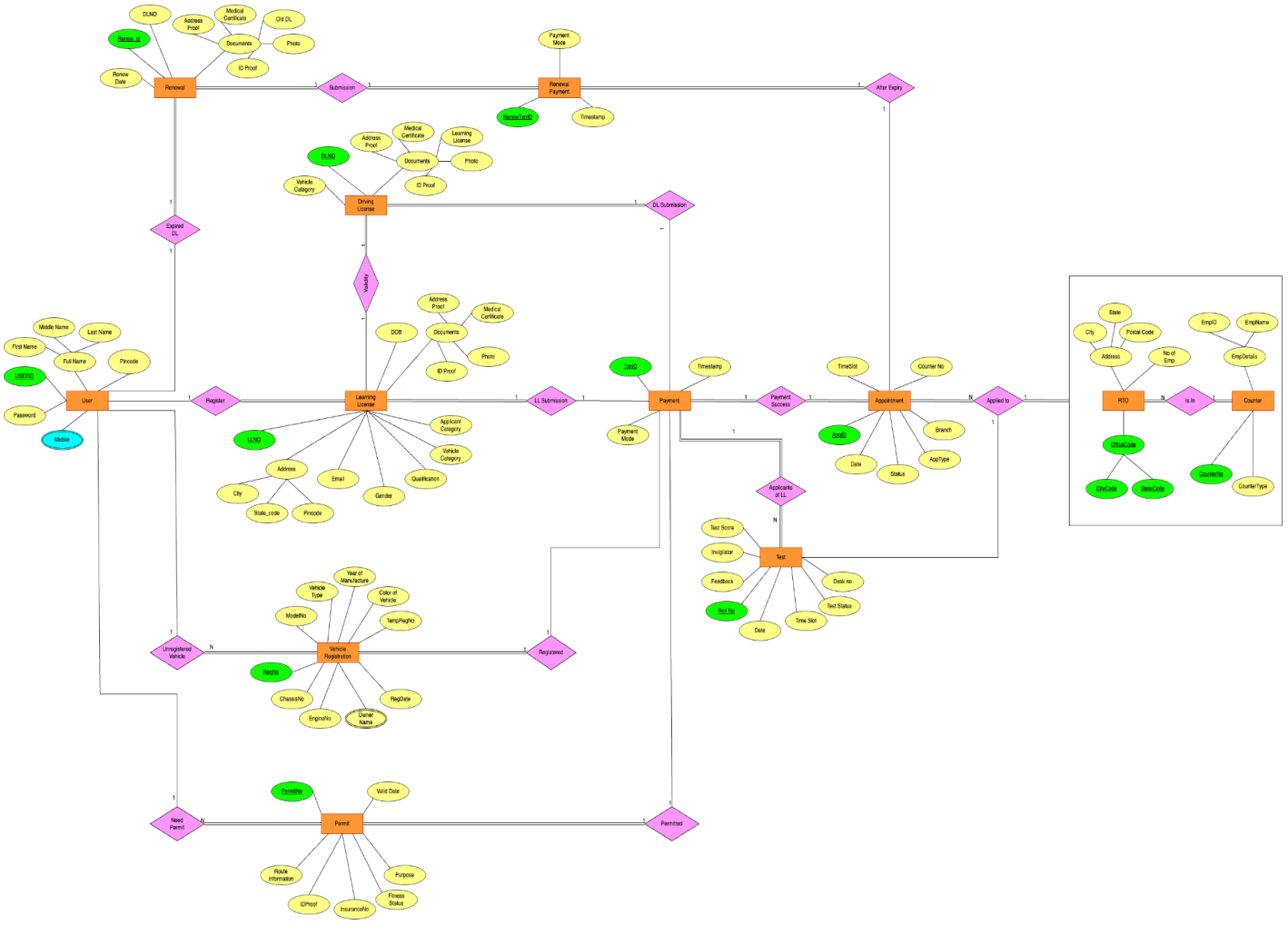
DBMS-IT214

Regional Transport Office(RTO) Management System

Objective

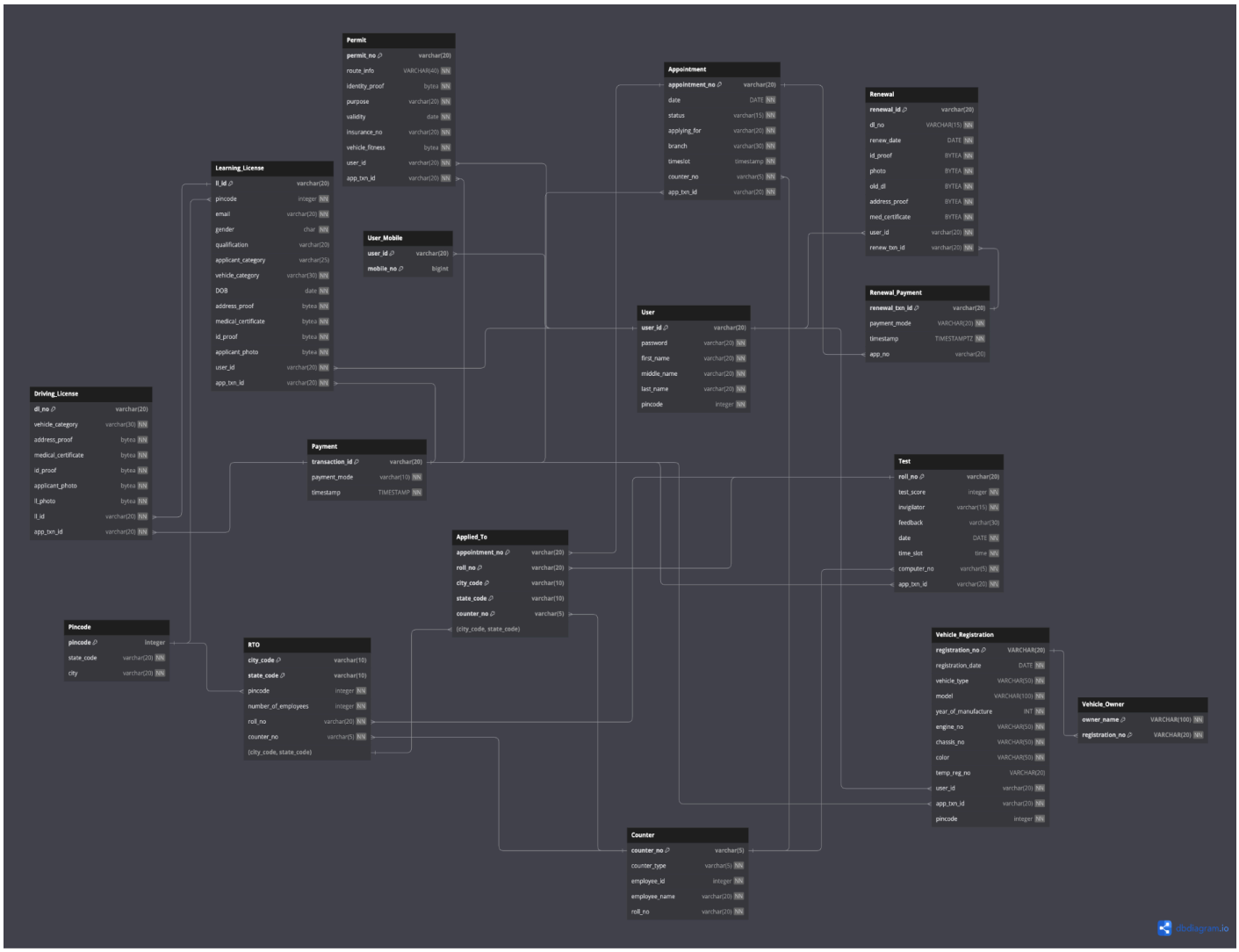
RTO Database System aims to design and develop a comprehensive system that can seamlessly manage all types of applications involved in the system. The system will streamline the registration and renewal processes, ensure accurate and timely appointments, and improve overall performance. As a result we get a Secure Repository of information pertaining to vehicles,drivers,licenses,registrations and other relevant records within the region. This will also help in analyzing transportation trends, pointing out the areas of improvement and its efficiency.

ER-Diagram:



DBMS_T208_Final_ER .png in zip(Better Clarity)

Relational-Diagram:



DBMS_T208_Final_Relational .png and .pdf in zip(Better Clarity)

Minimal FD and BCNF Forms:

Minimal FD

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

The formal definition is: A set of FD α to be minimal if it satisfies 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.

By calculating the functional dependencies for various attributes of our database, by observing we found out that normally the minimal FD are those which are having FD : α→β, where α is the key of the set.

BCNF(Boyce-Codd normal form):

Boyce-Codd normal form (BCNF) is a normal form used in database normalization. It is a slightly stronger 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. FD : α → β where α is a determinant and β is dependent.
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) User

R(UserID, firstName,middleName,lastName,password)

Keys: UserID

Minimal FD: **UserID → firstName** **UserID → middleName** **UserID → lastName** **UserID → password**
$(UserID)_+$ = R(UserID, firstName,middleName,lastName,password) **Hence, UserID is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

2) User_Mobile

R(UserID, mobileNo)

Keys: UserID,mobileNo

Minimal FD: **UserID → Mobile No.**
$\{UserID, mobileNo\}_+$ = R(UserID, mobileNo) **Hence {UserID, mobileNo} is the key**

BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

3) Location

R(pincode,city,state)

Keys: pincode

Minimal FD: **pincode → city** **pincode → state**
(pincode)$_+$ = R(pincode,city,state) **Hence pincode is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

4) Learning License

R(LLNO, UserID, email, gender, qualification, applicantCategory, vehicleCategory, DOB, IDProof, addressProof, medicalCertificate, appPhoto, appTxnID)

Keys: LLNO

Minimal FD:

LLNO → **UserID**

LLNO → **email**

LLNO → **gender**

LLNO → **qualification**

LLNO → **applicantCategory**

LLNO → **vehicleCategory**

LLNO → **DOB**

LLNO → **IDProof**

LLNO → **addressProof**

LLNO → **medicalCertificate**

LLNO → **appPhoto**

LLNO → **appTxnID**

($LLNO)_+$ = R(LLNO, UserID, email, gender, qualification, applicantCategory, vehicleCategory, DOB, IDProof, addressProof, medicalCertificate, appPhoto, appTxnID)

Hence *LLNO* is the key

BCNF Proof:

For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.

5) Driving License

R(DLNO, LLNO, appTxnID, vehicleCategory, addressProof, LLPhoto, IDProof, appPhoto)

Keys: DLNO

Minimal FD: ***DLNO*** **→ LLNO** ***DLNO*** **→ appTxnID** ***LLNO*** **→ vehicleCategory** ***LLNO*** **→ addressProof** ***LLNO*** **→ IDProof** ***LLNO*** **→ LLPhoto** ***LLNO*** **→ medicalCertificate** ***LLNO*** **→ appPhoto**
$\{DLNO\}^{+}$ = R(DLNO, LLNO, appTxnID, vehicleCategory, addressProof, LLPhoto, IDProof, appPhoto) **Hence DLNO is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

6) Payment

R(appTxnID, paymentMode,timestamp,amount)

Keys: appTxnID

Minimal FD:

appTxnID → claimID **appTxnID → paymentMode** **appTxnID → timestamp** **appTxnID → amount**
$(appTxnID)_+$ = R(appTxnID, paymentMode,timestamp,amount) **Hence appTxnID is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

7) Renewal

R(renewalID, DLNO,renewDate,appPhoto, IDProof, oldDL, addressProof, medicalCertificate,userID, renewTxnID)

Keys: renewalID

Minimal FD: **renewalID → DLNO** **renewalID → renewDate** **renewalID → appPhoto** **renewalID → IDProof** **renewalID → oldDL** **renewalID → addressProof**

renewalID → medicalCertificate

renewalID → userID

renewalID → renewTxnID

$(renewalID)^{+}$ = R(renewalID, DLNO,renewDate,appPhoto, IDProof, oldDL, addressProof, medicalCertificate,userID, renewTxnID)

Hence renewalID is the key

BCNF Proof:

For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.

8) Renewal_Payment

R(renewalTxnID, paymentMode,timestamp,appNo, renewFee)

Keys: renewalTxnID

Minimal FD:

renewalTxnID → paymentMode

renewalTxnID → timestamp

renewalTxnID → appNo

renewalTxnID → renewFee

(renewalTxnID)+ = R(renewalTxnID, paymentMode,timestamp,appNo, renewFee)

Hence renewalTxnID is the key

BCNF Proof:

For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.

9) Vehicle Registration

R(regNo, regDate,vehicleType,model, yearOfManufacture, engineNo,chassisNo, color, tempRegNo,userID,appTxnId)

Keys: regNo

Minimal FD:

regNo → regDate
regNo → vehicleType
regNo → model
regNo → yearOfManufacture
regNo → engineNo
regNo → chassisNo
regNo → color
regNo → tempRegNo
regNo → userID
regNo → appTxnId

$(regNo)_+$ = R(regNo, regDate,vehicleType,model, yearOfManufacture, engineNo,chassisNo, color, tempRegNo,userID,appTxnId) **Hence regNo is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

10) Vehicle_Owner

R(regNo, ownerName)

Keys: regNo,ownerName

Minimal FD: **regNo → ownerName**
$\{regNo, ownerName\}_+$ = R(regNo, ownerName) **Hence {regNo, ownerName} is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

11) Appointment

R(appNo, date,status,applyingFor, branch, timeslot,counterNo,appTxnID)

Keys: appNo

Minimal FD: **appNo → date** **appNo → status** **appNo → applyingFor** **appNo → branch** **appNo → timeslot** **appNo → counterNo** **appNo → appTxnID**
$(appNo)^+$ = R(appNo, date,status,applyingFor, branch, timeslot,counterNo,appTxnID) **Hence appNo is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

12) Test

R(rollNo, testScore, invigilator, feedback, testDate, timeSlot, computerNo, appTxnID)

Keys: rollNo

Minimal FD:

rollNo → testScore
rollNo → invigilator
rollNo → feedback
rollNo → testDate
rollNo → timeSlot
rollNo → computerNo
rollNo → appTxnID

$(rollNo)^+$ = R(rollNo, testScore, invigilator, feedback, testDate, timeSlot, computerNo, appTxnID)

Hence rollNo is the key

BCNF Proof:

For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.

13) Permit

R(permitNo, routeInfo, IDProof, purpose, validity, insuranceNo, vehicleFitness, userID, appTxnID)

Keys: permitNo

Minimal FD:

permitNo → routeInfo
permitNo → IDProof

permitNo → purpose

permitNo → validity

permitNo → insuranceNo

permitNo → vehicleFitness

permitNo → userID

permitNo → appTxnID

$(permitNo)^+$ = R(permitNo, routeInfo, IDProof, purpose, validity, insuranceNo, vehicleFitness, userID, appTxnID)

Hence permitNo is the key

BCNF Proof:

For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.

14) Counter

R(counterNo, counterType, employeeID, employeeName, rollNo)

Keys: counterNo

Minimal FD:

counterNo → counterType

counterNo → employeeID

counterNo → employeeName

counterNo → rollNo

$(counterNo)_+$ = R(counterNo, counterType, employeeID, employeeName, rollNo) **Hence counterNo is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

15) RTO

R(cityCode, stateCode, pincode, noOfEmp, rollNo, counterNo)

Keys: {cityCode,stateCode}

Minimal FD: **{cityCode,stateCode} → pincode** **{cityCode,stateCode} → noOfEmp** **{cityCode,stateCode} → rollNo** **{cityCode,stateCode} → counterNo**
$(cityCode,stateCode)_+$ = R(cityCode, stateCode, pincode, noOfEmp, rollNo, counterNo) **Hence (cityCode,stateCode) is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

16) Applied_To

R(appNo, rollNo, cityCode,stateCode, counterNo)

Keys: {appNo, rollNo, cityCode,stateCode, counterNo}

Minimal FD: **It's a trivial dependency case so all attributes will depend on each other**
{appNo, rollNo, cityCode,stateCode, counterNo}$_+$ = R(appNo, rollNo, cityCode,stateCode, counterNo) **Hence {appNo, rollNo, cityCode,stateCode, counterNo} is the key**
BCNF Proof: ***For every minimal FD dependency listed above α is the candidate key, hence the relation is in BCNF.***

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DDL Scripts:

Attached in zip

Data Insertion scripts:

Attached in zip

SQL Queries:

Attached in zip