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Assignment: SQL Database Foundations: Sections 1, 2, 3, 4 - Intro, Modeling, Data Modeler
Date: 09/04/24

1.1 - What I learned:

- The goal of this course is to...
    - understand and model a relational database
    - describe key business requirements when developing databases
    - modeling data with entity relationship diagram (ERD) and physical models
    - learn to use SQL statements

1.2 - Practice

Tasks

1. ABC School District would like to create a student on-line information and registration system to capture student-related information. The system needs to be designed as an on-line process to allow all new students to register on-line. It should also allow existing students to update and review all information. Create a list of important data that would need to be captured and stored in the student registration database.
    a. Name
    b. Birthday
    c. Address
    d. Email
    e. Phone Number
    f. Registration Date
    g. Grade
    h. GPA
    i. Current Classes
    j. Past Completed Classes

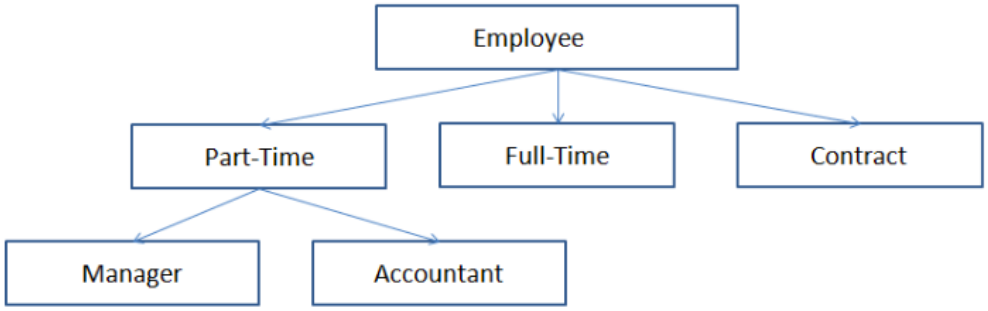
2. XYZ community would like to create a library management system. The objective is for the database to handle all transactions for the library. The database needs to store all the data that is relevant to managing the books, managing customers, and the day-to- day activities of the library. Create a list of important data that would need to be captured and stored in the library management database.
    a. Book Title
    b. Author(s)
    c. Year Published
    d. Total Copies
    e. Unborrowed Copies
    f. Borrowed Copies

g. Pickup Status
h. Current Holder Names
i. Former Holder Names
j. Due Dates

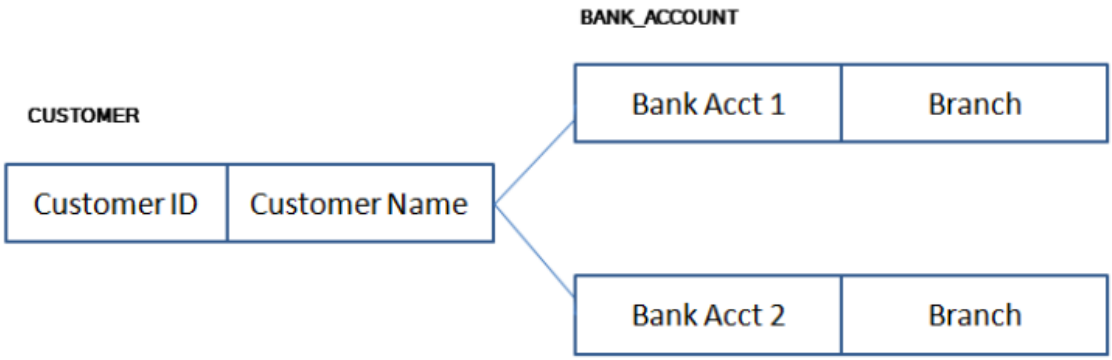
1.3 - Practice

Tasks

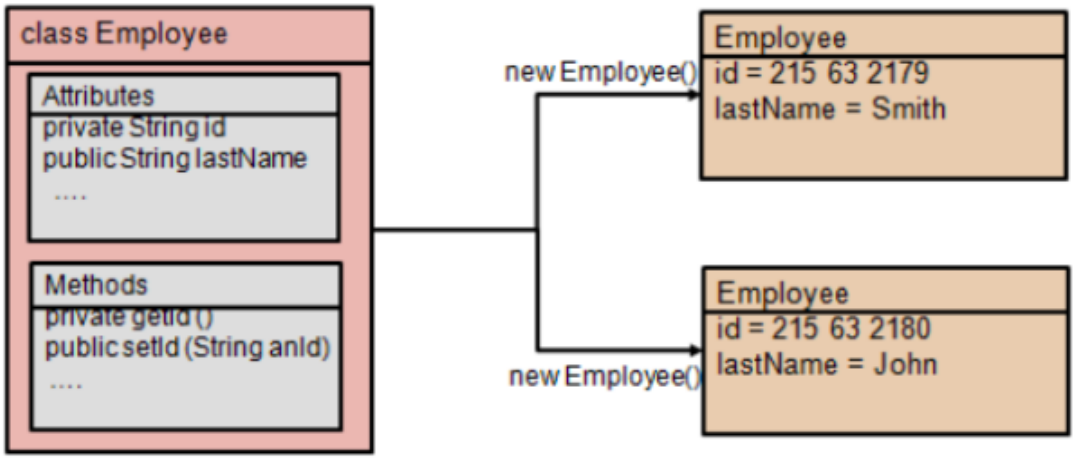
1. Identify the type of database model that has been represented in the given model snapshots:
    a. Hierarchical model



    b. Network model



    c. Object-oriented model



d. Flat file model

CUSTOMER

Account ID	Customer Name	Branch
A0001	Jeff Covey	Burlington Blvd
A0002	William Jake	Sheldon Park
A0003	Mary Schmidt	Notre Dam Street

e. Flat file model

	Book ID	Author Name	Book Title
Record 1	BK0001	Oscar Wilde	A Vision
Record 2	BK0002	Leo Tolstoy	War and Peace
Record 3	BK0003	Oliver Goldsmith	Citizen of the World
Record 4	BK0003	Oliver Goldsmith	Androcles and the Lion

1.4 - Practice

Tasks

1. LibBook is a successful digital library that rents CDs and provides access to Internet for browsing their repository of articles and magazines. With the growing business, LibBook needs to enhance their information system to support proposed changes to the business. LibBook attracts new members easily and the number of members is growing rapidly. The membership base is not stable, however, which is a cause for concern. The main idea is to introduce the concept of membership at LibBook. Members will pay a membership fee and initially, there will be three types of membership (corporate, student, individual) although more may be introduced later. Student membership is free. Corporate and Faculty memberships incur a fee but entitle the member to privileges. The type of membership can be changed only if sufficient justification is provided. Identify the business rules and the associated constraints from the case scenario described.
    a. **Business Rules:** Members must pay a membership fee

        i. **Constraints:** They can enroll in 1 of 3 membership types: corporate, student, individual
    b. **Business Rules:** Student membership is free. Corporate and Faculty memberships incur a fee, but entitle the member to privileges
        i. **Constraints:** Membership type can only be changed if sufficient justification is provided

2. Star Care hospital is a multi-specialty hospital that caters to needs of different patients. Every doctor registered with this hospital is assigned a unique ID that starts with the letter "DC". The hospital ensures that the doctors associated with them have a minimum of seven years of working experience. Every patient is required to register with the hospital on their first visit. When a patient arrives, a unique patient number starting with the letters "PT" is assigned to him/her. Identify the business rules and the associated constraints from the case scenario described.
    a. **Business Rules:** All doctors are assigned a unique ID that starts with the letter "DC"
        i. **Constraints:** All doctors' working experience must be a minimum of 7 years
    b. **Business Rules:** Every patient is required to register with the hospital on their first visit
        i. **Constraints:** The patient number assigned to arriving patients must be unique and start with the letters "PT."

2.1 - Practice

Tasks

1. Identify the possible tables and associated fields from the given scenario: Book.com is an online virtual store on the Internet where customers can browse the catalog and select products of interest
    a. Every book has a title, ISBN, year and price. The store also keeps the author and publisher for any book.
    b. For authors, the database keeps the name, address and the URL of their homepage.
    c. For publishers, the database keeps the name, address, phone number and the URL of their website.
    d. The store has several warehouses, each of which has a code, address and phone number.
    e. The warehouse stocks several books. A book may be stocked at multiple warehouses.
    f. The database records the number of copies of a book stocked at various warehouses.

g. The bookstore keeps the name, address, email-id, and phone number of its customers.
h. A customer owns several shopping carts. A shopping cart is identified by a Shopping_Cart_ID and contains several books.
i. Some shopping carts may contain more than one copy of same book. The database records the number of copies of each book in any shopping cart.
j. At that time, more information will be needed to complete the transaction. Usually, the customer will be asked to fill or select a billing address, a shipping address, a shipping option, and payment information such as credit card number. An email notification is sent to the customer as soon as the order is placed.

ANSWER:

Possible Tables

- Books
- Authors
- Publishers
- Warehouses
- Warehouse_Books
- Customers
- Carts
- Transactions

Field Names

- Book → Book_ID, Title, ISBN, Year_Published, Price, Author_ID, Publisher_ID
- Author → Author_ID, First_Name, Last_Name, Address, Website_URL
- Publisher → Publisher_ID, First_Name, Last_Name, Address, Phone_Number, Website_URL
- Warehouses → Warehouse_ID, Code, Address, Phone_Number
- Warehouse_Books → Warehouse_Book_ID, Book_ID, Total_Copies, Warehouse_ID
- Customers → Customer_ID, First_Name, Last_Name, Address, Email_ID, Phone_Number
- Carts → Shopping_Cart_ID, Customer_ID, Book_ID, Book_Copies
- Transactions → Transaction_ID, Customer_ID, Billing_Address, Shipping_Address, Shipping_Option, Card_Type, Card_Number

2. Identify the tables and associated fields from the above scenario. ABC Ltd plans to computerize its sales ordering and stock control system. A feasibility study has strongly suggested that a relational database system be installed. The details of ABC's sales and stock control are as follows:
    a. Customers send in orders for goods. Each order may contain requests for variable quantities of one or more products from ABC's range. ABC keeps a stock file

showing for each product the product details and the preferred supplier, the quantity in stock, the reorder level and other details.

b. ABC delivers those products that it has in stock in response to the customer order and an invoice is produced for the dispatched items. Any items that were not in stock are placed on a back order list and these items are usually re-ordered from the preferred supplier. Occasionally items are ordered from alternative sources.
c. In response to the invoices that are sent out to ABC's customers, the customers send in payments. Sometimes a payment will be for one invoice, sometimes for part of an invoice and sometimes for several invoices and part-invoices.

ANSWER:

Possible Tables

- Customers
- Orders
- Carts
- Cart_Items
- Products
- Preferred_Suppliers
- Alternative_Suppliers
- Backorder
- Invoices
- Payments

Field Names

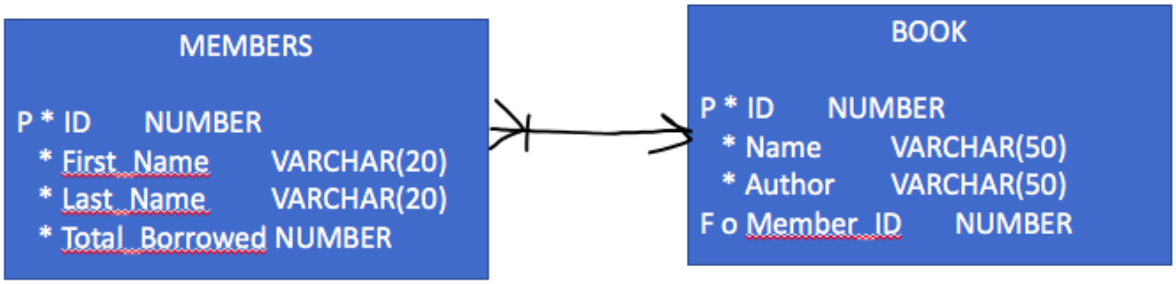
- Customers → Customer_ID, First_Name, Last_Name, Address, Email, Phone_Number
- Orders → Order_ID, Customer_ID, Billing_Address, Shipping_Address, Shipping_Option, Card_Type, Card_Number, Cart_ID
- Carts → Cart_ID, Customer_ID, Date_Created
- Cart_Items → Cart_Item_ID, Cart_ID, Customer_ID, Product_ID, Quantity, Total_Cost
- Products → Product_ID, Name, Preferred_Supplier_ID, Alternative_Supplier_ID, Stock_Count, Price, Reorder_Level
- Preferred_Suppliers → Preferred_Supplier_ID, Name, Phone_Number, Email, Website_URL
- Alternative_Suppliers → Alternative_Supplier_ID, Name, Phone_Number, Email, Website_URL
- Backorder → Backorder_ID, Product_ID, Supplier_ID, Quantity
- Invoices → Invoice_ID, Customer_ID, Total_Due, Total_Paid
- Payments → Payment_ID, Customer_ID, Invoice_ID, Payment_Total

2.2 - Practice

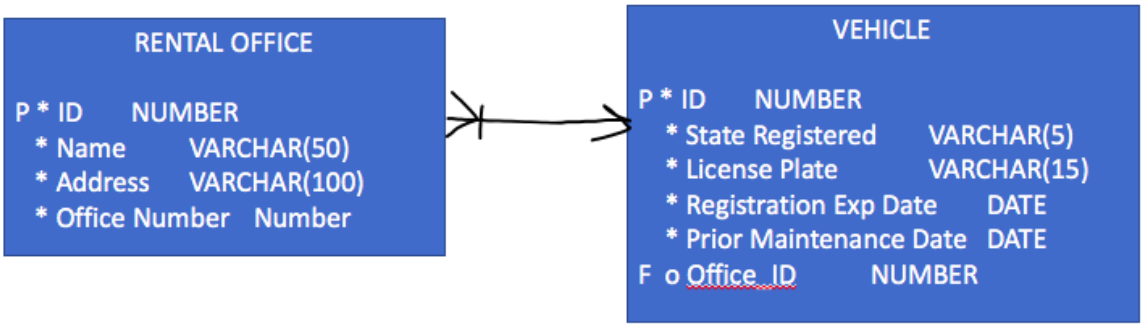
1. Provide five reasons for creating a conceptual data model.

a. Provides a broad overview on how the system may be designed
b. Provides a rough idea of the data to be collected
c. Quick to create
d. Identifies key entities and relationships early in the process before delving into more specifics
e. Facilitates communication among stakeholders

2. List two examples of conceptual models and physical models.
    a. Conceptual Models
        i. Example Library Database Model
            1. Each member may borrow one or more books. Each book may be borrowed by one or more members.
            2. Each book may be published by one and only one publisher. Each publisher must publish one or more books.
        ii. Example Car Rental Company Database Model
            1. Each rental office may rent one or more vehicles. Each vehicle may be rented by one and only one rental office.
            2. Each customer may rent one or more vehicles. Each vehicle must be rented by one and only one customer.
    b. Physical Models
        i. 1st e.g. below



        ii. 2nd e.g. below



2.3 - Practice

Exercise 1:

Summary of how the Academic Database (School Management System) works:

- School/University has many Departments which offer courses to students in a given academic session.
- Each of these courses is taught by a faculty.
- Students enroll for different courses in an academic session.
- Besides the registration details, the parent information of the student also needs to be maintained by the University/School.
- The Department maintains the student's attendance details which would decide the eligibility of the student to take up the exams for that academic session.
- For each academic session, exams are conducted and the results are shared with the student within a stipulated period of time.
- The Department also maintains a log of the Faculty login and logout time for their reporting needs

Tasks: With the information provided above, identify and create the entities for the School Management System.

- DEPARTMENT
- COURSE
- ACADEMIC SESSION
- STUDENT
- PARENT INFORMATION
- EXAM
- EXAM RESULT
- FACULTY
- FACULTY LOGIN

Exercise 2: Add the appropriate attributes as well as the optionality (*, °) to all the entities of the Academic Database

- DEPARTMENT
    - * ID
    - * Name
- COURSE
    - * ID
    - * Course Number
    - * Department ID
    - * Academic Session ID

    - ° Total Seats
    - ° Seats Taken
    - ° Seats Left
- ACADEMIC SESSION
    - * ID
    - * Season
    - * Start Date
    - * End Date
- STUDENT
    - * ID
    - * First Name
    - * Last Name
    - * Birthday
    - * Address
    - ° Middle Name
    - ° Phone Number
    - ° Email
- PARENT INFORMATION
    - * ID
    - * First Name
    - * Last Name
    - * Birthday
    - * Address
    - * Student ID
    - ° Middle Name
    - ° Phone Number
    - ° Email
- EXAM
    - * ID
    - * Course ID
    - ° Attendance Requirement
- EXAM RESULT
    - * ID
    - * Student ID
    - * Course ID
    - * Grade
- FACULTY
    - * ID
    - * First Name
    - * Last Name

    - * Birthday
    - * Address
    - ° Department ID
    - ° Middle Name
    - ° Phone Number
    - ° Email
- FACULTY LOG
    - * ID
    - * Login Time
    - * Logout Time
    - * Faculty ID

2.4 - Practice

Exercise 1: Identify the Unique Identifier and corresponding Primary keys

Tasks

1. How do you find a particular song in the whole collection? What would be a unique identifier for SONG?
    a. I would find a particular song in a whole collection by first searching up the name. If several songs have the same name, I would next look up the artist to further narrow the results. A unique identifier for a SONG entity would be "ID" as each ID would be unique for each song and likely act as a primary key.
2. Think about all the students in the classroom. Each student is described by several traits or attributes. Which attribute or attributes allow you to pick a single student from the rest of the class?
    a. Student ID would be an attribute that allows someone to pick a single student from the rest of the class.
3. For each entity, select the attribute that could be the unique identifier of each entity.

Entity: STUDENT
Attributes: student ID, first name, last name, address

Entity: MOVIE
Attributes: title, date released, producer, director

Entity: LOCKER
Attributes: size, location, number

    a. STUDENT → student ID
    b. MOVIE → director
    c. LOCKER → number

Exercise 2: Identify the Unique Identifiers and add to the ERD

Tasks:

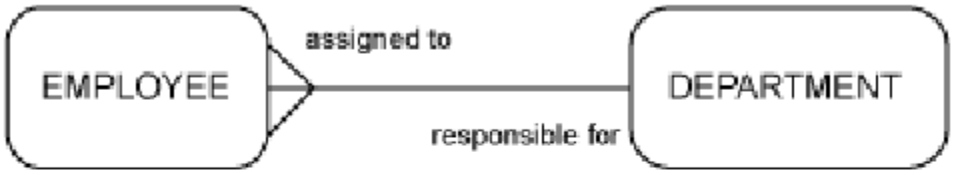
1. Use the Academic Database ERD from the previous exercises to identify the following:
    a. Unique Identifiers
        i. STUDENT → student ID
        ii. MOVIE → movie ID
        iii. LOCKER → locker ID
    b. Candidate Unique Identifiers
        i. STUDENT → address
        ii. MOVIE → director
        iii. LOCKER → number

2.5 - Practice

Exercise 1: Identify relationships from the ERD

Tasks:

1. Read the relationship. Which text corresponds to the diagram?
    a. ANS: b

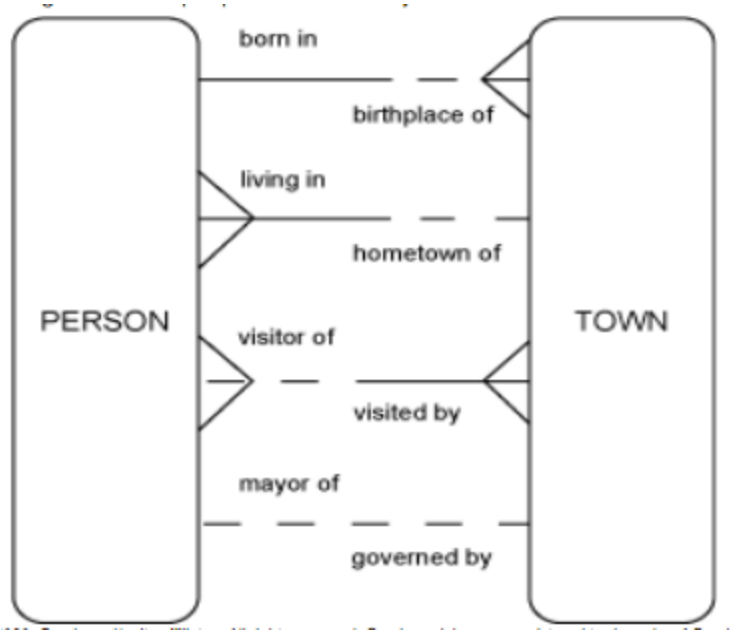


a. Each EMPLOYEE may be assigned to one or more DEPARTMENTs.
Each DEPARTMENT must be responsible for one or more EMPLOYEEs.

b. Each EMPLOYEE must be assigned to one and only one DEPARTMENT.
Each DEPARTMENT must be responsible for one or more EMPLOYEEs.

c. Each EMPLOYEE must be assigned to exactly one DEPARTMENT.
Each DEPARTMENT may be responsible for exactly one EMPLOYEE.

2. Read each relationship in the model below. For each relationship, write the ERD statement and your comments. Use your knowledge of normal people and towns in your comments
    a. Each person must be born in one or more towns. Each town may be the birthplace of one and only one person.
    b. Each person must be living in one and only one town. Each town may be the hometown of one or more person.
    c. Each person may be the visitor of one or more towns. Each town must be visited by one or more person.
    d. Each person may be the mayor of one and only one town. Each town may be governed by one and only one person.



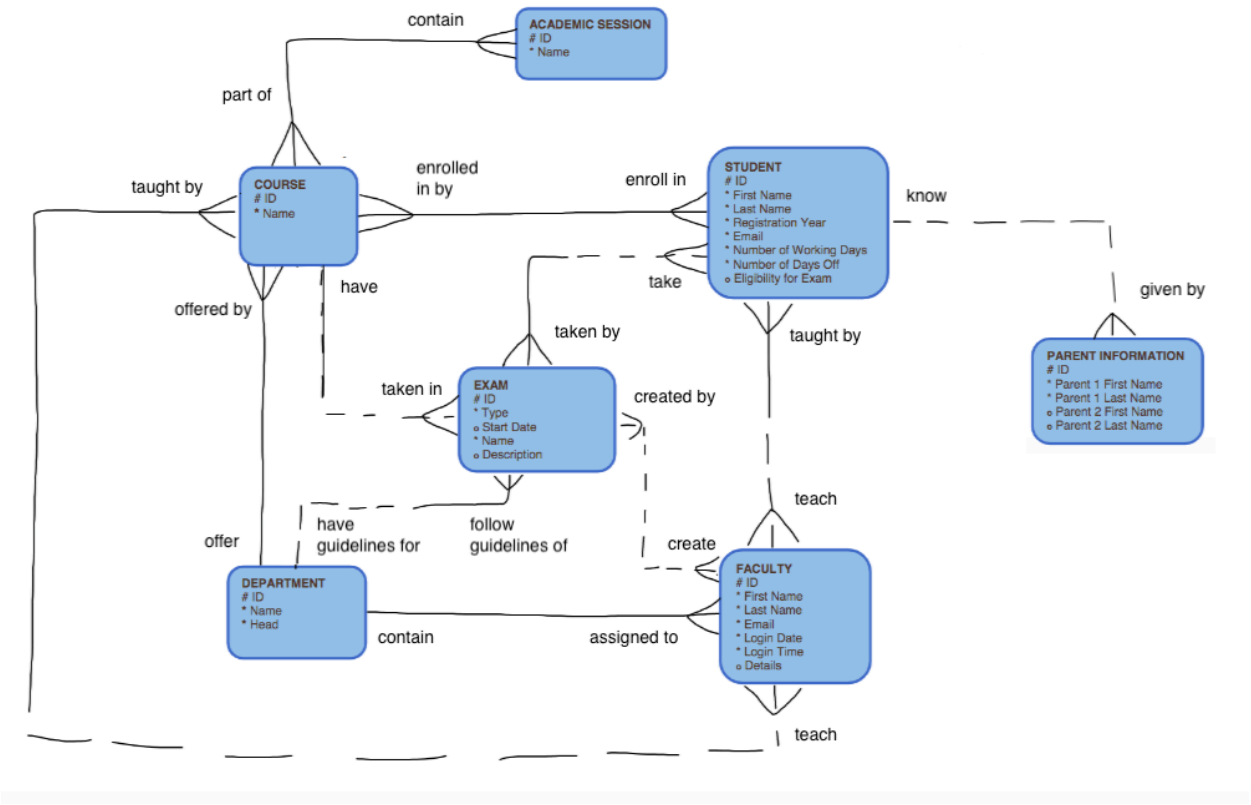
Exercise 2: Analyze and Model Relationships

Tasks

1. Write the ERDish for each of the relationships in the Academic Database including relationship names, optionality and cardinality. Draw the ERD including the relationships
    a. ERD drawing is below the table

	Course	Department	Faculty	Student	Parent Information	Academic Session	Exam
Course		offered by	taught by	enrolled in by		part of	have
Department	offer		contain				create guidelines for
Faculty	teach	assigned to		teach			create
Student	enroll in		taught by		know		take
Parent Information				given by			
Academic Session	contain						
Exam	taken in	follows guidelines	created by	taken by			

		of					



2.6 - Practice

Tasks:

1. Identify the possible Entities and Attributes from the given scenario.

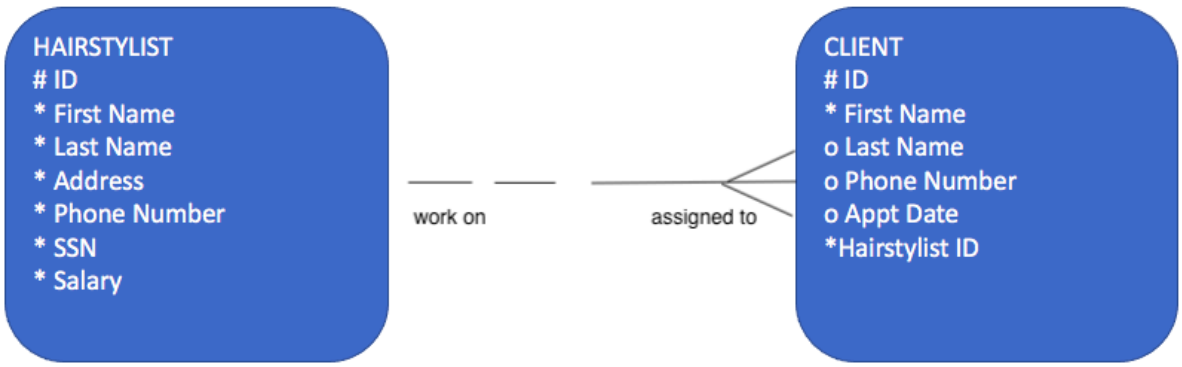
SCENARIO: A company has several departments. Each department has a supervisor and at least one employee. Employees must be assigned to at least one, but possibly more departments. At least one employee is assigned to a project, but an employee may be on vacation and not assigned to any projects. The important data fields are the names of the departments, projects, supervisors and employees, as well as the supervisor and employee number and a unique project number

a. DEPARTMENT
    i. ID
    ii. Name
    iii. Total Employees
b. DEPARTMENT EMPLOYEE
    i. ID

    ii. Department ID
    iii. Employee ID
c. SUPERVISOR
    i. ID
    ii. Name
    iii. Supervisor Number
d. EMPLOYEE
    i. ID
    ii. Name
    iii. Project ID
e. PROJECT
    i. ID
    ii. Name
    iii. Project Number

2. Read the given business scenario. Draw the entities HAIRSTYLIST and CLIENT. List the attributes associated with each entity and specify whether they are mandatory or optional. Identify the UIDs. Follow the diagramming conventions discussed. State the ERDish for the relationships.

SCENARIO: “In our salon, we have a number of hairstylists. They are all salaried employees, so we keep a record of their first name, last name, address, phone number, social-security number, and salary. During the course of a day, a hairstylist may see several clients. On a slow day, a hairstylist may not work on anyone at all. We have several walk-in clients, and they each get assigned to one hairstylist. We just ask for their first name. We also have customers who call to make an appointment. When they do this, we ask for their first name, last name, and phone number. We also ask if they would like a specific hairstylist. If they have no preference, we assign one for them. Of course, they are allowed to switch to another hairstylist for their next visit to the salon. We are interested in tracking the daily appointments -- which stylist works on which client during a given day.”

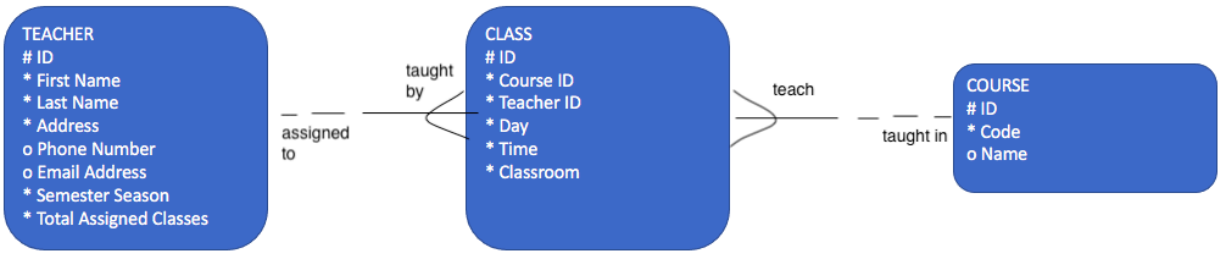


a. ERDish → Each hairstylist may work on one or more clients. Each client must be assigned to one and only one hairstylist.

3. Read the given business scenario. Draw the entities TEACHER and COURSE and CLASS. List the attributes underneath each entity. Specify whether they are mandatory or optional. Identify the UIDs. State the ERDish for the relationships.

SCENARIO:
"We have several teachers at our school. A teacher can be assigned up to three classes per semester. If a teacher is on sabbatical, he doesn't teach that semester. We keep a record of the teacher's first name, last name, address, phone number, and email address.

Our school offers many courses -- such as Data Modeling, Introduction to SQL, Trigonometry, Physics, and Biology. Each course has a code. For example: Data Modeling would be DM001, Trigonometry would be TR004, etc. During each semester, a course may be taught in several classes -- so there could be two classes of Physics, three classes of Biology, etc. Each class can be taught by only one teacher. We assign a unique ID for each class, and we also keep track of the day it is taught, the time, and the classroom."



a. ERDish
   i. Each teacher may be assigned to one or more classes. Each class must be taught by one and only one teacher

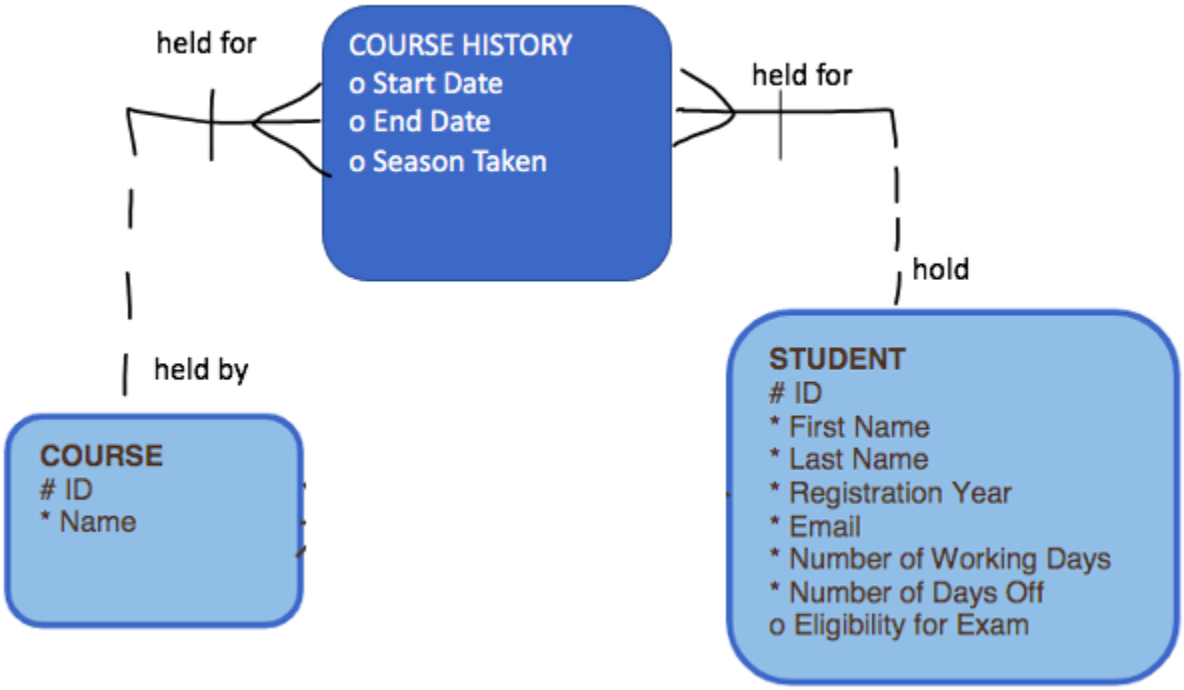
ii. Each class must teach one and only one course. Each course may be taught in one or more classes.

3.1 - Practice

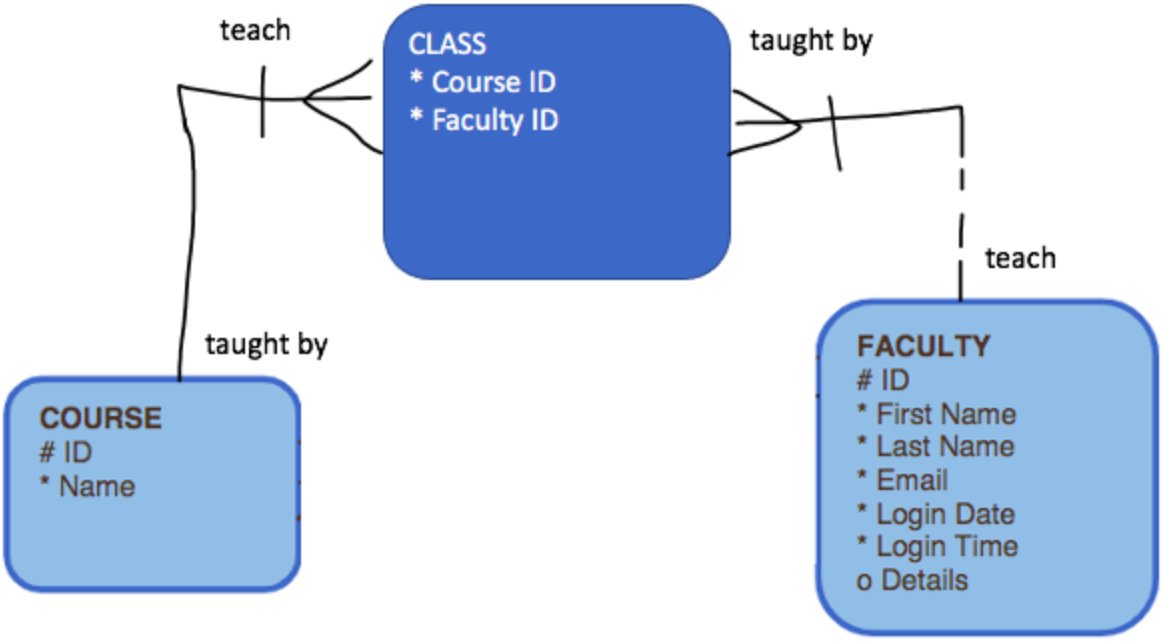
Exercise 1 Overview: In this practice, you will resolve the following M: M relationships within the Academic database. Add additional attributes in the intersection entities where needed.

Tasks

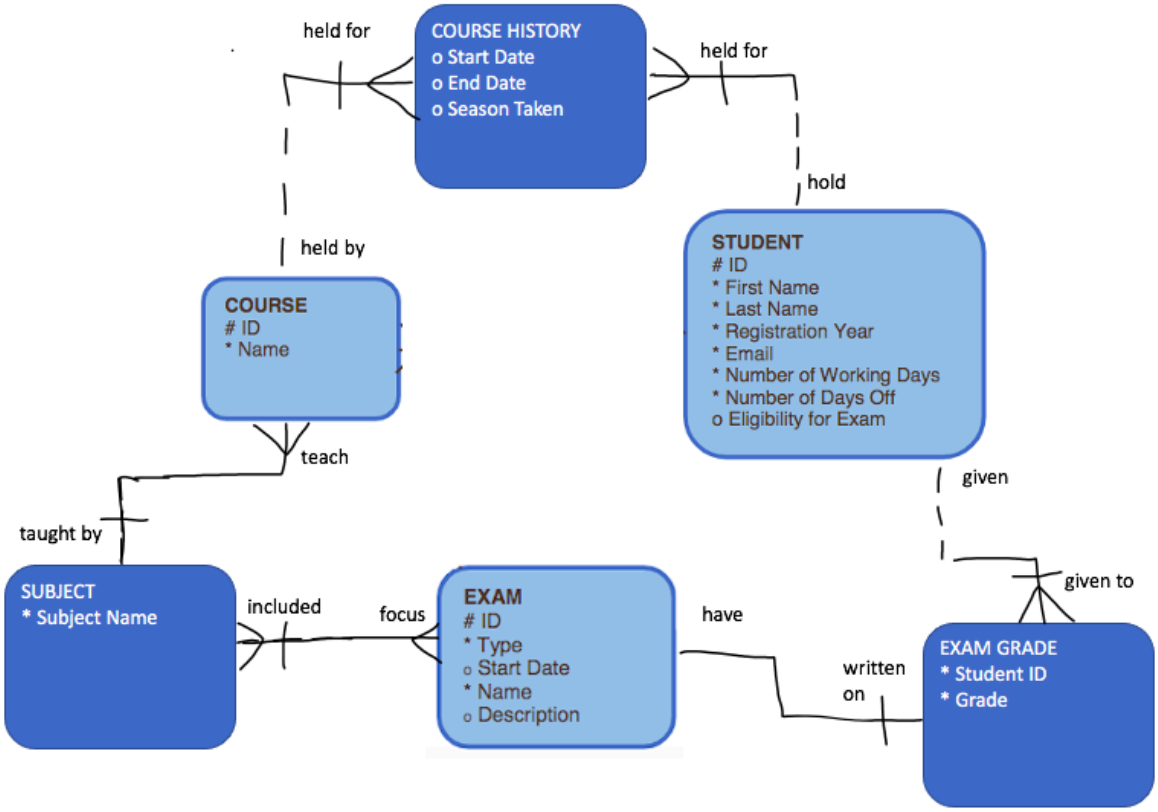
1. Resolve M: M relationships between STUDENT and the COURSE using a barred relationship.



2. Resolve M: M relationships between FACULTY and the COURSE



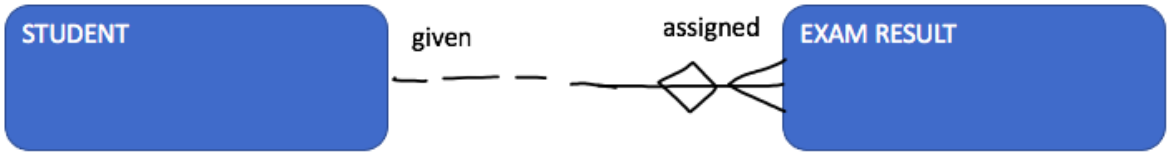
3. Resolve M: M relationships between STUDENT,COURSE and EXAM



Exercise 2 Overview: In this practice, you create the ERD from the given scenario and add nontransferability option to it.

Tasks

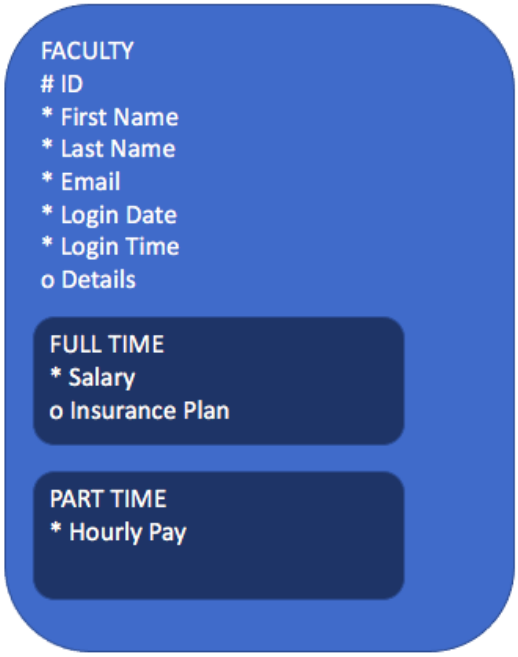
1. A STUDENT will be assigned an EXAM RESULT after taking an exam. Once an EXAM RESULT has been issued, it cannot be transferred to another STUDENT.



Exercise 3: Identify and draw supertype and subtype entities

Tasks

1. Faculty can be either full time or part time. Full time faculty receive a salary and are entitled to an insurance plan. Part time faculty are paid on an hourly basis and receive no benefits. Redraw the following entity as a supertype with subtype entities reflecting the new information.

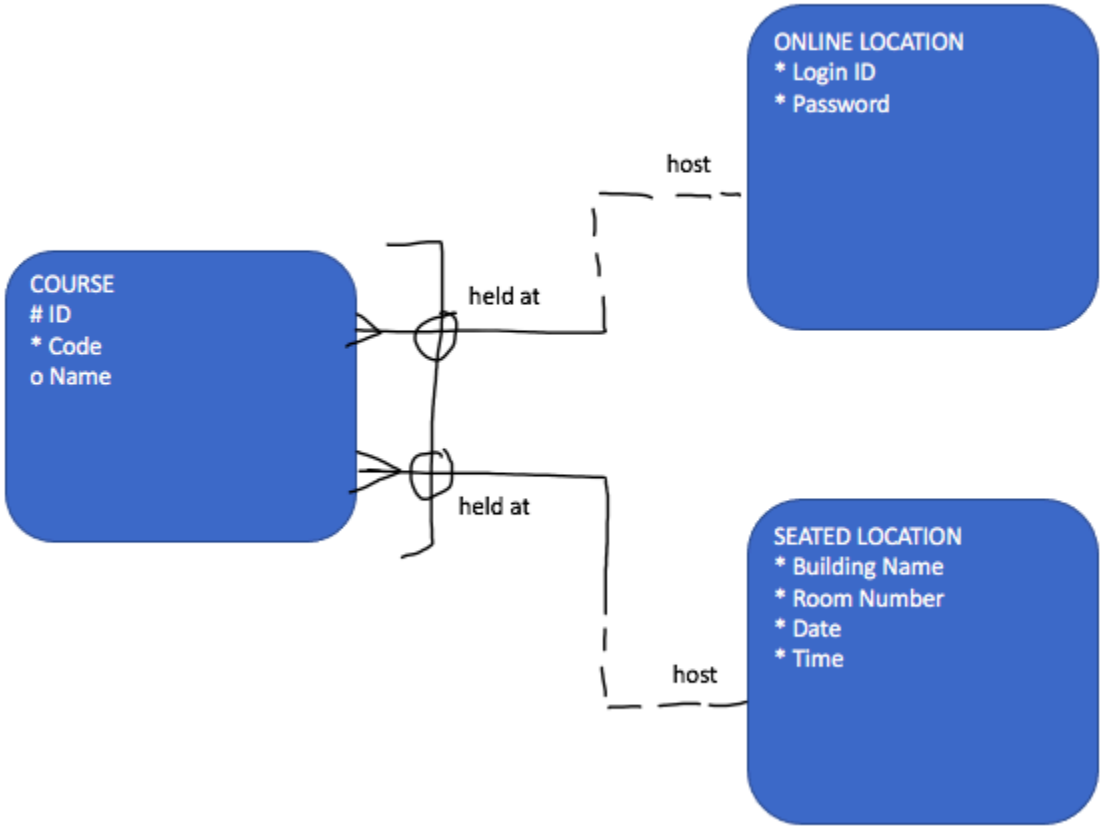


Exercise 4: Examine Exclusive Relationships (Arcs)

Tasks

1. Determine how exclusive relationships should be modeled in the following scenario.

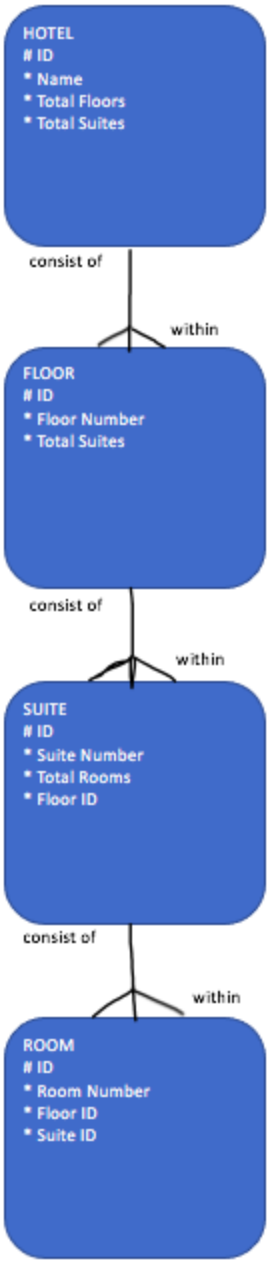
SCENARIO: Each COURSE instance in the Academic Database can either be held ONLINE or in a SEATED location. Each SEATED location has a building name, room number and a date/time when the COURSE is offered. The ONLINE classes have a logon id and a password required to enter the COURSE. Model this new information as an Arc in the Academic Database.



Exercise 5: Model Hierarchical Data

Tasks

1. In this practice, model the entities, relationships, attributes, and unique identifiers for the hierarchy of a hotel. The hotel has many floors, many suites on each floor, and many rooms within each suite



Exercise 6: Model Hierarchical Data and Recursive Relationships

Tasks

1. Develop two ERDs to represent the following situation. Develop one as a hierarchical structure and one as a recursive structure.

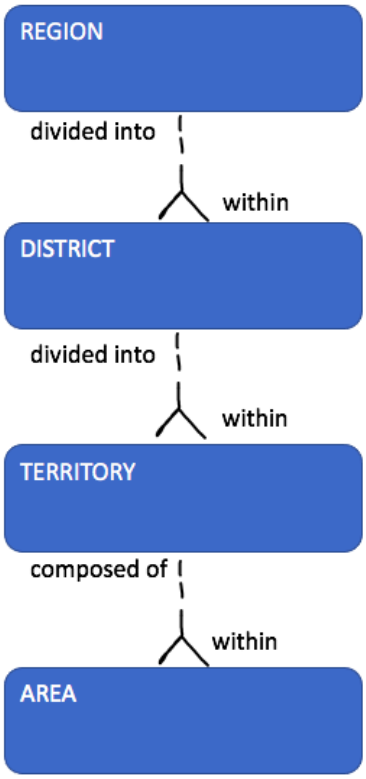
Curves Dynamics sells products throughout the United States. They are divided into four major sales regions: the Northern, Eastern, Southern, and Western regions. Each sales region has a unique region code. Each sales region is then divided into sales districts. For example, the

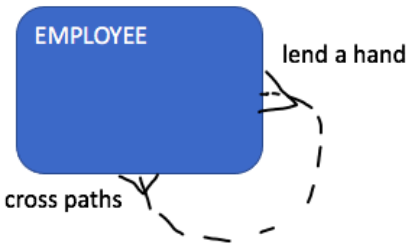
Western Region is divided into the Rocky Mountain, Northwest, Pacific Coast, and Pacific districts.

Each district has a unique district code. Each district is made up of sales territories. The Rocky Mountain district is composed of three territories: Wyoming-Montana, Colorado, and Utah-New Mexico. The Northwest district is made up of two territories: the Washington and Oregon-Idaho territories. The Pacific Coast district is composed of two territories: the California and Nevada territories. The Pacific district includes the Hawaii territory and the Alaska territory. Each territory has a unique territory code

Each sales territory is broken down into sales areas. For example, Colorado is made up of two sales areas: the Front Range and the Western Slope sales areas. Each sales area has a unique sales-area code. Each salesperson is responsible for one or more sales areas, and has a specific sales quota. Each sales manager is responsible for one or more sales districts and sales directors who are responsible for one or more sales regions.

Each sales manager is responsible for the territories within his districts. Employees' responsibilities do not overlap. A sales area is always the responsibility of a single salesperson, and managers and directors' responsibilities do not overlap. Sometimes salespersons, managers, and directors will be on leave or special assignments and will not have sales area responsibilities. All sales personnel are identified by their employee IDs.





Exercise 7: Developing a complete ERD using Supertype/Subtypes and Arcs

Tasks

1. Develop an ERD for the following information requirements:
    a. **NOTE: Answer is posted in a separate image file titled "oracle_3.1_E7_T1"**

The Right-Way Rental Truck Company rents small moving trucks and trailers for local and one-way usage. There are 347 rental offices across the western United States. The rental inventory includes a total of 5,750 vehicles, including various types of trucks and trailers. The data that needs to be tracked is rental agreements and vehicle assignments.

Each rental office rents vehicles that they have in inventory, to customers ready to take possession of the vehicle. Reservations are not taken, and speculation on when the customer will return the rented vehicles is not tracked. The central office oversees the vehicle distribution, and directs transfers of vehicles from one rental office to another. Each rental office has an office name like "Madison Right-Way" and address. Each office also has a unique three-digit office number. Each office is a home office for some vehicles, and each vehicle is based out of a single home office.

Each vehicle has a vehicle ID, state of registration, and a license plate registration number. There are five different types of vehicles: 36-foot trucks, 24-foot trucks, 10-foot trucks, 8-foot covered trailers, and 6-foot open trailers, each with a type code. For all vehicles, a last maintenance date and expiration date of its registration needs to be tracked. In addition, for trucks, the current odometer reading, the gas tank capacity, and whether or not it has a working radio needs to be stored. For long moves, customers really prefer a radio. The current mileage is logged before the truck is rented, and then again when it returns. Additionally for trailers the maximum weight capacity must be logged.

Most rental agreements are for individual customers, but a rental agreement can be for either an individual or a company. A small percentage of trucks are rented to companies. Each company is assigned a company number and the name and address of the company are tracked. The corporate sales group handles all the information separately.

For each individual customer, the following information is tracked: name, home phone, address, and driver's license state, number and expiration date. If a customer damaged a vehicle, abandoned it, or did not fully pay the bill, the customer is tagged as a poor risk, and the customer may not rent again.

Only a single individual or company can obtain a rental agreement, and a separate rental agreement is written for each vehicle. Customers can rent two or more vehicles at the same time. Each rental agreement is identified by the originating rental office number and a rental

agreement number. In addition, the rental date, anticipated duration of the rental, the originating rental office, the drop-off rental office, the amount of the deposit paid, the quoted daily rental rate, and the quoted rate per mile are tracked. For trailers, there is no mileage charge.

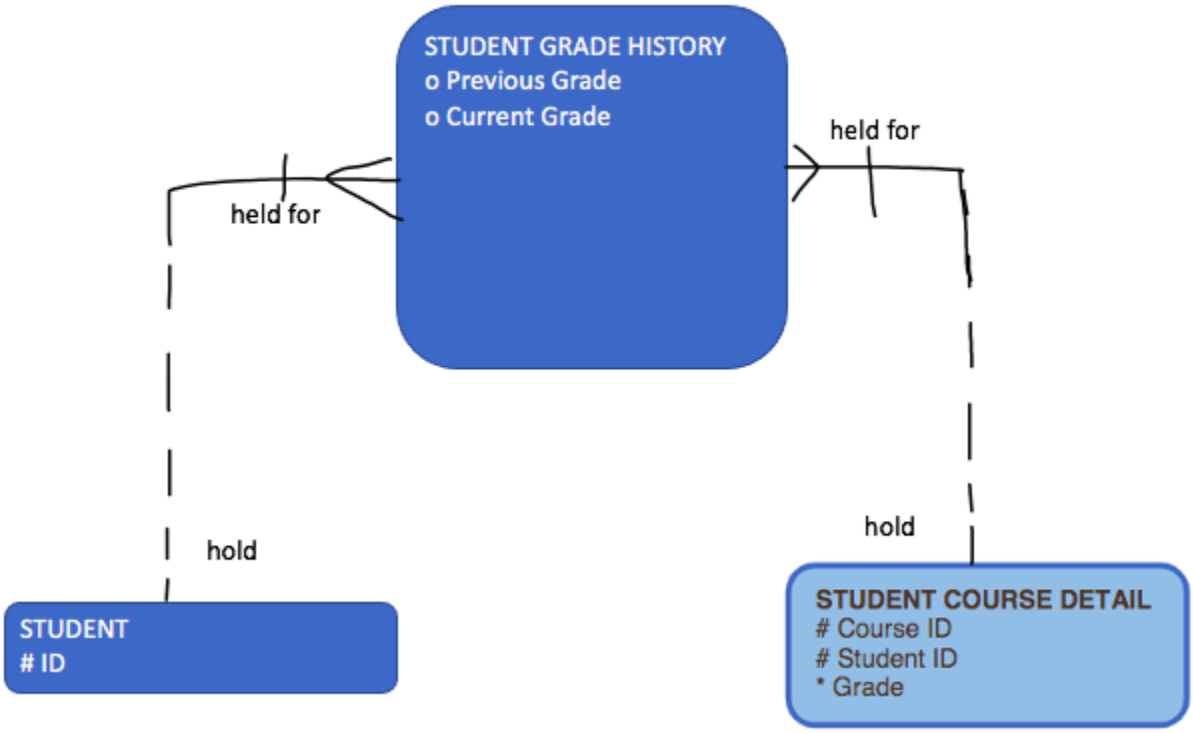
3.2 - Practice

Exercise 1: Track Data Change over Time

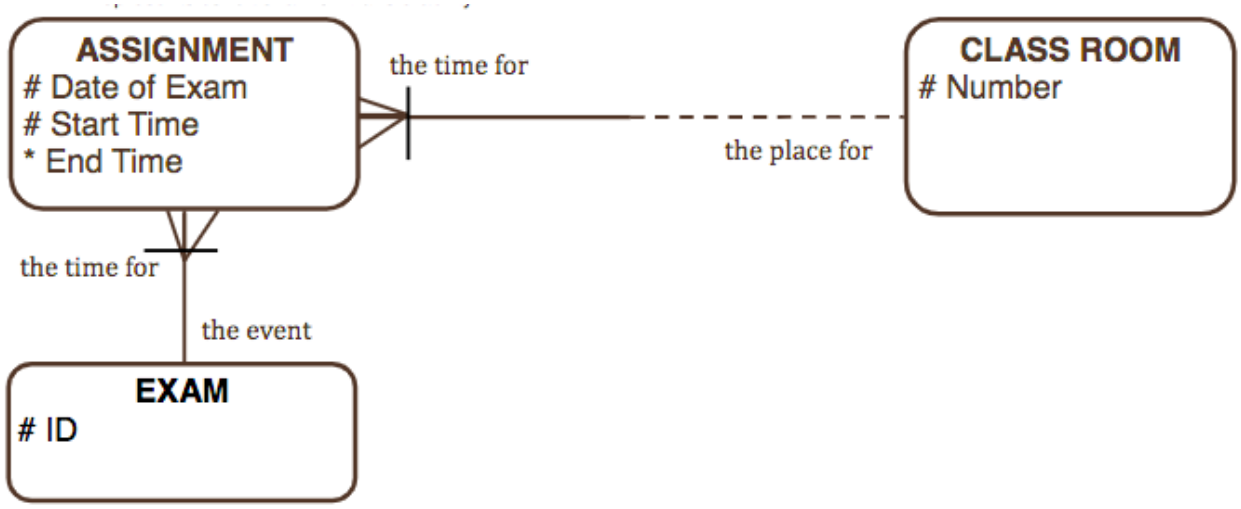
Tasks:

1. Construct the ERD for the given scenario.

SCENARIO: In the Academic Database a Grade is issued to each STUDENT for each COURSE taken and stored in the STUDENT COURSE DETAIL entity. A STUDENT may decide to re-take a COURSE to better their Grade. The administration would like to keep a record of the old/previous Grade as well as the new Grade. Show how the ERD would be modified to include historical Grades if the STUDENT should have them. **We will not make this actual change to the ERD.



2. Examine the ERD that represents classroom assignments for different exams.



a. Why is start time part of the UID of ASSIGNMENT?
    i. You would not have two assignments that have the same start time since each assignment must be the time for one and only one exam.
b. Name at least three time-related constraints. For example: End time must be later than start time. Indicate if the constraint represents conditional non-transferability
    i. The start time must be before the end time
    ii. Certain classrooms are available to be used on the date and time that the assignment is scheduled
    iii. The exam must begin on the date and start time

3.3 - Practice

Exercise 1: Relational Databases

Tasks

1. Analyze the given table which is not normalized. The table holds information specific to items such as the Item ID, Color of the item, and the Unit price of each of the item. Some of the rows in the table have repeating groups of information. Evaluate the data in the table and bring the table to first normal form:

Item ID	Color	Unit Price
IT001	Red, Blue	$16.56
IT002	Yellow	$17.48
IT003	Green	$19.76
IT004	Blue, Yellow	$20.00

ANSWER:

Item ID	**Color**	**Unit Price**

IT001	Red	$16.56
IT001	Blue	$16.56
IT002	Yellow	$17.48
IT003	Green	$19.76
IT004	Blue	$20.00
IT004	Yellow	$20.00

2. Analyze the given table. The table is in the first normal form and has a composite primary key made up of the Supplier ID and Store Id. The non-key attribute location is only dependent on the Store ID. Evaluate the data stored in the table and bring the table to second normal form:

Supplier ID	Store ID	Location
SP001	S1	New York
SP001	S3	Vermont
SP002	S1	New Hampshire
SP003	S2	Rhode Island
SP004	S3	Illinois

ANSWER:

Store ID	**Location**
S1	New York
S3	Vermont
S1	New Hampshire
S2	Rhode Island
S3	Illinois

3. Analyze the given table and the data stored. In the table the Book ID is the primary key and the Category Description is dependent on the Category ID. Evaluate the data stored in the table and eliminate the transitive dependency to bring the table to the third normal form:

Book ID	Category ID	Category Desc	Price
1	1	Cooking	$27.99
2	2	Travel	$17.99
3	1	Cooking	$20.99
4	3	Computers	$40.99
5	2	Travel	$19.99

ANSWER:

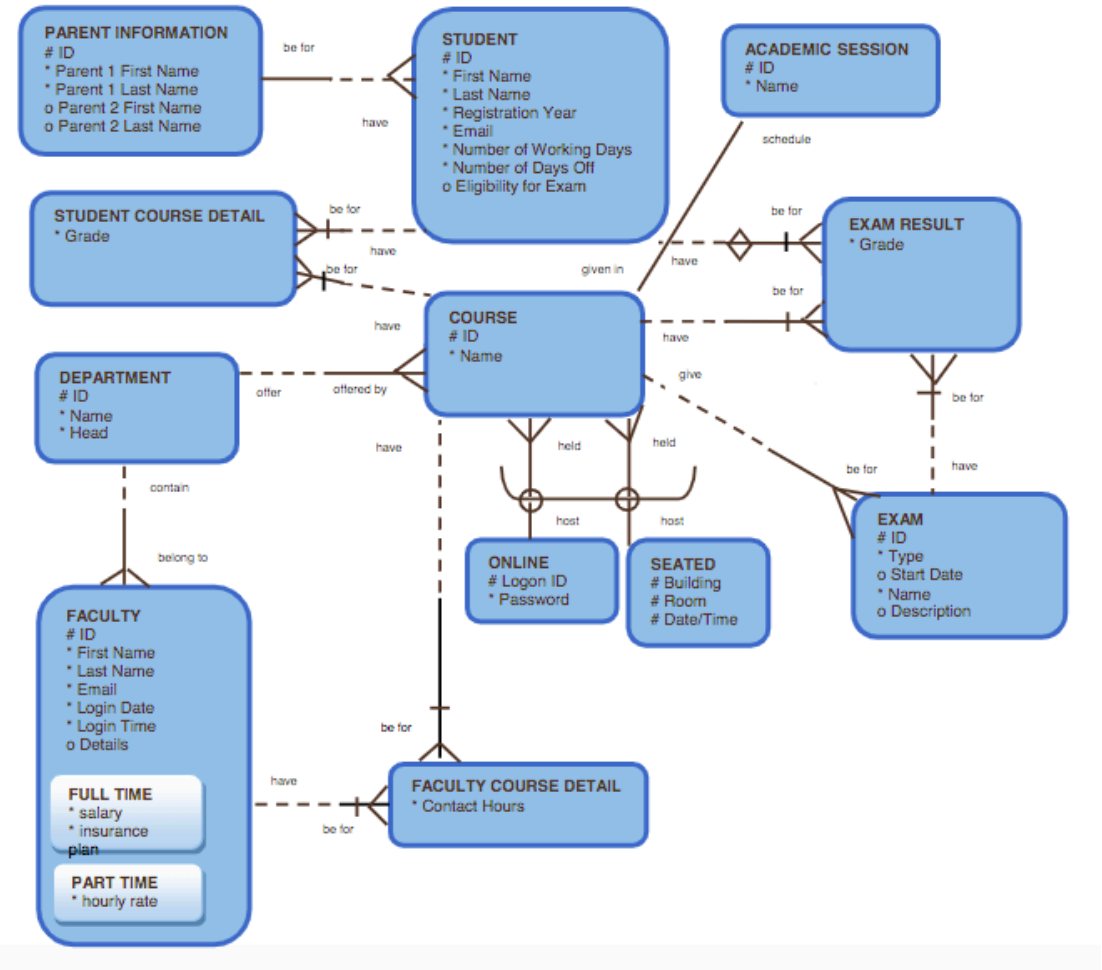
Book ID	Category ID	Price
1	1	$27.99
2	2	$17.99
3	1	$20.99
4	3	$40.99
5	2	$19.99

Category ID	Category Desc
1	Cooking
2	Travel
1	Cooking
3	Computers
2	Travel

Exercise 2: Normalize Academic Database ERD

Tasks

1. For the Academic Database ERD (shown below), evaluate each entity against the rules of normalization, identify the misplaced attributes, and explain which rule of normalization each misplaced attribute violates



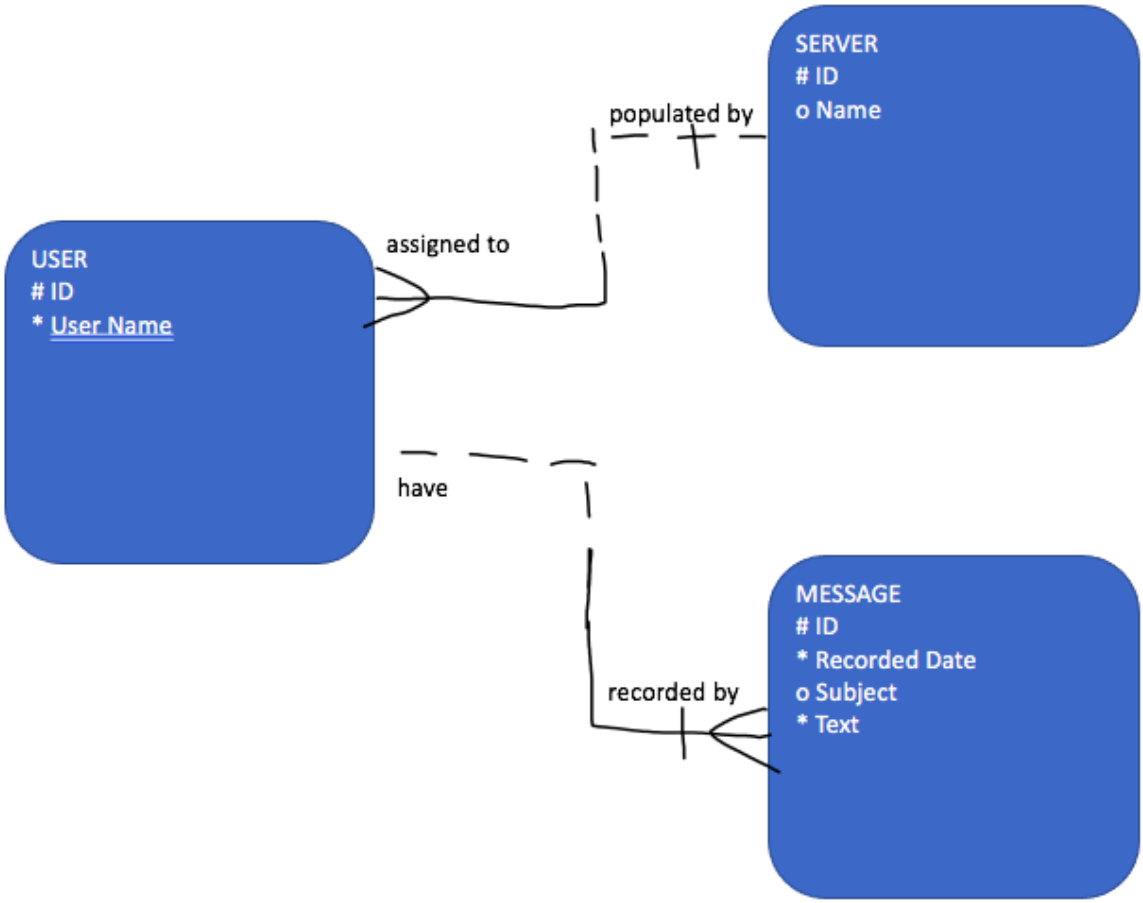
a. The below attributes are 1NF violation because they each can have multiple values
    i. FACULTY → Login Date, Details
    ii. FACULTY COURSE DETAIL → Contact Hours
    iii. EXAM → Start Date, Description
    iv. SEATED → Date/Time
b. There are no violations of 2NF and 3NF

Exercise 3: Validate an ERD for Normalization

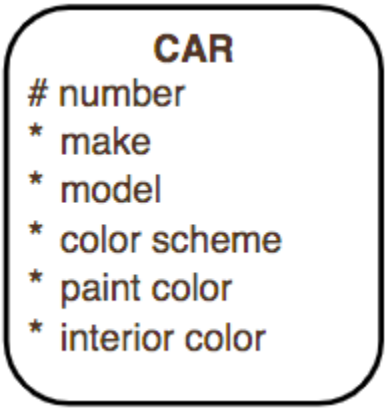
1. Evaluate the following unnormalized data in the USER entity and develop an entity relationship diagram that is normalized to third normal form

User ID	User Name	Message ID	Recorded Date	Subject	Text	Server ID	Server Name
2301	Smith	54101	05/07	Meeting Today	There is…	3786	IMAP05
2301	Smith	54098	07/12	Promotions	I like to…	3786	IMAP05
2301	Smith	54445	10/06	Next Assignment	Your next…	3786	IMAP05
5607	Jones	54512	06/07	Lunch?	Can You…	6001	IMAP08
5607	Jones	54101	05/07	Meeting Today	There is…	6001	IMAP08
5607	Jones	54660	12/01	Jogging Today?	Can you…	6001	IMAP08
7773	Walsh	54101	05/07	Meeting Today	There is…	9988	EMEA01
7773	Walsh	54554	03/17	Stock Quote	The latest…	9988	EMEA01
0022	Patel	54101	05/07	Meeting Today	There is…	9988	EMEA01
0022	Patel	54512	06/07	Lunch?	Can you…	9988	EMEA01

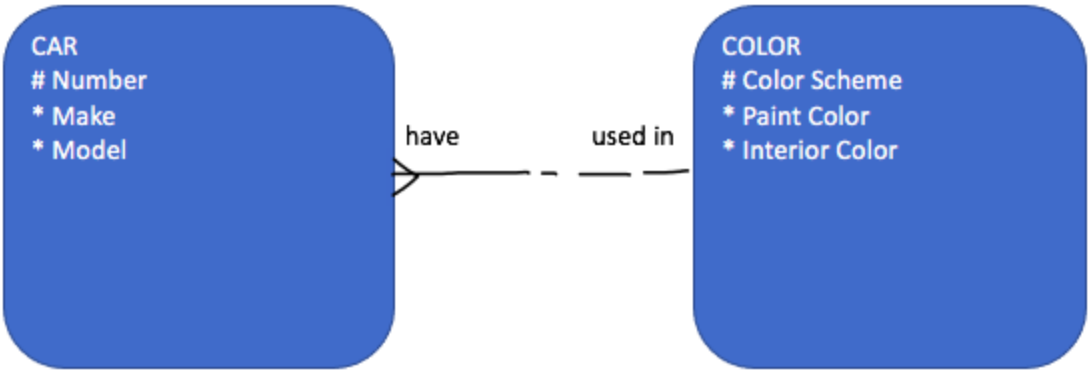
ERD (next page)



2. A color scheme for a car includes specifications for paint color for the body and the interior colors and materials. For example: The “Desert” color scheme includes silver paint and gray leather interior; the “Sunburst” color scheme includes gold paint and cream leather interior. Does the model below follow the rules of Third Normal Form? If you spot a violation, correct it.



ANSWER:



Exercise 4: Gather database requirements and Business Rules

Tasks

1. Book.com is an online virtual store on the Internet where customers can browse the catalog and select products of interest. **Your task is to identify the business rules.**
    a. Every book has a title, ISBN, year and price. The store also keeps the author and publisher for any book.
        i. Structural business rule
    b. For authors, the database keeps the name, address and the URL of their homepage.
        i. Structural business rule
    c. For publishers, the database keeps the name, address, phone number and the URL of their website.
        i. Structural business rule
    d. The store has several warehouses, each of which has a code, address and phone number.
        i. Structural business rule
    e. The warehouse stocks several books. A book may be stocked at multiple warehouses.
        i. Structural business rule
    f. The database records the number of copies of a book stocked at various warehouses.
        i. Structural business rule
    g. The bookstore keeps the name, address, email-id, and phone number of its customers.
        i. Structural business rule
    h. A customer owns several shopping carts. A shopping cart is identified by a Shopping_Cart_ID and contains several books.
        i. Structural business rule

i. Some shopping carts may contain more than one copy of the same book. The database records the number of copies of each book in any shopping cart.
    i. Structural business rule
j. At that time, more information will be needed to complete the transaction. Usually, the customer will be asked to fill or select a billing address, a shipping address, a shipping option, and payment information such as credit card number. An email notification is sent to the customer as soon as the order is placed
    i. Procedural business rule
        1. Customers must fill out more information to complete a transaction
        2. Email notification must be sent to customers after the order is placed
    ii. Structural Business Rule → The transaction will include billing address, a shipping address, a shipping option, and payment information

2. Identify if the given description can be categorized as a Structural Business rule, Procedural Business rule or Programmatic Business rule
    a. NOTE: answer is on the next page

Business Rule	Structural Business Rule	Procedural Business Rule	Programmatic Business Rule
All teachers in our school must possess a valid teaching certificate	✓		
Each Department must offer a Course	✓		
Approval of travel requests to an event must be signed by the project manager of the event		✓	
A customer may make numerous payments on account	✓		
A machine operator may not work more than 10 hours in a day		✓	
The Rental amount in RENTAL is calculated from the Rental rate multiplied by the number of days			✓
A Customer can have zero, one or many ORDERS	✓		
The Total cost of the RENTAL is calculated from the sum of Insurance amount, Rental amount, and Late charge			✓
A customer's debt must not exceed the customer's credit limit.		✓	

3.4 - Practice

Exercise 1: Identify entities, attributes, instances and their corresponding tables, rows and columns

Tasks

1. Match the ERD elements to their corresponding database elements
    a. Attribute → Column
    b. Entity → Table
    c. ER Model → Physical design
    d. Instance → Row
    e. Primary UID → Primary Key
    f. Relationship → Foreign key
    g. Secondary UID → Unique key
2. Identify the table diagram notations listed below.
    a. pk → primary key
    b. fk → foreign key
    c. uk → unique key
    d. * → mandatory (not bull)
    e. o → optional (nulls allowed)
3. Create short names for the terms below based on the naming conventions rules
    a. Authors
        i. ATR
    b. Publishers
        i. PBR
    c. Customers
        i. CTR
4. The goal of this practice is to recognize attributes for an entity. These three entities—SONG, EVENT, and CUSTOMER—play a role in a DJ business and are listed as the first three column headings in the table below. The fourth column contains a list of attributes. Use an X or a check mark to indicate that the attribute could belong to one or more of the entities listed. For example, could Title be an attribute for Song, for Event, and/or for Customer?

SONG	EVENT	CUSTOMER	
X	X		Title
X	X		Description
	X		Venue
		X	First Name

	X	X	Phone Number
X	X		Release Date
		X	Last Name
X	X		Type
		X	Email address

Exercise 2: Mapping the Academic Database

Tasks

1. With the ERD provided below, map the entities, attributes and UIDs to tables, rows, and keys using a table diagram as shown:
    a. **NOTE: Answer is posted in separate file titled "oracle_3.4_E2_T1.xlsx"**