INDIAN INSTITUTE OF INFORMATION TECHNOLOGY

CS310 – DATABASE MANAGEMENT SYSTEM
VEHICLE INSURANCE COMPANY
BY- TEAM 15 (Terminal 0)

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About the Project

Project title:
Database design for a Vehicle Insurance Company.

Aim:
To create and Maintain a Vehicle Insurance Database implemented in MySQL Database System and retrieve information from it and provide a comprehensive understanding and practical experience in data Modelling, use of normalization techniques, transactional relational database design, and implementation of SQL queries.

Purpose:
The purpose of this project is to acquire a good amount of knowledge as well as practical experience in Advanced Entity Modelling, Normalization, Relational Database Design, and acquiring good knowledge in SQL.

Scope:
The scope of this project is compacted to a Database Administrator A Data Analyst or A Software Engineer, who is familiar with the concepts of Database Management Systems (DBMS), and who can write and understand SQL queries for retrieving information from the database. In this project, all of my teammates implemented the entire database in MySQL Database. To proceed with the project, one needs to be familiar with MySQL Workbench and MySQL Server.

Project Benefits:

When a developer builds an application or software, that Software needs Data to perform day-to-day operations and analytics over-processed data which is something driving the business nowadays to excel in their respective areas of operations. So as a developer, we need a Database Management System where we can create, update, delete, administer, and analyze the data. We developed a good database, that could be used with analytical tools and faster in delivering the accurate information at accurate times for better decision making and understanding.

Information about MySQL:

MySQL is the most popular Open Source Relational SQL Database Management System. MySQL is one of the prominent RDBMS being used for developing various web-based software applications. MySQL is developed and supported by MySQL AB, which is a Swedish company. SQL is a computer language supported by several database software programs. It makes accessing database data for other programs easy. Programs that need database software for handling low-level tasks of managing information would simply use SQL to transmit instructions.

Software Requirements:

- A Windows/ Linux/ Mac system.
  Properly installed MySQL server & MySQL Workbench

PART-A: -CONCEPTUAL DATA MODEL

Part A: Conceptual Data Model

Design Rules:

To design our car insurance database conceptual data model we first needed todecide what characteristics underpin the model under investigation. As a group we decided on various rules that need to be implemented in order for the model to be consistent and precise. Table 1 below illustrates these rules.

Table 1: Design rules for CDM model of car insurance database

Design Rule	Description	Example
Rule 1	All the individual entity types must be in capital letters.	CUSTOMER
Rule 2	An underscore is used to label an entity type with more than one word.	TERMS_CONDITIONS
Rule 3	Plurals are not used when labelling entity types.	APPLICATION
Rule 4	No abbreviations are used when labelling entity types.	QUOTE
Rule 5	Entity types must not be in Numerical.	VEHICLE
Rule 6	Every entity must contain a Primary key.	Like CUSTOMER_ID for the customer Entity.

Assumptions :

To design the Conceptual Data Model (CDM) we have a certain set of assumptions. These assumptions will help shape our model to allow consistency withinour design. Table 2 presents the assumptions used in this model.

Table 2: Assumptions used in car insurance database model

Assumption	Description
Assumption 1	Customers must have original proof Id's like aadhaar, driving license etc..

Assumption 2	Customer not having personal accidental cases before in on-road
Assumption 3	The online insurance is given to customers over 18 years of age.
Assumption 4	The online insurance needs some driving history of the customer.
Assumption 5	The online insurance needs to know the type of car the customer drives.
Assumption 6	The online insurance needs to know about the insurance history of the customer.

Entity Types:

All of the entity types that we feel are relevant in our CDM are illustrated in Table 3,below.

Table 3: Entity types used in car insurance database system CDM model.

Entity Type	Description
T15_CUSTOMER	Records all the personal details about the customer.
T15_APPLICATION	Records details of the insurance coverage requested by Customer
T15_ QUOTE	Records details of customer potential cost of the insurance product.
T15_INSURANCE_POLICY_COVERAGE	Records details of the insurance agreement.
T15_PREMIUM_PAYMENT	Records details of customer cost and payments.
T15_CLAIM	Records details of customer claims in case of an accident.
T15_CLAIM_SETTLEMENT	Records details of settlement made on claims.
T15_STAFF	Records details of employees.
T15_DEPARTMENT	Records details of the various departments.
T15_OFFICE	Records details of different office locations.
T15_MEMBERSHIP	Records details of customer membership,clubs and societies.
T15_VEHICLE_SERVICE	Records details of different car services offered.
T15_NOK	Records details of the next o kin.

T15_COVERAGE	Records all terms and conditions in regard to the policy
T15_INSURANCE_POLICY	Records details of Insurance agreement.
T15_PRODUCT	Records details of the products offered by insurance company
T15_RECEIPT	Details of premium payments to customer
T15_INSURANCE_COMPANY	Details of the insurance organization giving the insurance cover.
T15_VEHICLE	Records details of Vehicle model, cost and registration.
T15_INCIDENT	Records details of the accident, theft, fire, etc.
T15_POLICY_RENEWABLE	Records details of due date of insurance policy.
T15_INCIDENT_REPORT	Records details of the individual incident

Relationships in CDM :

Applying Relationships to Entities :

To apply relationships to our entity types we formed certain assumptions to simplify and determine connections between entity types. These assumptions and explanations are illustrated in Table 4 below.

Table 4: CDM relationship of entities for car insurance database :-

Entity Type	Related To Entities	Relationship
T15_QUOTE	**T15_APPLICATION**	One to one
T15_ APPLICATION	**T15_INSURANCE** **POLICY** **T15_CUSTOMER**	One to many One to many
T15_CUSTOMER	**T15_MEMBERSHIP** **T15_PREMIUM_PAYMEN** **TT15_CLAIM** **T15_VEHICLE**	Many to many One to many One to many One to one, one to many
T15_ INSURANCE_POLICY	**T15_** **DEPARTMENT** **T15_NOK**	One to many One to many

T15_PREMIUM_PAYMENT	**T15_RECEIPT**	One to many
T15_CLAIM	**T15_ CLAIM_SETTLEMENT**	One to one
T15_VEHICLE **INSURANCE** **T15_DEPARTMENT**	**T15_DEPARTMEN** **TT15_SERVICE**	One to one, one to many One to many
T15_DEPARTMENT	**T15_OFFICE** **T15_INSURANCE_COMPANY**	Many to many One to many
T15_INSURANCE_COMPANY	**T15_STAFF**	Many to many

PART-B:-LOGICAL DATA MODEL

Introduction

Part B of this report includes design of logical data model (LDM) for vehicle insurance company XYZ Ltd.

First we had to make some changes and improvements to the conceptual data model which are explained and presented in the last part of this report. Then we identify all the attributes in old and new entities and assignthem the primary (PK) and foreign keys (FK) and make relationships with them in Erwin to make a full LDM. We identified each variable and the data types that this LDM could be used to design the database in Access or Oracle database management systems.

Introduction of terms used for constructing LDM:

Elements:

Elements in the data model are named entities. This is any distinguishable object that presents part of the database. It can be related to any object in the real world such as: a car, a customer (person), a policy, a company, etc. with respective attributes that are relevant to the software system.

Properties of entities can have values:

- Name
- Description of the meaning and significance.
- Weather entity is dependent or non-dependent.
- List of attributes (Car entity: year, manufacturer, model, mileage, owner, license, book of maintenance) with properties (data type, size, is it requiredor not).
- The attributes (or attribute) are used to precisely identify an entity(primary key – PK, foreigner key – FK, ...).
- Constraints of individual or combined attributes values (e.g. date of issue of new policy can't be prior to renewal date of policy).
- Rules to grant permission to users or user groups to access the entity.
- Expected number of entity instances and expected growth rate.

Or additional:

- List of attributes to be indexed to optimize access time.
- List of attributes to be encrypted or compressed.
- Weather entity should become a database view or a table.
- Weather entity should become a materialized view.
- List of database triggers to be implemented for that entity.

Relations

Relationship- Designates logical association between entities, withcardinality of the participant

Entities: one-to-one, one-to-many, or many-to-many relationships. Relationships can be identifying or non-identifying (identifying A-B;existence of B depends on existence of A).

Generalization/specialization– Indicates an "is a" relationship betweenentities. For example ,department entity is a generalization of different types of departments; at the same time vehicle Insurance department or travel insurance department is specialization of department entity.

Aggregation- is an abstraction that turns relationship between entities into an aggregate entity, rarely used. Example: "customer-insurance advisor - date" can be an aggregate entity called Appointment.

Constraints

The database normalization technique is used to impose restrictions on datamodel that is based on dependencies between entities and their attributes.
Normalization is used with the goal objective to avoid duplication of information in order to safe guard the consistency (integrity) of the data.

Data types

When we assign attributes to entities with primary keys and foreign keys do the normalization, we identify each attribute with data type for each data management system – Access as seen in example Table 6, below.

Table 6: Example of data types in Access and DMS

Entity type	Attributes	Data type
T15_CUSTOMER	T15_FIRST_NAME	Varchar(10)
	T15_LAST_NAME	Varchar(10)
	T15_DATE_OF_BIRTH	Date

Business Rules, Attributes, Data types and Primary/Foreign Keys

This section of the report identifies all of the attributes, data types and primary and foreign keys for our system LDM. For better overview we present the table number to the corresponding entity type, followed by thebusiness rule of what we wish the entity type to capture, posted below in Table 7.

Table 7: Table number entity type

Table Number	Entity Type	Business Rules
1	T15_CUSTOMER	Records all the personal details about the customer
2	T15_APPLICATION	Records details of the insurance coverage requested by the customer.
3	T15_QUOTE	Records details of customer potential cost of the insurance product.
4	T15_INSURANCE_POLICY	Records details of the Insurance agreement.

5	T15_PREMIUM_PAYMENT	Records details of customer cost of payments.
6	T15_VEHICLE	Records details of Vehicle model, cost and registration.
7	T15_CLAIM	Records details of customer claims in case of an incident.
8	T15_CLAIM SETTLEMENT	Records details of settlement made on claims
9	T15_STAFF	Records details of employees
10	T15_DEPARTMENT	Records details of the various departments
11	T15_OFFICE	Records details of different office locations
12	T15_MEMBERSHIP	Records details of customer membership, clubs, societies.
13	T15_VEHICLE_SERVICE	Records details of different vehicle services offered
14	T15_NOK	Records details of the next of kin
15	T15_INSURANCE_COMPANY	Details of the Insurance organization giving the insurance cover
16	T15_POLICY_RENEWABLE	Records details of due date of insurance policy
17	T15_INCIDENT	Records details of the accident, theft, fire, etc.
18	T15_INCIDENT_REPORT	Records details of the individual incident
19	T15_COVERAGE	Records all terms and conditions in regard to the policy
20	T15_PRODUCT	Records details of the products offered by insurance company
21	T15_RECEIPT	Details of premium payments to customer
22	T15_INSURANCE_POLICY_COVERAGE	It shows agreement and coverage details

Table 8: Abbreviation table of attributes manes used in LDM.

LDM Attributes	Column Name Abbreviations
T15_CUST_ID	CUSTOMER_IDENTIFICATION
T15_CUST_FNAME	CUSTOMER_FNAME
T15_CUST_LNAME	CUSTOMER_LNAME
T15_CUST_DOB	CUSTOMER_DATEOFBIRTH
T15_CUST_PPS_NUMBER	CUSTOMER_PERSONALPUBLICNUMBER
T15_STAFF_FNAME	STAFF_FNAME
T15_STAFF_LNAME	STAFF_LNAME
T15_STAFF_PPS_NUMBE	STAFF_PERSONALPUBLICNUMBER
RT15_ADMIN_COST	ADMINISTRATION_COST
T15_NOK_ID	NEXTOFKIN_IDENTFICATION

Table-LDM 1: T15_CUSTOMER

Attributes	Data type	Primary Keys and Foreign keys
T15_CUST_ID	INT	PK
T15_CUST_FNAME	VARCHAR(10)	
T15_CUST_LNAME	VARCHAR(10)	
T15_CUST_DOB	DATE	
T15_CUST_GENDER	CHAR(2)	
T15_CUST_ADDRESS	VARCHAR(20)	
T15_CUST_MOB_NUMBER	VARCHAR(10)	
T15_CUST_EMAIL	VARCHAR(20)	
T15_CUST_PASSPORT_NUMBER	VARCHAR(20)	
T15_CUST_MARITAL_STATUS	CHAR(10)	
T15_CUST_PPS_NUMBER	INT	

EXPLANATION:-

The T15_ CUSTOMER attributes record all the essential personal details ofthe customer. The T15_CUST_ID is the unique primary key.

Table-LDM 2: T15_APPLICATION

Attributes	Data type	Primary Keys and Foreign keys
T15_APPLICATION_I	VARCHAR(20)	PK
DT15_CUST_ID	INT	FK
T15_VEHICLE_ID	INT	
T15_APPLICATION_STATUS	CHAR(8)	
T15_COVERAGE	VARCHAR(50)	

EXPLANATION:-

The T15_APPLICATION attributes record all the essential application details of the customer. The T15_APPLICATION_ID is the unique primary key and the T15_CUST_ID is a foreign key linking the table back to the entity type T15_CUSTOMER.

Table-LDM 3: T15_QUOTE

Attributes	DATA TYPE	PRIMARY KEYS AND FOREIGN KEYS
T15_QUOTE_ID	VARCHAR(20)	PK
T15_APPLICATION_ID	VARCHAR(20)	FK
T15_CUST_ID	INT	FK
T15_ISSUE_DATE	DATE	
T15_VALID_FROM_DATE	DATE	
T15_VALID_TILL_DATE	DATE	
T15_DESCRIPTION	VARCHAR(100)	
T15_PRODUCT_ID	VARCHAR(20)	
T15_COVERAGE_LEVEL	VARCHAR(20)	

EXPLANATION:-

The T15_QUOTE attributes record all the essential quotation details of the customer. The T15_QUOTE_ID is the unique primary key and T15_APPLICATION_ID and T15_CUST_ID is a foreign key linking the table backto the respective entities

Table-LDM 4: T15_INSURANCE_POLICY

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_AGREEMENT_ID	VARCHAR(20)	PK
T15_APPLICATION_ID	VARCHAR(20)	FK
T15_CUST_ID	INT	FK
T15_DEPARTMENT_NAME	VARCHAR(20)	
T15_POLICY_NUMBER	VARCHAR(20)	
T15_START_DATE	DATE	
T15_EXPIRY_DATE	DATE	
T15_TERMS_CONDITION_DESCRIPTION	VARCHAR(100)	

EXPLANATION:-

The T15_INSURANCE POLICY attributes record all the essential policy details of the customer. The T15_AGREEMENT_ID is the unique primary key and the T15_CUST_ID, and T15_APPLICATION_ID are linked to the other corresponding entities through theirforeign keys.

Table-LDM 5: T15_PREMIUM_PAYMENT

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_PREMIMUM_PAYMENT_ID	VARCHAR(20)	PK
T15_CUST_ID	INT	FK
T15_PREMIUM_PAYMENT_AMOUNT	INT	
T15_PREMIUM_PAYMENT_SCHEDULE	DATE	
T15_RECIEPT_ID	VARCHAR(20)	
T15_POLICY_NUMBER	VARCHAR(20)	

EXPLANATION:-

The T15_PREMIUM_PAYMENT attributes record all the essential policy premium payments details of the customer. The T15_PREMIUM_PAYMENT_ID is the unique primary key and the T15_CUST_ID is the Foreign key linking tables to T15_CUSTOMER entities.

Table-LDM 6: T15_VEHICLE

ATTRIBUTES	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_VEHICLE_ID	INT	PK
T15_CUST_ID	INT	FK
T15_POLICY_ID	VARCHAR(20)	
T15_DEPENDENT_NOK_ID	VARCHAR(20)	
T15_VEHICLE_REGISTRATION_NUMBER	VARCHAR(20)	
T15_VEHICLE_VALUE	INT	
T15_VEHICLE_TYPE	VARCHAR(20)	
T15_VEHICLE_SIZE	INT	
T15_VEHICLE_NUMBER_OF_SEAT	INT	
T15_VEHICLE_MANUFACTURER	VARCHAR(20)	
T15_VEHICLE_ENGINE_NUMBER	INT	
T15_VEHICLE_CHASIS_NUMBER	INT	
T15_VEHICLE_NUMBER	VARCHAR(20)	
T15_VEHICLE_MODEL_NUMBER	VARCHAR(20)	

EXPLANATION:-

The T15_VEHICLE attributes record all the essential T15_VEHICLE details belonging to the customer. The T15_VEHICLE_ID is the unique primary key and the T15_CUST_ID is the foreign key linking table to T15_CUSTOMER entity.

Table-LDM 7: T15_CLAIM

ATTRIBUTES	Data type	PRIMARY KEYS ANDFOREIGN KEYS
T15_CLAIM_ID	INT	PK
T15_CUST_I	INT	FK
T15_AGREEMENT_ID	VARCHAR(20)	
T15_CLAIM_AMOUNT	INT	
T15_INCIDENT_ID	VARCHAR(20)	
T15_DAMAGE_TYPE	VARCHAR(20)	
T15_DATE_OF CLAIM	DATE	
T15_CLAIM_STATUS	CHAR(10)	

EXPLANATION:-

The T15_CLAIM attributes record all the essential T15_CLAIM details of the customer in case of an incident. The T15_CLAIM_ID is the unique primary keyand the T15_CUST_ID is foreign key linking table to T15_CUSTOMER entity.

Table-LDM 8:T15_CLAIM_SETTLEMENT

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_CLAIM_SETTLEMENT_ID	INT	PK
T15_CUST_ID	INT	FK
T15_VEHICLE_ID	INT	
T15_DATE_SETTLED	DATE	
T15_AMOUNT_PAID	INT	
T15_COVERAGE_ID	VARCHAR(20)	
T15_CLAIM_ID	INT	FK

EXPLANATION:-

The T15_CLAIM_SETTLEMENT attributes record all the essentialclaim settlement details of the customer after an incident. The T15_CLAIM_SETTLEMENT_ID is the unique primary key and the T15_CUST_ID and T15_CLAIM_ID are the foreign keys that link the table to the corresponding entity.

PHYSICAL MODEL

When creating physical models we create tables or clusters and we must write specifications of internal data type for each its columns. These types define generic domain of values that each column can contain.

Some concerns using data types building a physical model:

- Data types can have a narrow focus (number, date).
- Some are general purpose data types (various character data types).
- Data types can allow for variable length or not. Choosing a large fixed length for a column to only store a few bytes per row, makes a large table. This may affect performance specially if stored on multiple blocks, resulting in great number of I/O's and so affecting performance.
- Large data object types are not advised to be used in where clause as they are only retrievable against other columns

The Data types used in our project:

- **CHAR (size)** these are fixed-length character data of length-sized bytes. Maximumsize is 2000 bytes.

  Typical use: for official International Currency Codes which are a fixed three charactersin length such as USD, FFR.

- **VARCHAR (size)** Variable-length character string having maximum length-sized bytes. Maximum size is 4000, and minimum is 1. This is the most commonly-used data type and you should use it if you are not sure which one to use.

  Typical use: for storing individual ASCII text lines of unlimited length ASCII texts on whichyou need to be able to search using a wildcard.

- **DATE** Valid date range from January 1, 4712 BC to December 31, 4712 AD. A date data type also contains time components. You should use it only when you know the full date

  including day, month, and year. The time component is often set to 00:00 (midnight)in normal use of dates.

Typical use: any date where the full date is known.

- **INTEGER:** The INTEGER datatype is usually referred to as NUMBER(38). Its precision can range from 1 to 38.

Table-LDM 9: T15_STAFF

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_STAFF_ID	VARCHAR(20)	PK
T15_COMPANY_NAME	VARCHAR(20)	FK
T15_STAFF_FNAME	VARCHAR(10)	
T15_STAFF_LNAME	VARCHAR(10)	
T15_STAFF_ADDRESS	VARCHAR(20)	
T15_STAFF_CONTACT	VARCHAR(10)	
T15_STAFF_GENDER	CHAR(2)	
T15_STAFF_MARITAL_STATUS	CHAR(10)	
T15_STAFF_NATIONALITY	CHAR(15)	
T15_STAFF_QUALIFIACATION	VARCHAR(20)	
T15_STAFF_ALLOWANCE	INT	
T15_STAFF_PPS_NUMBER	INT	

EXPLANATION:-

The T15_STAFF attributes record all the essential staff details working in the insurance company. The T15_STAFF_ID is the unique primary key and the T15_COMPANY_NAME is a foreign key linking the table back to the entity type T15_COMPANY.

Table-LDM 10: T15_DEPARTMENT

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_DEPARTMENT_NAM	VARCHAR(20)	FK,PK
ET15_COMPANY_NAME	VARCHAR(20)	FK
T15_OFFICE	VARCHAR(18)	
T15_CONTACT_INFORMATION	VARCHAR(30)	
T15_DEPARTMENT_STAFF	VARCHAR(18)	
T15_DEPARTMENT_LEADER	VARCHAR(18)	

EXPLANATION:-

The T15_DEPARTMENT attributes record all the essential company department details within the insurance company. The T15_DEPARTMENT_NAME is the unique primary key and Foreign key and the T15_COMPANY_NAME is a foreign key linking the table back to the entity type COMPANY.

Table-LDM 11: T15_OFFICE

Attributes	Data type	PRIMARY KEYS ANDFOREIGN KEYS
T15_OFFICE_NAME	VARCHAR(20)	PK
T15_DEPARTMENT_NAME	VARCHAR(20)	FK
T15_COMPANY_NAME	VARCHAR(20)	FK
T15_OFFICE_LEADER	VARCHAR(20)	
T15_CONTACT_INFORMATION	VARCHAR(20)	
T15_ADDRES	VARCHAR(20)	
T15_ADMIN_COST	INT	
T15_STAFF	VARCHAR(50)	

EXPLANATION:-

The T15_OFFICE attributes record all the essential office details within the insurance company. The T15_OFFICE_NAME is the unique primary key and the T15_DEPARTMENT_NAME and T15_COMPANY_NAME are foreign keys linking the table back to the respective entity types.

Table-LDM 12: T15_MEMBERSHIP

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_MEMBERSHIP_ID	VARCHAR(20)	PK
T15_CUST_ID	INT	FK
T15_MEMBERSHIP_TYPE	CHAR(15)	
T15_ORGANISTAION_CONTACT	VARCHAR(20)	

EXPLANATION:-

The T15_MEMBERSHIP attributes record all the essential membership details available for insured customers. The T15_MEMBERSHIP_ID is the uniqueprimary key and the T15_CUST_ID is a foreign key linking the table back to the entity type T15_CUSTOMER.

Table-LDM 13: T15_VEHICLE_SERVICE

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_VEHICLE_SERVICE	VARCHAR(30)	PK
T15_VEHICLE_ID	INT	FK
T15_CUST_ID	INT	FK
T15_VEHICLE_SERVICE_ADDRESS	VARCHAR(20)	
T15_VEHICLE_SERVICE_CONTACT	VARCHAR(20)	
T15_VEHICLE_SERVICE_	VARCHAR(20)	
T15_VEHICLE_SERVICE_INCHARGE	VARCHAR(20)	
T15_VEHICLE_SERVICE_TYPE	VARCHAR(20)	
T15_COMPANY_NAME	VARCHAR(20)	

EXPLANATION:-

The T15_VEHICLE_SERVICE attributes record all the essential vehicle services offered to insured customer details. The T15_VEHICLE_SERVICE is the unique primary key and the T15_CUST_ID and T15_VEHICLE_ID are linked to the other corresponding entities.

Table-LDM 14: T15_NOK

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_NOK_ID	VARCHAR(20)	PK
T15_AGREEMENT_ID	VARCHAR(20)	FK
T15_APPLICTAION_ID	VARCHAR(20)	FK
T15_CUST_ID	INT	FK
T15_NOK_NAME	VARCHAR(20)	
T15_NOK_ADDRESS	VARCHAR(20)	
T15_NOK_PHONE_NUMBER	VARCHAR(10)	
T15_NOK_GENDER	CHAR(2)	
T15_NOK_MARITAL_STATUS	CHAR(10)	

EXPLANATION:-

The T15_NOK attributes record information on the next of kin details.
T15_NOK_ID is the unique primary key here.T15_ AGREEMENT_ID, T15_APPLICATION_ID, and T15_CUST_ID are foreign keys linking backinformation to their respective entities.

Table-LDM 15: T15_INSURANCE_COMPANY

Attributes	Data type	PRIMARY KEYS ANDFOREIGN KEYS
T15_COMPANY_NAME	VARCHAR(20)	PK
T15_COMAPNY_DEPARTMENT_NAME	VARCHAR(20)	PK
T15_COMPANY_ADRESS	VARCHAR(20)	
T15_COMPANY_CONTACT_NUMBER	VARCHAR(10)	
T15_COMPANY_FAX	INT	
T15_COMPANY_EMAIL	VARCHAR(20)	
T15_COMPANY_WEBSITE	VARCHAR(20)	
T15_COMPANY_LOCTAION	VARCHAR(20)	
T15_COMPANY_OFFICE_NAME	VARCHAR(20)	

EXPLANATION:-

The T15_INSURANCE COMPANY attributes record all the essential company details of the customer. The T15_COMPANY_NAME and T15_COMPANY_DEPARTMENT_NAME are the primary keys.

Table-LDM 16: T15_POLICY_RENEWABLE

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_POLICY_RENEWABLE_ID	VARCHAR(20)	PK
T15_AGREEMENT_ID	VARCHAR(20)	FK
T15_APPLICATION_ID	VARCHAR(20)	FK
T15_CUST_ID	INT	FK
T15_DATE_OF_RENEWAL	DATE	
T15_TYPE_OF_RENEWAL	CHAR(15)	

EXPLANATION:-

The T15_POLICY RENEWABLE attributes record all the essential policy renewal details of the insured customer. The T15_POLICY_RENEWABLE_ID is the unique primary key and the T15_AGREEMENT_ID, T15_APPLICATION_ID and T15_CUST_ID are foreign keys linking the table back to the respective entities.

Table-LDM 17: T15_INCIDENT

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
INCIDENT_ID	VARCHAR(20)	PK
INCIDENT_TYPE	VARCHAR(30)	
INCIDENT_DATE	DATE	
DESCRIPTION	VARCHAR(100)	

EXPLANATION:-

The T15_INCIDENT attributes record all the essential incident details such as Accident and theft on the insured customer vehicle. The T15_INCIDENT_ID isthe unique primary key.

Table-LDM 18: T15_INCIDENT_REPORT

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_INCIDENT_REPORT_ID	VARCHAR(20)	PK
T15_INCIDENT_ID	VARCHAR(20)	FK
T15_CUST_ID	INT	FK
T15_INCIDENT_TYEP	CHAR(10)	
T15_INCIDENT_INSPECTOR	VARCHAR(20)	
T15_INCIDENT_COST	INT	
T15_INCIDENT_REPORT_DESCRIPTION	VARCHAR(100)	

EXPLANATION:-

The T15_ INCIDENT_REPORT_ID attributes record all the essential incident occurrences on the customer vehicle. The T15_INCIDENT_REPORT_ID is the unique primary key and the T15_CUST_ID, AND T15_INCIDENT_ID are foreign keys linking the table back to their respective entity types.

Table-LDM 19: T15_COVERAGE

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_COVERAGE_ID	VARCHAR(20)	PK
T15_COMPANY_NAME	VARCHAR(20)	FK
T15_COVERAGE_AMOUNT	INT	
T15_COVERAGE_TYPE	CHAR(15)	
T15_COVERAGE_LEVEL	CHAR(10)	
T15_PRODUCT_ID	VARCHAR(20)	
T15_COVERAGE_DESCRIPTION	VARCHAR(100)	
T15_COVERAGE_TERMS	VARCHAR(50)	

EXPLANATION:-

The T15_COVERAGE attributes record all the essential coverage details of the insurance policy to the customer. The T15_COVERAGE_ID is the unique primary key and the T15_COMPANY_NAME is a foreign key linking the table back to the entity type T15_COMPANY.

Table-LDM 20: T15_PRODUCT

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_PRODUCT_NUMBER	VARCHAR(20)	PK
T15_COMPANY_NAME	VARCHAR(20)	FK
T15_PRODUCT_TYPE	CHAR(15)	
T15_PRODUCT_PRICE	INT	

EXPLANATION:-

The T15_PRODUCT attributes record all the essential company products details offered by the Insurance Company. The T15_PRODUCT_NUMBER is the unique primary key and T15_COMPANY_NAME is the foreign key linking table to T15_COMPANY entities.

Table-LDM 21: T15_RECEIPT

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_RECIEPT_ID	VARCHAR(20)	PK
T15_PREMIUM_PAYMENT_ID	VARCHAR(20)	FK
T15_CUST_ID	INT	FK
T15_TIME	DATE	
T15_COST	INT	

EXPLANATION:-

The T15_RECEIPT attributes record all the essential payments done by T15_CUSTOMERS to the Insurance company. The T15_RECEIPT_ID is the unique primary key and T15_PREMIUM_PAYMENT_ID and T15_CUST_ID are Foreign keys linking tables to their respective entities.

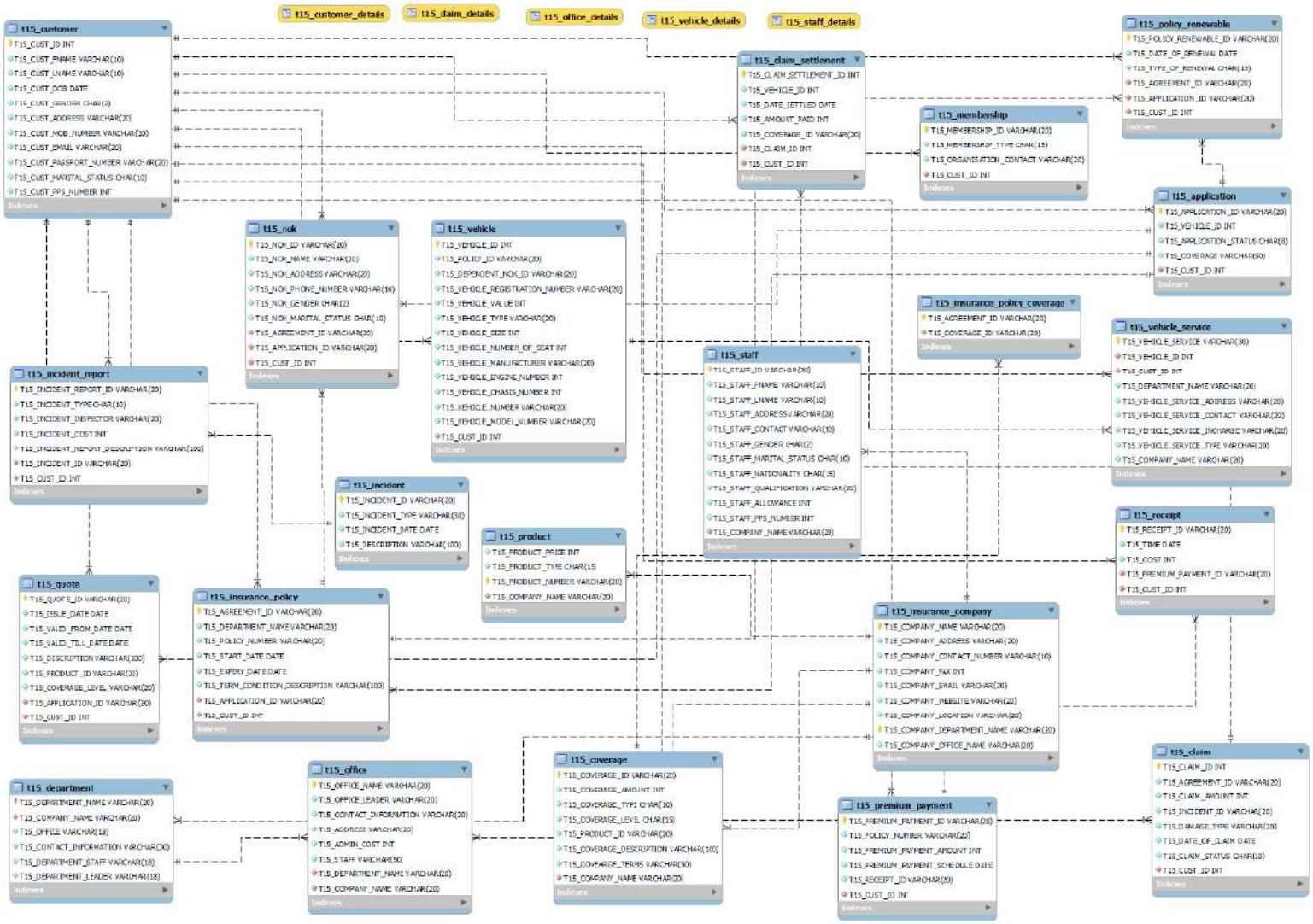
Table-LDM 22: T15_INSURANCE_POLICY_COVERAGE

Attributes	Data type	PRIMARY KEYS AND FOREIGN KEYS
T15_AGREEMENT_ID	VARCHAR(20)	PK
T15_COVERAGE_ID	VARCHAR(20)	FK

EXPLANATION:-

The T15_INSURANCE_POLICY_COVERAGE records details of theVehicle policy that entails Terms Conditions of the Contract.
T15_AGREEMENT_ID is the unique primary key and T15_COVERAGE_ID is the Foreign key linking this table to T15_COVERAGE Entity.

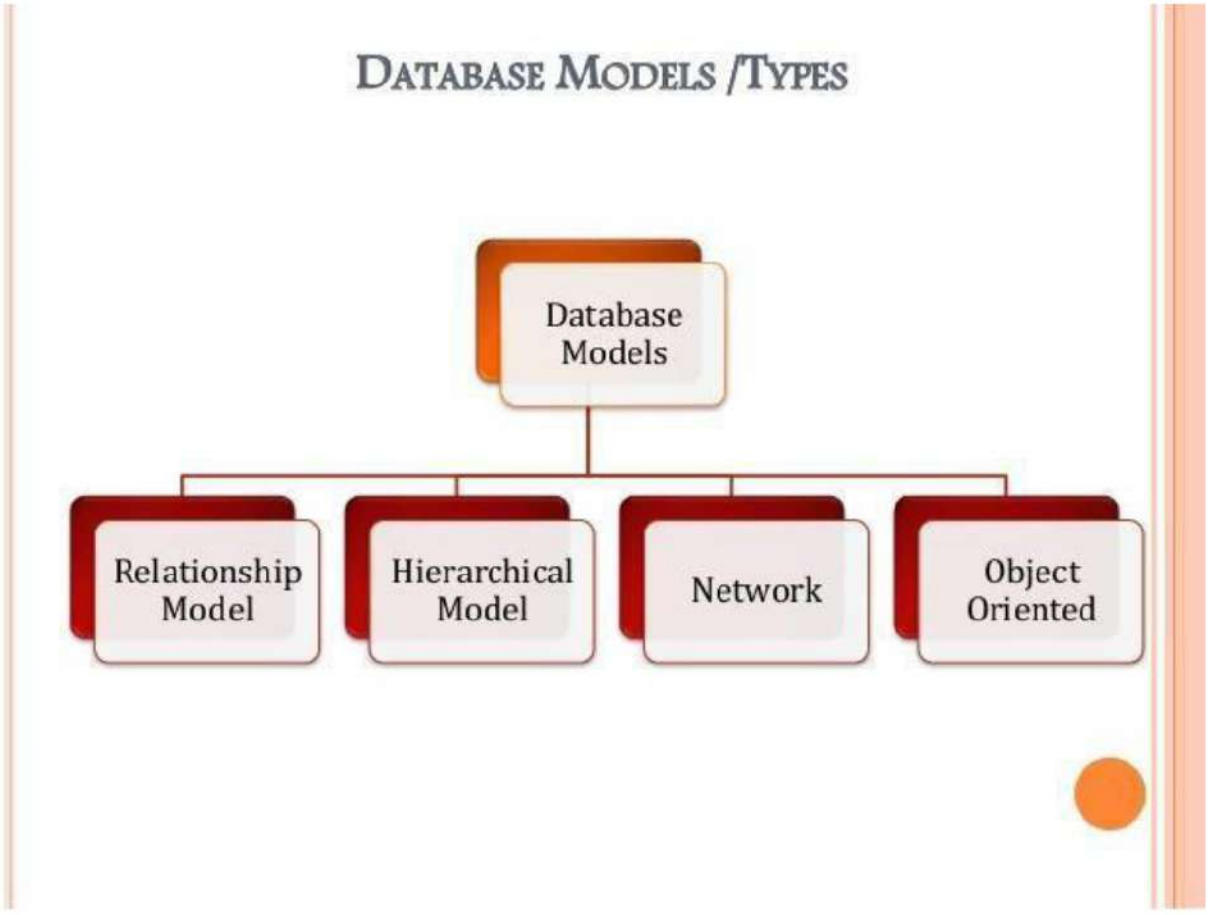
FIGURE – PHYSICAL SCHEMA



Part C: Physical Data Model andDatabase Design

Introduction

When building an entity relationship (ER) model we tend to use it to later build different physical models of database types. Therefore physical data model is used toimplement into different technical software and hardware environments that is due to current state of technology and is changing as technologies change.



Normalization

When building an entity relationship (ER) model we tend to use it to later build different physical models of database types. Therefore physical data model is used to implement into different technical software and hardware environments that is due to current state of technology and is changing as technologies change.

1.First Normal Form (1NF):

If a relation contain composite or multi-valued attribute, it violates first normal form, or a relation is in first normal form if it does not contain any **composite** or **multi-valued attribute**. A relation is in first normal form if every attribute in that relation is singled valued attribute.

2. Second Normal Form (2NF):

Second Normal Form (2NF) is based on the concept of full functional dependency. To be in second normal form, a relation must be in first normal form and relation must not contain any partial dependency.

3. Third Normal Form (3NF):

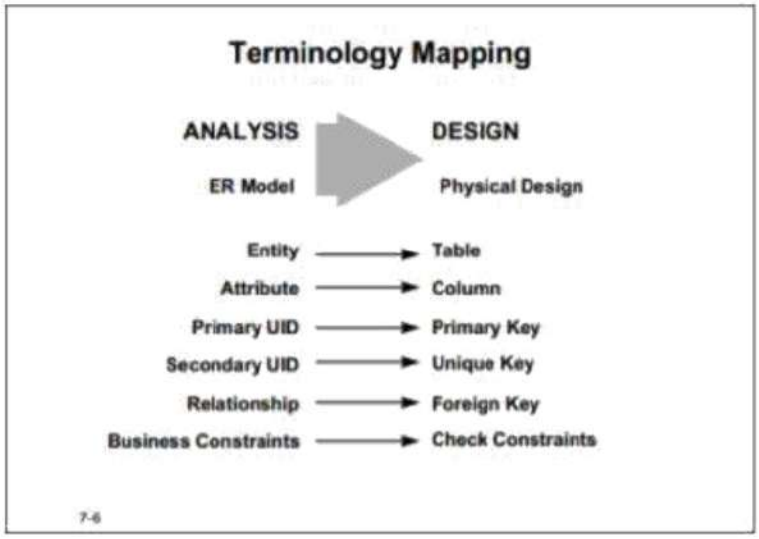
A relation is in third normal form, if there is no transitive dependency for non-prime attributes as well as it is in second normal form.

Normalization of Vehicle Insurance Company

Normal form	Table
First normal form (1NF)	
Second normal form (2NF)	DEPARTMENT OFFICE VEHICLE NOK INSURANCE_POLICY CLAIM CLAIM_SETTLEMENT PREMIUM_PAYMENT QUOTE INCIDENT_REPORT POLICY_RENEWABLE
Third normal form (3NF)	CUSTOMER RECEIPT APPLICATION STAFF INSURANCE_COMPANY MEMBERSHIP PRODUCT COVERAGE VEHICLE_SERVICE INCIDENT

Terminology

The relational data model consists of mathematical rules, that later translate its syntax to physical model, but there are not always correspondent to syntax of physical model. Therefore you have to keep track of them and find how to implement them in correct way. This change also means change of terminology.



RDBMS

As we start doing to build relational data management system (RDBMS) we need a large number of parameters to obtain a correct adapted physical model. You must be aware that there is no absolute truth here. Some of most important points of creating physical models for RDBMS (Steepening, et al., 2001):

- Expected volume of tables, the hardware characteristics (CPU speed, memory size, number of disks and corresponding space), the architecture-client/server or three size, the network bandwidth, speed and operating systems are important determinants.
- User experience second big issue (response time, the GUI and frequencyof use of modules).
- Depending which version you use as some elements may or may not exist.

DATABASE SECURITY

Database security is described by the following aspects :

- Data independence

Data independence is an important method ensures data security; it can be divided into logical independence and physical independence. Physical independence means applications and data are store independent of each other data is managed by DBMS and application not need understand it, application just need processing the data when the physical storage of data changing application without changing.

- Data Security

    1. Isolation protect important files in database.
    2. Using authorization rules, such as access control method and accounts, passwords permissions control.
    3. Data Encryption

- Data Integrity

1. Data validation: ensure clean, correct and useful data.
2. Data consistency: Different users are using the same data should be identical
3. Data correctness: The input value of the data should be consistent with data in database

- Concurrency Control

Concurrency Control means the database is a shared resource for multi-use, When multiple user concurrent access to data, in the database will have multiple transactions simultaneously access the same data. If not controlled for concurrent operation may be cause incorrect to read and store data, destroy the consistency of the database. Locking mechanism of the database can effectively protect the database achieve concurrency control.

The database provides three different types of locks:

1. DML lock: DML locks used to protect data integrity; DML locks mainly include TM lock and TX lock. TM lock called table lock, TX called transaction locks or row locks.

2. DDL lock: DDL lock protects the structure of the database objects. In the DDL operation is automatically added DDL lock to the object, to protect these objects will not be modified by other sessions.

3. Internal locks and Latches: Protect the internal structure of the database.

- Recovery

When the database fails DBMS need to find faults and fix problems, thus preventing data corruption. Moreover database should regularly back up and establish a spare machine, makes the database can be restored as quickly as possible from the fault.

Who has access to certain parts of database ?

"A CRUD matrix is a table showing the functions in an application containing SQL statement affecting parts of a database" (Williams, 2001). It is a great way to show us what kind interaction appears between user and tables in database. This analysis of possible user scenarios and shows us tables that are very used and those that are not used, and it brings us the view how database is burdened with possible – bottleneck in system performance (Williams, 2001).

Using four SQL statements:

- Create – INSERTE – to store new data
- Read – SELECT – to retrieve data
- Update – UPDATE – to change or modify data
- Delete – DELETE – delete or remove data

MODULES / ENTITIES	Customer	Manger of insurance	Insurance agent	Accountant	HR department	Damage inspector	Database administrator	Finance department	
CUSTOMER	CR	R	CRUD	R	-	-	R	-	
APPLICATION	R	R	CRD	R	R	-	CRD	R	
QUOTE	R	R	CRUD	R	R	-	R	R	
INSURANCE_POLICY	R	R	CRUD	R	-	R	CRD	R	
PREMIUM_PAYMENT	-	-	CRUD	CRUD	-	-	RU	CRUD	
VEHICLE	-	R	CRUD	-	-	-	RU	-	
CLAIM	-	R	CRUD	CRD	-	-	RU	CRUD	
CLAIM_SETTLEMENT	R	CRUD	CR	-	-	-	RU	CRUD	
STAFF	-	CR	R	R	CRUD	-	RU	-	
DEPARTMENT	-	R	R	-	CRUD	-	RU	R	
OFFICE	R	R	R	R	CRUD	-	RU	R	
MEMBERSHIP	CR	R	CRD	-	-	-	RU	R	
VEHICLE_SERVICE	R	CRD	CRU	-	-	-	RU	R	
NOK	R	R	CRUD	-	-	-	RU	R	
INSURANCE_COMPANY	R	R	R	R	R	-	RU	R	
POLICY_RENEWABLE	R	CRUD	CRU	-	-	-	RU	-	
INCIDENT	-	CRD	R	-	-	R	RU	R	
INCIDENT_REPORT	R	CRD	R	R	-	CRUD	RU	R	
COVERAGE	R	R	CRD	R	-	-	RU	R	
PRODUCT	R	CRUD	R	R	R	R	RU	R	
RECEIPT	R	CRUD	CRD	CRUD	-	-	RU	CRUD	

Conclusion:

We have a class project created database (DB) with all documentations and reports included. Our goal was to create DB for Online vehicle insurance company with code . There were some big and small challenges but we succeeded in making a functional DB. We started to build a conceptual data model (CDM) we continued with logical data model (LDM) and then we made physical data model (PDM).

Thank You