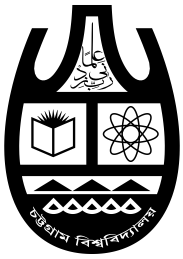

DEPARTMENT OF COMPUTER SCIENCE

The University of Chittagong

Student Name:	Sumaiya Tabassum
Student ID:	23701025
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Course Title:	Database Systems
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Task:	Assignment 01 - Database System Concepts: Chapter 06 Exercise
Submitted to:	Rudra Pratap Deb Nath, Associate Professor, Department of Computer Science and Engineering
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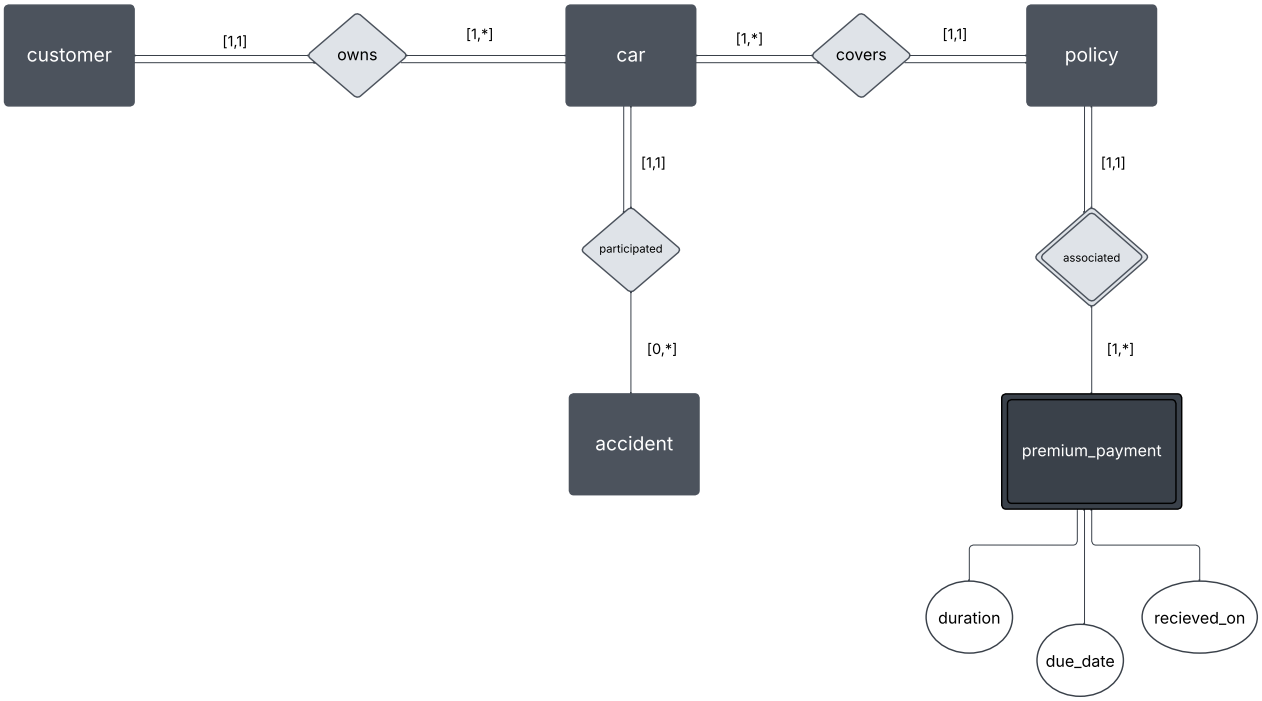
Contents

Chapter 06

6.1

Construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date, and the date when the payment was received.

Ans:



6.2

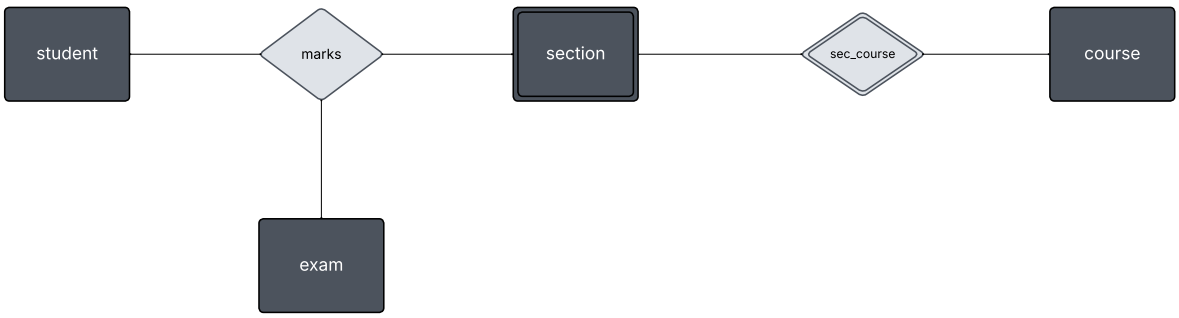
Consider a database that includes the entity sets student, course, and section from the university schema and that additionally records the marks that students receive in different exams of different sections.

a. Construct an E-R diagram that models exams as entities and uses a ternary relationship as part of the design.

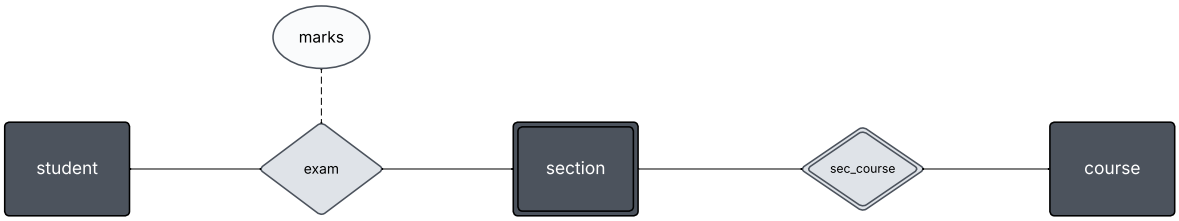
b. Construct an alternative E-R diagram that uses only a binary relationship between student and section. Make sure that only one relationship exists between a particular student and section pair, yet you can represent the marks that a student gets in different exams.

Ans:

a.



b.

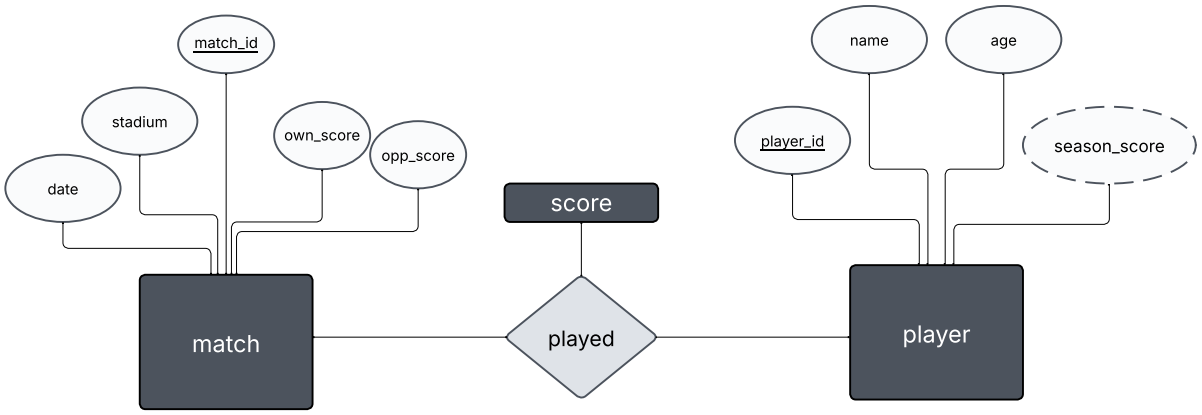


6.3

Design an E-R diagram for keeping track of the scoring statistics of your favorite sports team. You should store the matches played, the scores in each match, the players in each match, and individual player scoring statistics for each match. Summary statistics should be modeled as derived attributes with an explanation as to how they are computed.

Ans:

Here the derived attribute is season_score which is computed by summing the scores associated with the player entity type through the played relationship type.



6.5

An E-R diagram can be viewed as a graph. What do the following mean in terms of the structure of an enterprise schema?

a. The graph is disconnected.

b. The graph has a cycle.

Ans:

a. If the E-R diagram is disconnected, it means some groups of entities aren't connected at all. So, parts of the company don't have any relationship with each other. It's like the company is split into separate parts that don't interact, and each part could have its own separate database.

b. If there's a cycle in the E-R diagram, that means some entities are connected in more than one way. So, those entities have multiple relationships between them. But if there's no cycle (the diagram is acyclic), then there's only one unique way to get from one entity to another, meaning just one relationship between each pair.

6.7

A weak entity set can always be made into a strong entity set by adding to its attributes the primary-key attributes of its identifying entity set. Outline what sort of redundancy will result if we do so..

Ans:

If a weak entity is turned into a strong one by adding the primary key attributes of its identifying entity, we will end up repeating those key attributes in every weak entity record. This causes redundant data because the identifying entity's key is stored many times, wasting space and possibly causing update problems.

6.9

Suppose the advisor relationship set were one-to-one. What extra constraints are required on the relation advisor to ensure that the one-to-one cardinality constraint is enforced?

Ans:

To enforce the one-to-one constraint, both ***student_id*** and ***instructor_id*** must be unique in the advisor relation.

6.13

An E-R diagram usually models the state of an enterprise at a point in time. Suppose we wish to track temporal changes, that is, changes to data over time. For example, Zhang may have been a student between September 2015 and May 2019, while Shankar may have had instructor Einstein as advisor from May 2018 to December 2018, and again from June 2019 to January 2020. Similary, attribute values of an entity or relationship, such as title and credits of course, salary, or even name of instructor, and tot_cred of student, can change over time.

One way to model temporal changes is as follows: We define a new data type called **valid_time**, which is a time interval, or a set of time intervals. We then associate a valid_time attribute with each entity and relationship, recording the time periods during which the entity or relationship is valid. The end time of an interval can be infinity; for example, if Shankar became a student in September 2018, and is still a student, we can represent the end time of the vali_time interval as infinity for the Shankar entity. Similarly, we model attributes that can change over time as a set of values, each with its own valid_time.

a. Draw an E-R diagram with the student and instructor entities, and the advisor relationship, with the above extensions to track temporal changes.

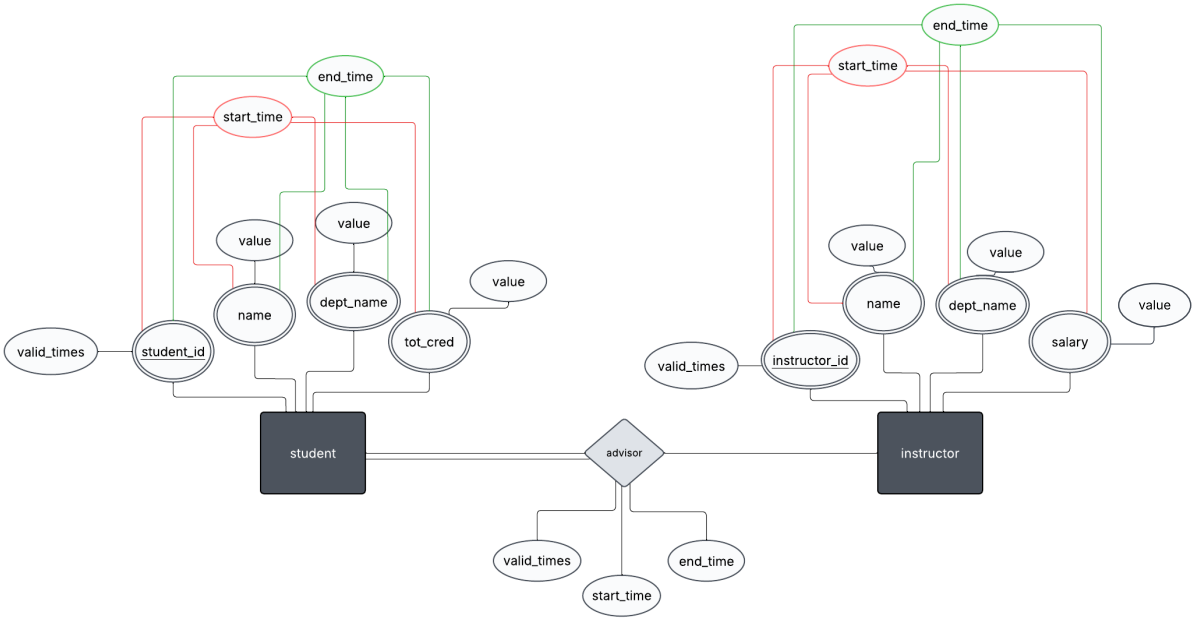
b. Convert the E-R diagram discussed above into a set of relations.

It should be clear that the set of relations generated is rather complex, leading to difficulties in tasks such as writing queries in SQL. An alternative approach, which is used more widely, is to ignore

temporal changes when designing the E-R model (in particular, temporal changes to attribute values), and to modify the relations generated from the E-R Model to track temporal changes.

Ans:

a.



b. The set of relations are given below:

student(*student_id*)

student_valid_times(*student_id, start_time, end_time*)

student_name(*student_id, value, start_time, end_time*)

student_dept_name(*student_id, value, start_time, end_time*)

student_tot_cred(*student_id, value, start_time, end_time*)

instructor(*instructor_id*)

instructor_valid_times(*instructor_id, start_time, end_time*)

instructor_name(*instructor_id, value, start_time, end_time*)

instructor_dept_name(*instructor_id, value, start_time, end_time*)

instructor_salary(*instructor_id, value, start_time, end_time*)

advisor(*student_id, instructor_id, start_time, end_time*)

6.14

Explain the distinctions among the terms *primary key*, *candidate key*, and *superkey*.

Ans:

Superkey: Any set of one or more attributes that can uniquely identify a record where there can be more attributes than necessary to uniquely identify the record.

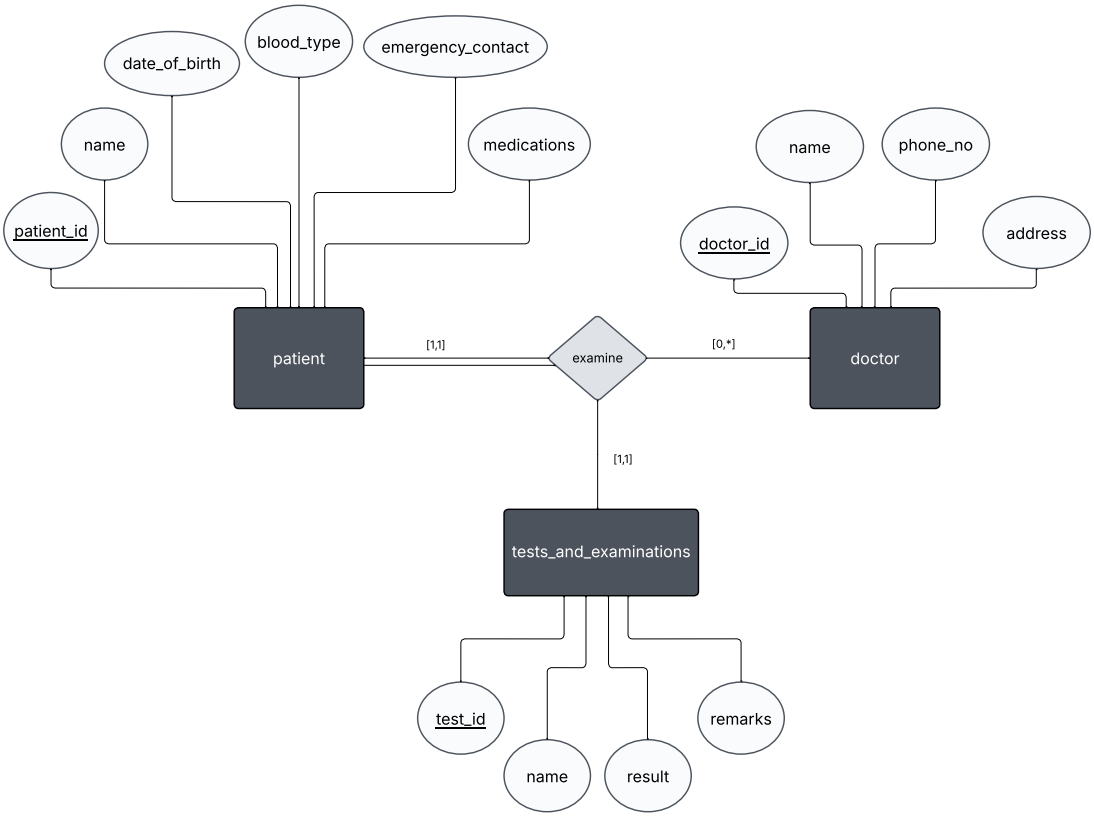
Candidate key: A minimal superkey for which no propr subset is a superkey. There needs to be only attributes that uniquely identifies the record, no extra attributes.

Primary key: The selected candidate key that is used to uniquely identify a record. The value of this attribute can not be NULL.

6.15

Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted.

Ans:



6.19

We can convert any weak entity set to a strong entity set by simply adding appropriate attributes. Why, then do we have weak entity sets?

Ans:

Weak entity sets help model existence-dependent relationships, avoid unnecessary redundancy, and make the ER design more meaningful and easier to understand, even though converting them into strong entities is possible.

6.21

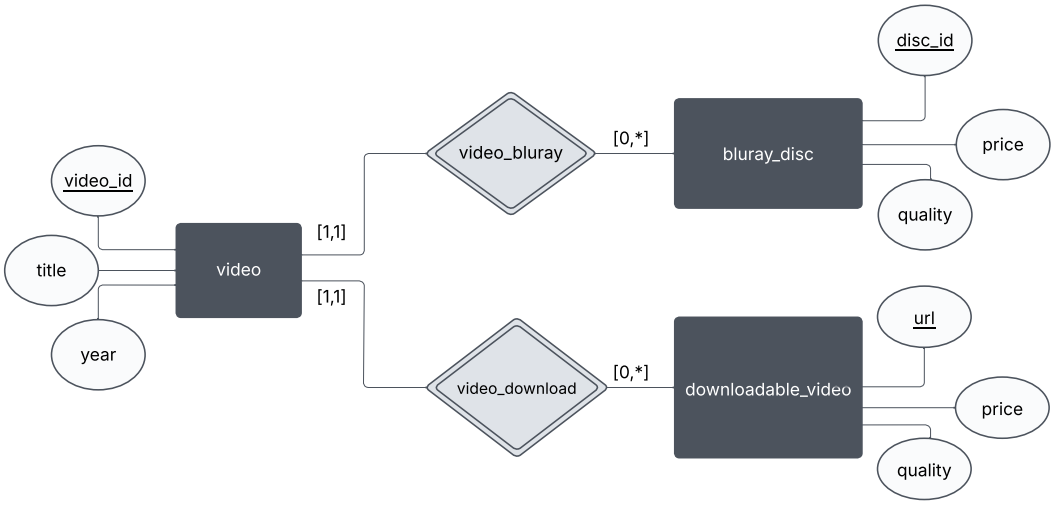
Consider the E-R diagram in Figure 6.30, which models an online bookstore.

a. Suppose the bookstore adds Blu-ray discs and downloadable video to its collection. The same item may be present in one or both formats, with differing prices. Draw the part of the E-R diagram that models this addition, show just the parts related to video.

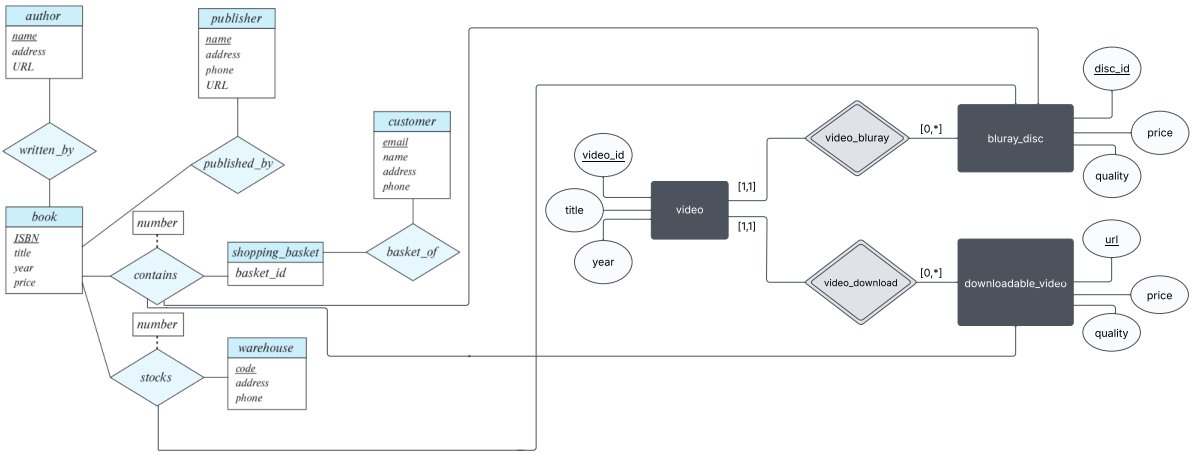
b. Now extend the full E-R diagram to model the case where a shopping basket may contain any combination of books, Blu-ray discs, or downloadable video.

Ans:

a.



b.



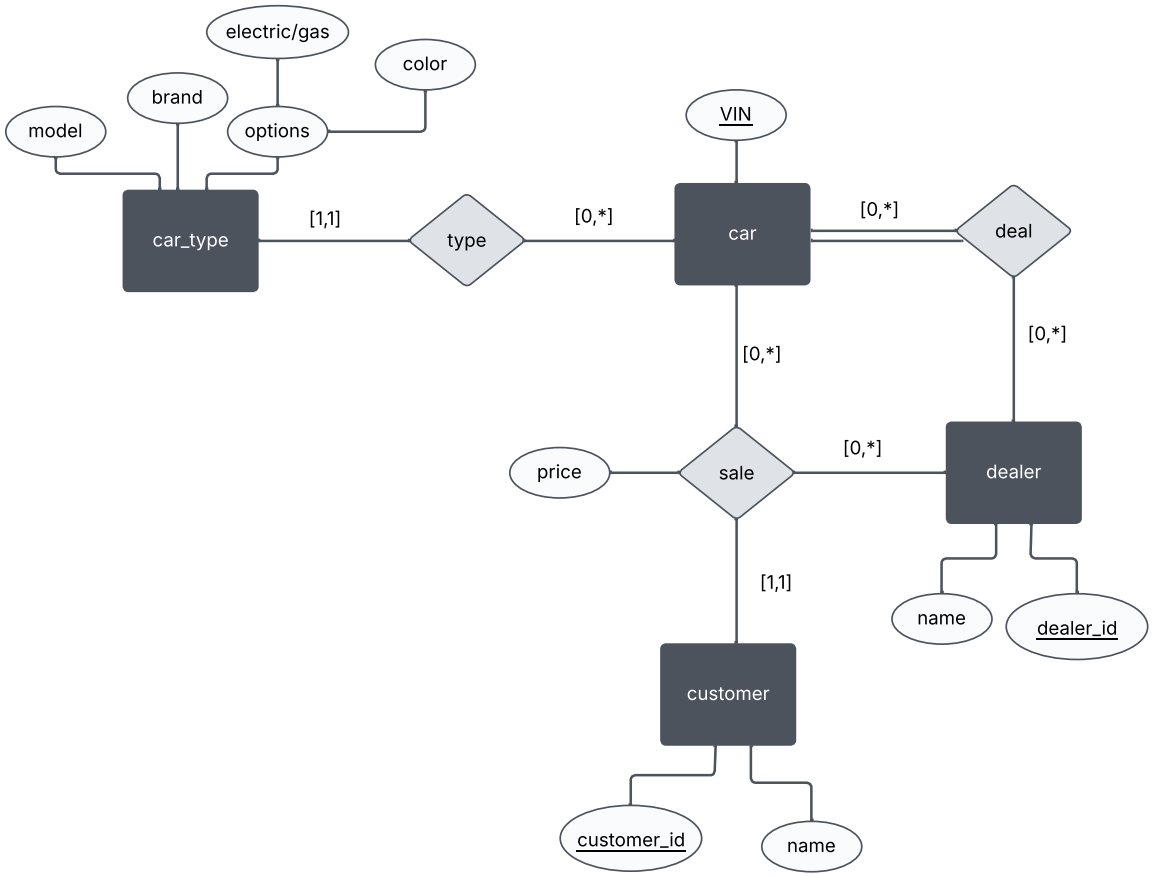
6.22

Design a database for an automobile company to provide to its dealers to assist them in maintaining customer records and dealer inventory and to assist sales staff in ordering cars.

Each vehicle is identified by a vehicle identification number (VIN). Each individual vehicle is a particular model of a particular brand offered by the company (e.g., the XF is a model of the car brand Jaguar of Tata Motors). Each model can be offered with a variety of options, but an individual car may have only some (or none) of the available options. The database needs to store information about models, brands, and options, as well as information about individual dealers, customers, and cars.

Your design should include an E-R diagram, a set of relational schemas, and a list of constraints, including primary-key and foreign-key constraints.

Ans:

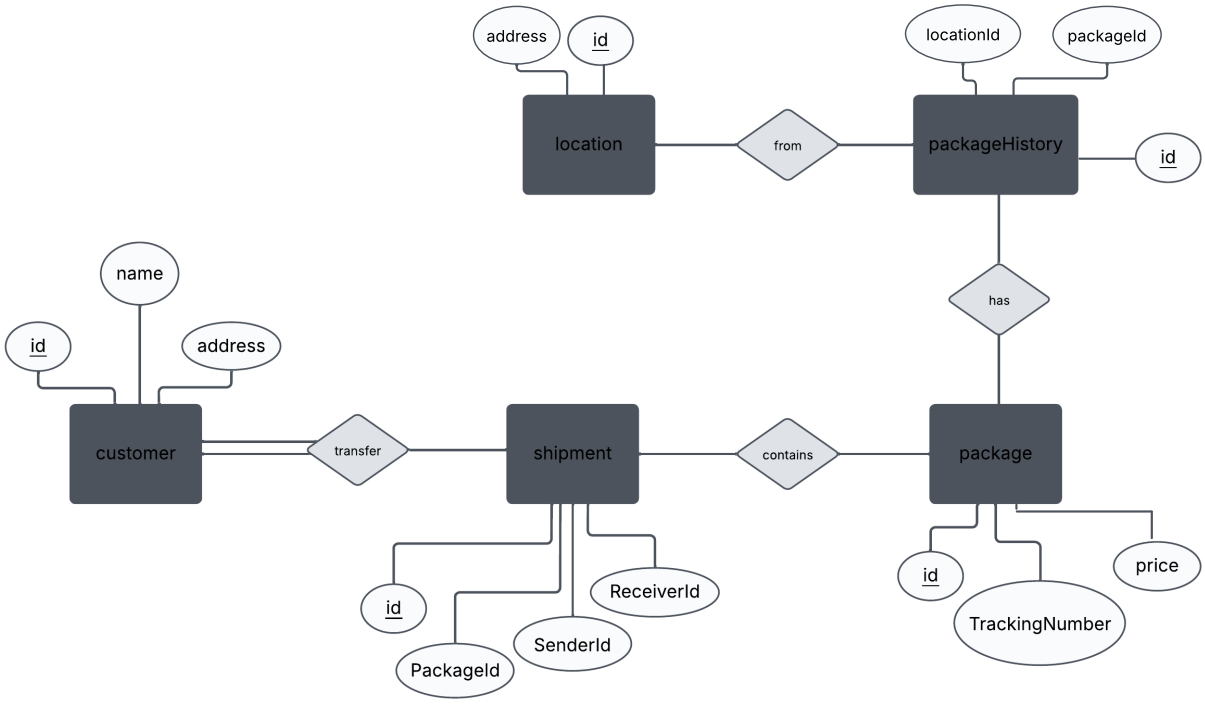


6.23

Design a database for a worldwide package delivery company (e.g., DHL or FedEx). The database must be able to keep track of customers who ship items and customers who receive items; some customers may do both. Each package must be identifiable and trackable, so the database must be able to store the location of the package and its history of locations. Locations include trucks, planes, airports, and warehouses.

Your design should include an E-R diagram, a set of relational schemas, and a list of constraints, including primary-key and foreign-key constraints.

Ans:

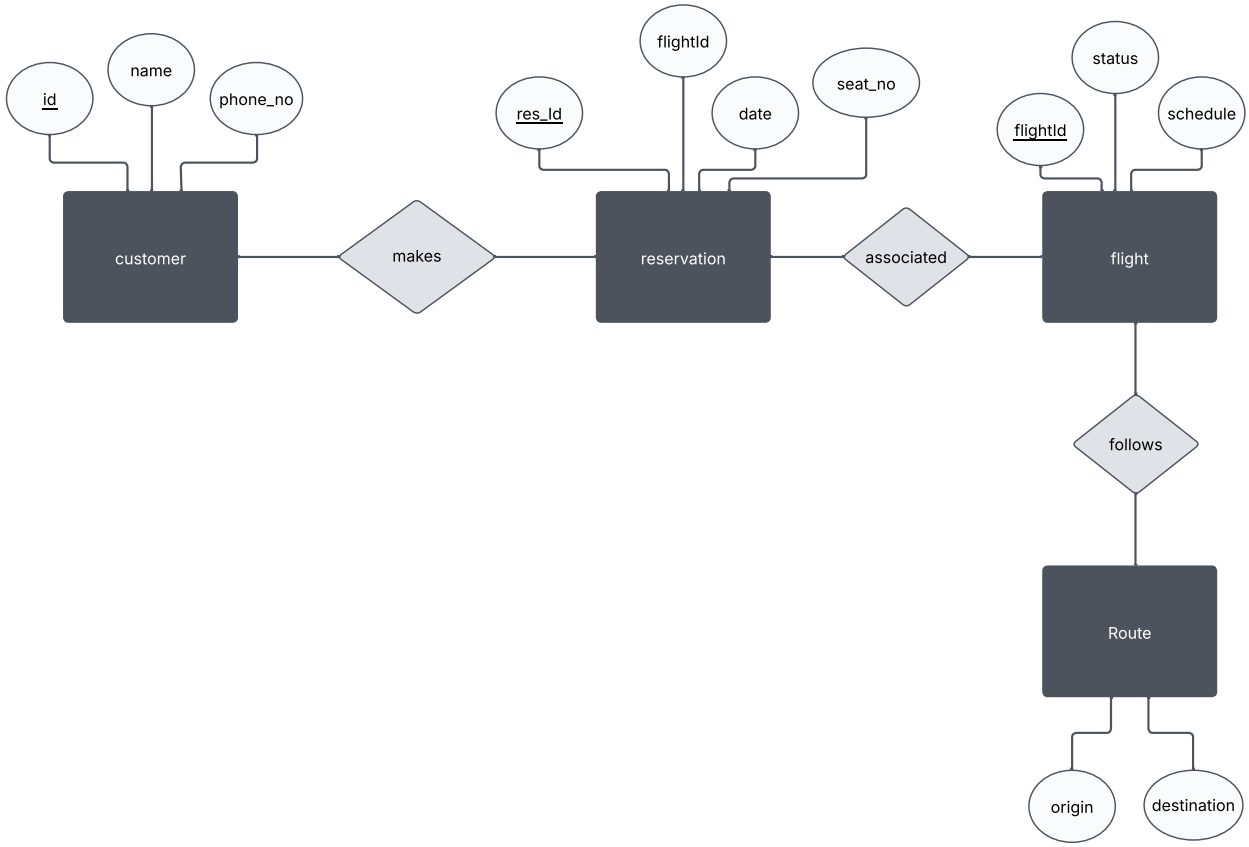


6.24

Design a database for an airline. The database must keep track of customers and their reservations, flights and their status, seat assignments on individual flights, and the schedule and routing of future flights.

Your design should include an E-R diagram, a set of relational schemas, and a list of constraints, including primary-key and foreign-key cosntraints.

Ans:


id
name
phone_no
customer
makes
res_Id
flightId
date
seat_no
reservation
associated
flightId
status
schedule
flight
follows
Route
origin
destination