

Database Foundations 1-2: Introduction to Database Practices

Exercise 1: Identify Database Design Considerations for Given Case Scenarios

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.

- Student ID
- First Name
- Last Name
- DOB
- Address
- Email Address
- Parent/Guardian Information

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.

- Book ID
- Title
- ISBN
- Genre
- Customer ID
- Customer Name
- Transaction Number
- Date of transaction
- Due Date

Database Foundations 1-3: Types of Database Models Practices

Exercise 1: Identify the Database Models

- Hierarchical Model
- Network Model
- Relational Model
- Flat File Model

- Object Oriented model

Database Foundations 1-4: Business Requirements Practices

Exercise 1: Business Requirements

Tasks

1. LibBook is a successful digital library that rents CDs and provides access to the 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.

- **Business Rules:** Members will pay a fee
- **Associated Constraints:** Type of membership (corporate, student, individual)

2. Star Care hospital is a multi-specialty hospital that caters to the 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.

- **Business Rules:** Every patient is required to register with the hospital on their first visit.
- **Associated Constraints:** When a patient arrives, a unique patient number starting with the letters "PT" is assigned to him/her.

Database Foundations 2-1 : Relational Databases Practices

Exercise 1: Analyze the features of a Relational Database

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.

BOOK:

BOOK_ID	TITLE	ISBN	YEAR	PRICE
100	Hello World	124639	2019	\$20
235	Tree	294308	2020	\$25
290	Animals	194389	2002	\$100

b. For authors, the database keeps the name, address and the URL of their homepage.

AUTHOR:

BOOK_ID	LAST_NAME	FIRST_NAME	ADDRESS	URL
100	Smith	Sara	Miami, FL	www.book.com/helloworld/
235	Lin	Michael	New York, NY	www.book.com/tree/
290	Zhang	Paul	New York, NY	www.book.com/animals/

c. For publishers, the database keeps the name, address, phone number and the URL of their website.

PUBLISHER:

BOOK_ID	LAST_NAME	FIRST_NAME	ADDRESS	PHONE_NUM	URL
100	Smith	Sara	Miami, FL	(842)843-3875	www.book.com/helloworld/
235	Lin	Michael	New York, NY	(631)562-7319	www.book.com/tree/
290	Zhang	Paul	New York, NY	(516)866-7456	www.book.com/animals/

d. The store has several warehouses, each of which has a code, address and phone number.

WAREHOUSE:

WAREHOUSE_ID	CODE	ADDRESS	PHONE_NUMBER
320444	6973	Miami, FL	(842)843-3875
048592	0342	New York, NY	(631)562-7319
028450	0348	New York, NY	(516)866-7456

e. The warehouse stocks several books. A book may be stocked at multiple warehouses.

DUPLICATE BOOKS:

WAREHOUSE_ID	BOOK_ID	IN STOCK
320444	100	NO
	235	YES
	290	YES

WAREHOUSE_ID	BOOK_ID	IN STOCK
048592	100	YES
	235	YES
	290	YES

WAREHOUSE_ID	BOOK_ID	IN STOCK
028450	100	NO
	235	YES
	290	NO

f. The database records the number of copies of a book stocked at various warehouses.

NUMBER OF COPIES

WAREHOUSE_ID	BOOK_ID	COPIES
320444	100	0
	235	452
	290	100

WAREHOUSE_ID	BOOK_ID	COPIES
048592	100	89
	235	45
	290	104

WAREHOUSE_ID	BOOK_ID	COPIES
028450	100	0
	235	204
	290	0

g. The bookstore keeps the name, address, email-id, and phone number of its customers.

CUSTOMERS:

CUSTOMER_ID	NAME	ADDRESS	EMAIL-ID	PHONE NUM
680	Nancy Sams	New York, NY	nancy.sams@gmail.com	(631)532-2843
135	Stacy Li	Miami, FL	stacy.li@gmail.com	(421)423-2942
699	Penny Jane	New York, NY	penny.jane@hotmail.com	(516)745-8453

h. A customer owns several shopping carts. A shopping cart is identified by a Shopping_Cart_ID and contains several books.

SHOPPING CART:

CUSTOMER_ID	SHOPPING_CART_ID
680	246790
	456890
	290590

CUSTOMER_ID	SHOPPING_CART_ID
135	273932
	000353

CUSTOMER_ID	SHOPPING_CART_ID
699	274902
	483042
	843555

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.

NUMBER OF SHOPPING CARTS:

SHOPPING_CART_ID	BOOK_ID
246790	100
	235
	290

BOOK_ID	COPIES
100	2
235	5
290	1

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.

ORDERS:

CUSTOMER_ID	BILLING_ADDRESS	SHIPPING_ADDRESS	SHIPPING_OPTION	CREDIT_CARD
680	New York, NY	New York, NY	EXPRESS	*****7921
135	Miami, FL	Miami, FL	FREE	*****8403
699	New York, NY	New York, NY	EXPRESS	*****4923

2. 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.

STOCK FILE:

PRODUCT_ID	DETAILS	SUPPLIER	QUANTITY	REORDER
1346	METAL	Metal inc.	2	2
6904	HEAVY	Depot co.	10	4
8509	FRAGILE	Glass inc.	5	1

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.

BACK ORDER:

PRODUCT_ID	SUPPLIER	ALTERNATIVE_SUPPLIER	REORDER
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1346	Metal inc.	Heavy inc.	2
6904	Depot co.	None	4
8509	Glass inc.	Pottery co.	1

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.

PAYMENT:

CUSTOMER_ID	PAYMENT_TYPE
1805	One invoice
1945	Part invoice
7592	Several invoices

Database Foundations 2-2: Conceptual and Physical Data Models Practices

Exercise 1: Conceptual and Physical Models

Tasks

- Provide five reasons for creating a conceptual data model.
 - Identify important identities
 - Identify relationships in the identities.
 - Capture functional and informational needs of business
 - Based on current needs and may reflect future needs
 - Addresses the needs of business
- List two examples of conceptual models and physical models.
 - Conceptual
 - ERDs (entity relational diagrams)
 - Model for school management system
 - Physical
 - Tables and columns for simplified library database
 - Tables and columns to identify departments employees

Database Foundations 2-3 : Entities and Attributes Practices

Exercise 1: Identify and draw entities as a beginning of an ERD

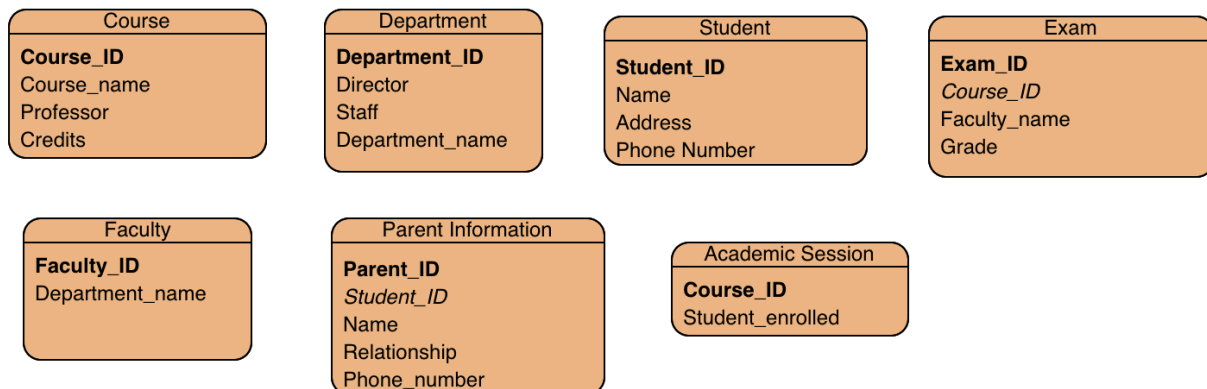
- a. A school/university has many Departments which offer courses to students in a given academic session
- b. Each of these courses is taught by a faculty
- c. Students enroll for different courses in an academic session
- d. Besides the registration details, the parent information of the student also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

Tasks

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

- a. School, Departments, Courses, Academic session
- b. Faculty name, Course name
- c. Student ID, Student name
- d. Parent/Guardian Name/Number/Relation
- e. Attendance
- f. Exam name, Exam results
- g. Faculty login time, Faculty logout time

Exercise 2: Identify and add Attributes and corresponding Mandatory and Optional notation to ERD



Database Foundations 2-4 : Unique Identifiers Practices

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?

- Identify: Artist, Genre, Album, or Title
- Unique identifier for SONG: Title.

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?

- Student ID.

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**

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

- Course
 - Course_ID
- Department
 - Department_ID
 - Department_Name
- Student
 - Student_ID

- Name
- Faculty
 - Faculty_ID
- Academic session
 - Course_ID
- Parent information
 - Parent_ID
- Exam
 - Exam_ID
 - Course_ID

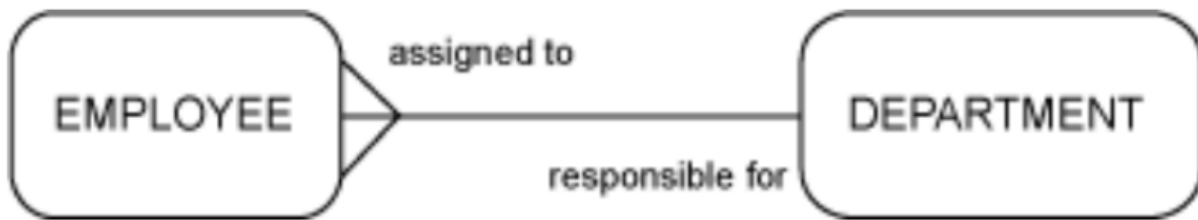
b. Candidate Unique Identifiers

- Course
 - Professor
- Department
 - Director
 - Staff
- Student
 - Address
 - Phone number
- Faculty
 - Department_Name
- Academic session
 - Students_enrolled
- Parent information
 - Student_ID
 - Phone_number
- Exam
 - Grade

Database Foundations 2-5 : Relationships Practices

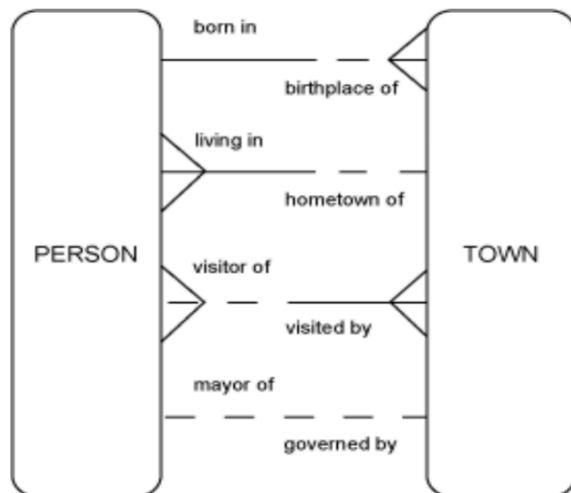
Exercise 1: Identify relationships from the ERD

1. Read the relationship. Which text corresponds to the diagram?



- 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.

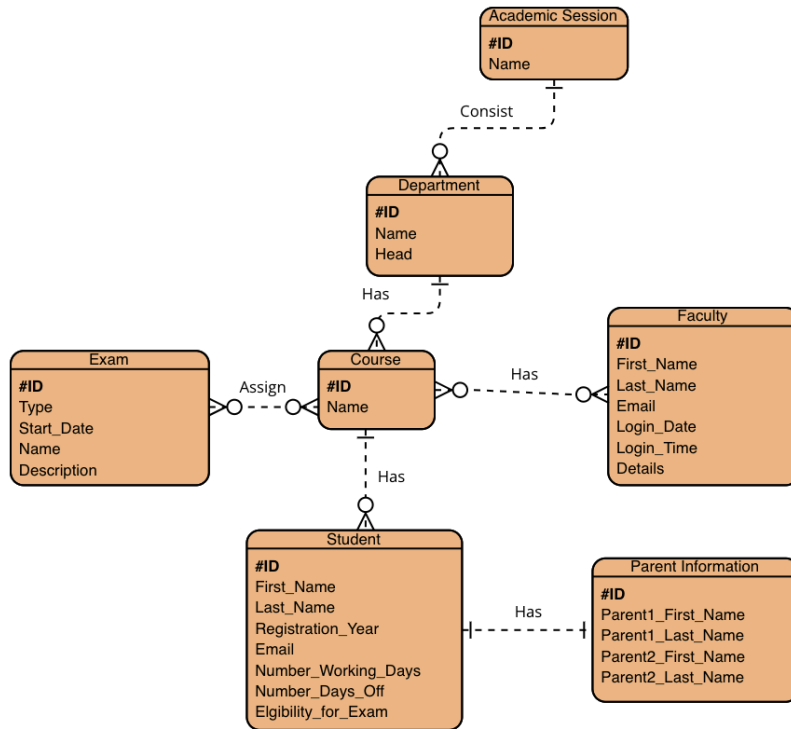
2. Read each relationship in the model below. For each relationship, write the ERD statement and your comments. Use your knowledge of normal people and towns in your comments.



- a. People can be born in one or more town
each person can only have one place of birth
- b. Each town can have one or more people
each person can only have one hometown
- c. Each town can have multiple visitors
each person can visit multiple towns
- d. Only one person can be mayor of a town
only one person can govern a town

Exercise 2: Analyze and Model Relationships

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.



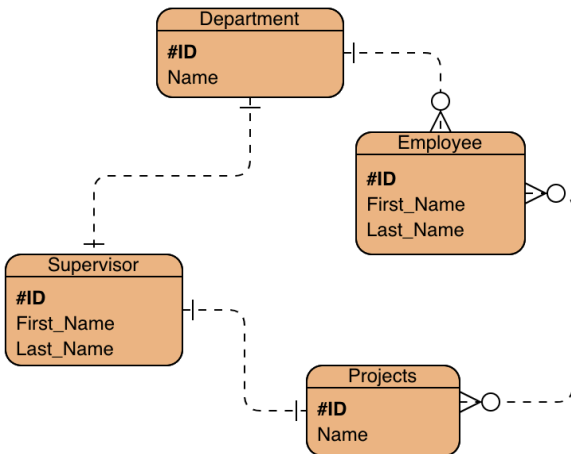
Database Foundations 2-6 : Entity Relationship Modeling (ERDs) Practices

Exercise 1: Identify the components in the ERD

Tasks

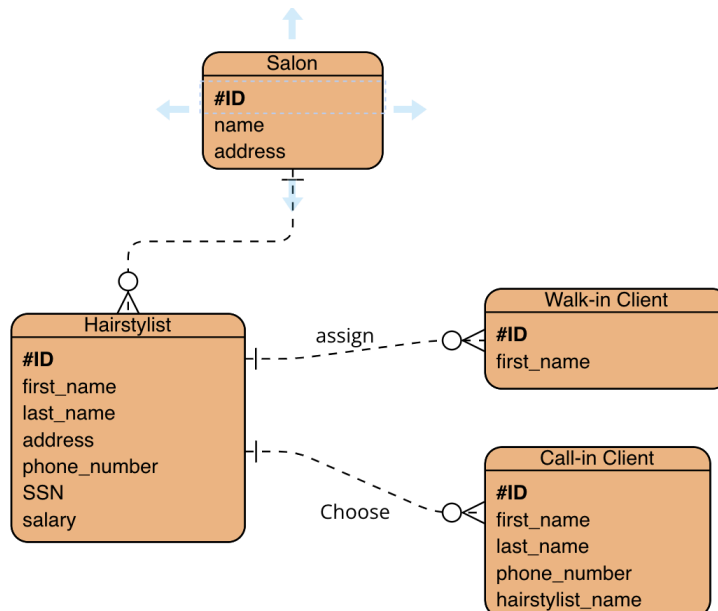
1. Identify the possible Entities and Attributes from the given scenario.

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.



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 UUIDs. Follow the diagramming conventions discussed. State the ERDish for the relationships.

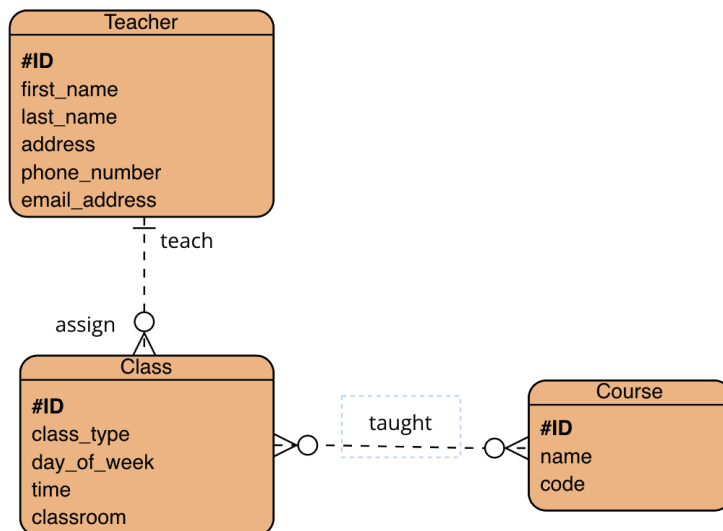
“In our salon, we have a number of hairstylists. They are all salaried employees, so we keep a record of their first name, last name, address, phone number, social-security number, and salary. During the course of a day, a hairstylist may see several clients. On a slow day, a hairstylist may not work 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.”



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 UUIDs. . State the ERDish for the relationships.

“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.”

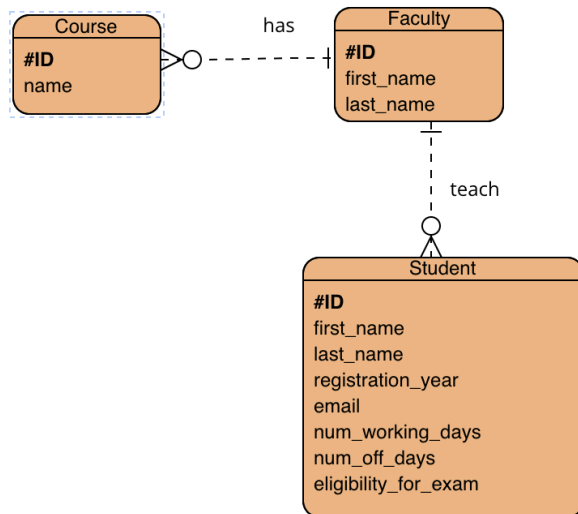


Database Foundations 3-1: More with Relationships Practices

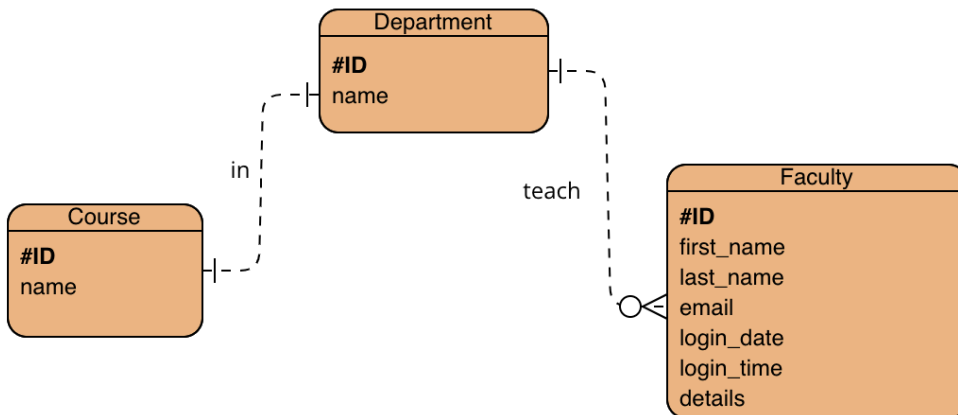
Exercise 1: Resolve M:M Relationships

Tasks

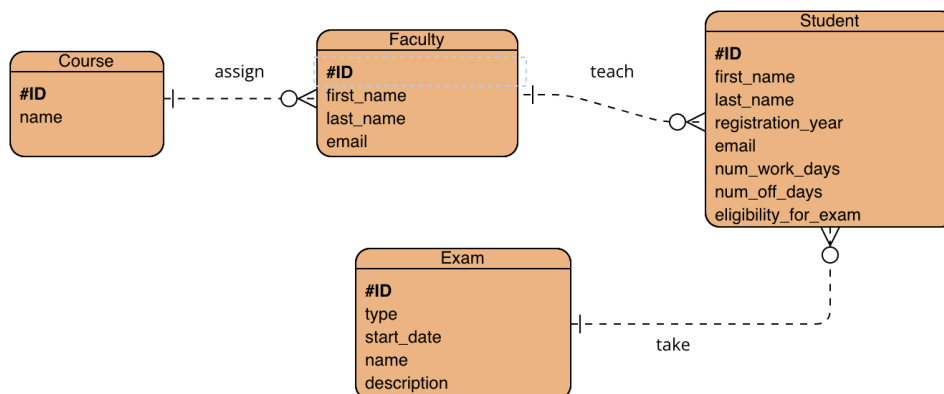
1. Resolve M: M relationships between STUDENT and the COURSE using a barred relationship.



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



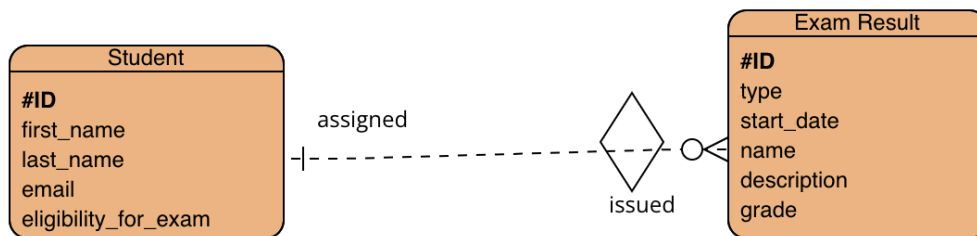
3. Resolve M: M relationships between STUDENT, COURSE and EXAM.



Exercise 2: Adding non transferability option to an ERD

Tasks

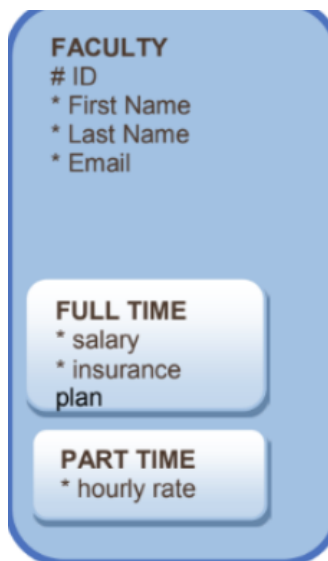
1. A STUDENT will be assigned an EXAM RESULT after taking an exam. Once an EXAM RESULT has been issued, it cannot be transferred to another STUDENT.



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.

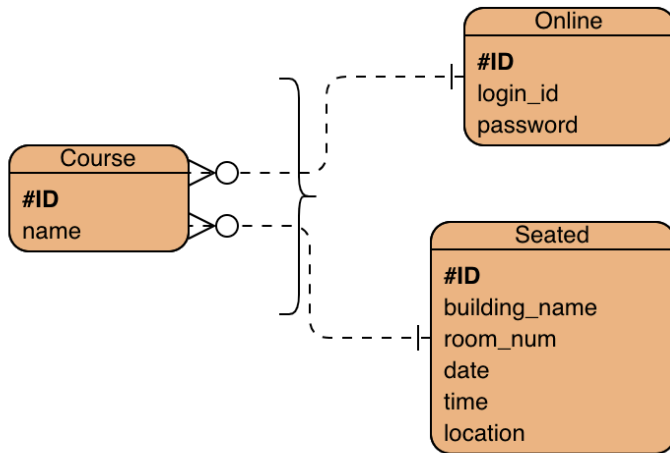


Exercise 4: Examine Exclusive Relationships (Arcs)

Tasks

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

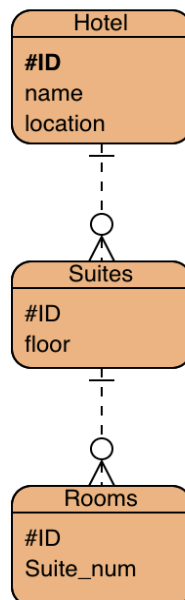
Each COURSE instance in the Academic Database can either be held ONLINE or in a SEATED location. Each SEATED location has a building name, room number and a date/time when the COURSE is offered. The ONLINE classes have a login id and a password required to enter the COURSE. Model this new information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

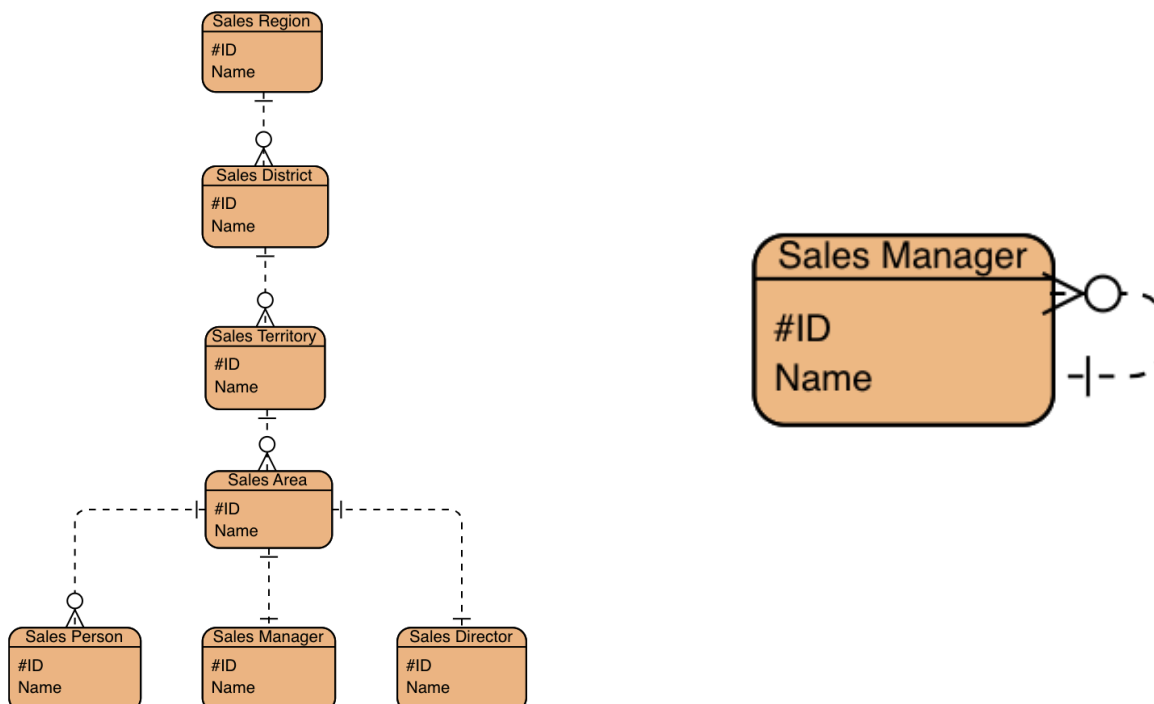


Exercise 6: Model Hierarchical Data and Recursive Relationships

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.

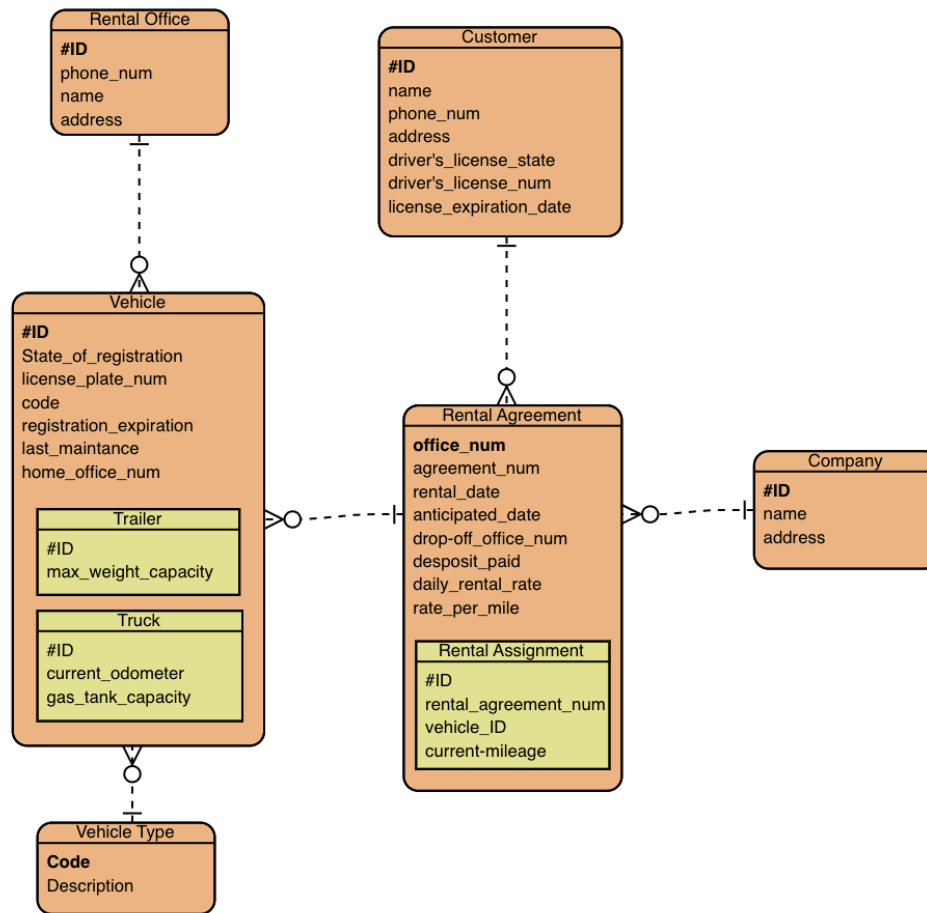


Exercise 7: Developing a complete ERD using Supertype/Subtypes and Arcs

Tasks

1. Develop an ERD for the following information requirements:

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.

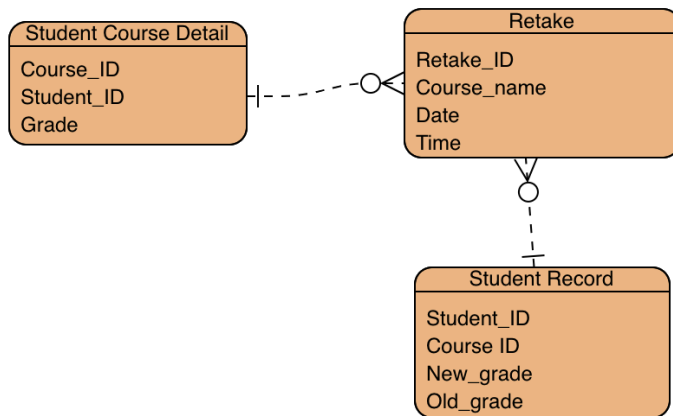


Database Foundations 3-2: Tracking Data Changes Practices Exercise 1: Track Data Change over Time

Tasks

1. Construct the ERD for the given 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.



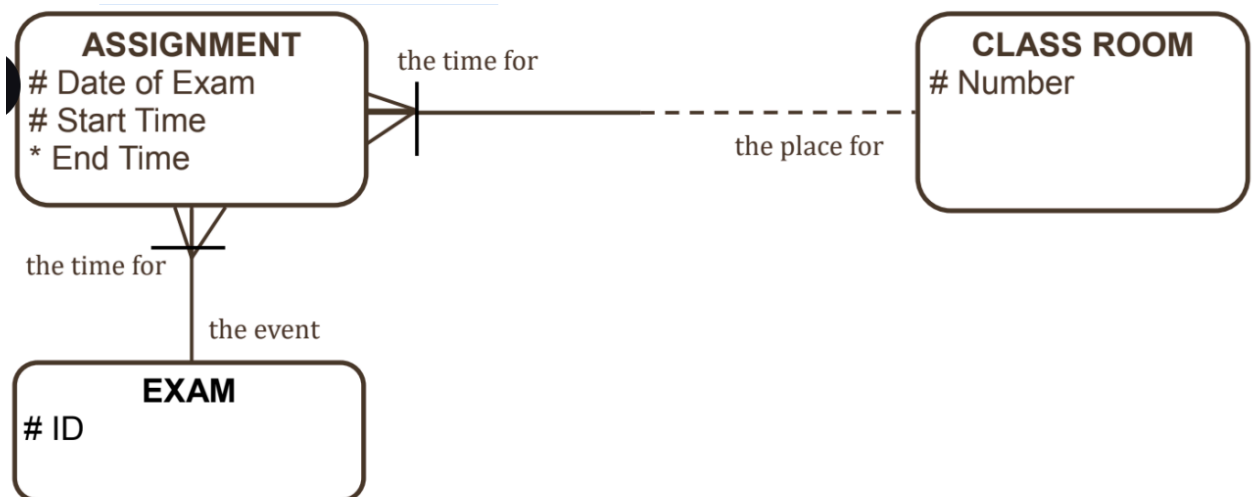
2. Examine the ERD that represents classroom assignments for different exams.

a. Why is start time part of the UID of ASSIGNMENT?

- It can not have an end time without a start time.

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.

- Start time must be before end time.
 - Not a conditional non-transferability
- Event duration should meet a certain minimum
 - Not a conditional non-transferability
- Start time cannot be the same as End time.
 - Not a conditional non-transferability



Database Foundations 3-3: Normalization and Business Rules Practices

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 group 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

ITEM ID	UNIT PRICE (\$)	QUANTITY
IT001	16.56	100
IT002	17.48	200
IT003	19.76	300
IT004	20.00	400

2. Analyze the given table. The table is in the first normal form and has 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

SUPPLIER ID	STORE ID
SP001	S1
SP001	S3

SP002	S1
SP003	S2
SP004	S3

STORE ID	LOCATION
S1	NEW YORK
S2	RHODE ISLAND
S3	VERMONT

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

TABLE 1: BOOK TABLE

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

TABLE 2: CATEGORY TABLE

CATEGORY ID	CATEGORY DESC
1	COOKING

2	TRAVEL
3	COMPUTERS

Exercise 2: Normalize Academic Database ERD

Tasks

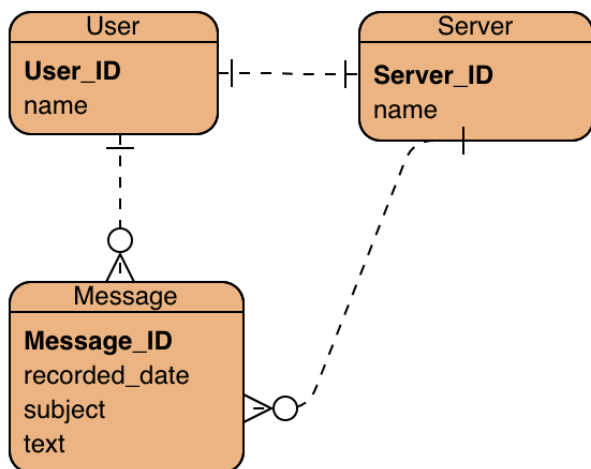
1. For the Academic Database ERD, evaluate each entity against the rules of normalization, identify the misplaced attributes, and explain which rule of normalization each misplaced attribute violates.

- In the student entity, the attributes number of working days, number of days off , and eligibility for exams can be placed in a new entity called schedule.
 - This is a 1NF.
- Entity faculty course detail with attribute contact hours can be put under faulty entities.
 - This is a 2NF.

Exercise 3: Validate an ERD for Normalization

Tasks

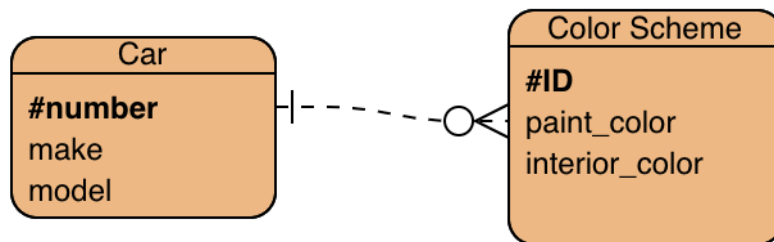
1. Evaluate the following unnormalized data in the USER entity and develop an entity relationship diagram that is normalized to third normal form.



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.

- The model has a third normal form error. There should be a separate entity for color of car
- CORRECTED MODEL:



Exercise 4: Gather database requirements and Business Rules

Tasks

1. Book.com is an online 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.

- Mandatory attributes for each book in the store

b. For authors, the database keeps the name, address and the url of their homepage.

- Defines the required information to include for each author

c. For publishers, the database keeps the name, address, phone number and the url of their website.

- Defines the required information for publishers

d. The store has several warehouses, each of which has a code, address and phone number.

- Defines the required attributes for warehouses

e. The warehouse stocks several books. A book may be stocked at multiple warehouses.

- Allows for book availability at multiple sites

f. The database records the number of copies of a book stocked at various warehouses.

- Book availability can be measured

g. The bookstore keeps the name, address, email-id, and phone number of its customers.

- Customer information should be kept on file

h. A customer owns several shopping carts. A shopping cart is identified by a Shopping_Cart_ID and contains several books.

- One customer may use multiple shopping carts.

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.

- Shopping carts may store duplicate books for single customers

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.

- Confirmation emails should be sent to customers

Your task is to identify the business rules.

2. Identify if the given description can be categorized as a Structural Business rule, Procedural Business rule or Programmatic Business rule.

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

A customer's debt must not exceed the customer's credit limit.	X		
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Database Foundations 3-4: Data Modeling Terminology and Mapping Practices

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

Tasks

1. Match the ERD elements to their corresponding database elements.

Analysis	Design
1. Attribute	a. Column
2. Entity	b. Foreign key
3. ER Model	c. Physical design
4. Instance	d. Primary key
5. Primary UID	e. Row
6. Relationship	f. Table
7. Secondary UID	g. Unique key

2. Identify the table diagram notations listed below.

- a. **pk:** Primary key
- b. **fk:** Foreign Key
- c. **uk:** Unique Key
- d. *****: Entity
- e. **o:** Relationship

3. Create short names for the terms below based on the naming conventions rules.

Key Type	Optionality	Column Name
pk	*	AUTHOR
	*	PUBLISHER
	*	CUSTOMER

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	X	DESCRIPTION
	X		VENUE
		X	FIRST NAME
		X	PHONE NUMBER
X			RELEASE DATE
		X	LAST NAME
	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:

STUDENT

Key type	Optionality	Column name
pk	*	ID
	*	First_name
	*	Last_name
	*	Registration_year
	*	Email

PARENT INFORMATION

Key type	Optionality	Column name
pk	*	ID
	*	Parent1_first_name
	*	parent1_last_name
	*	Parent2_first_name
	*	parent2_last_name

STUDENT ATTENDANCE

Key type	Optionality	Column name
fk	*	Student_ID
	*	Academic_session_ID
	*	Number_of_working_days
	*	Number_of_days_off
	o	eligibility_for_exam

STUDENT COURSE DETAIL

Key type	Optionality	Column name
fk	*	Faculty_ID
fk	*	Course_ID
	*	Grade

DEPARTMENT

Key type	Optionality	Column name
pk	*	ID
	*	Name
	*	Head

FACULTY

Key type	Optionality	Column name
pk	*	FACULTY_ID
	*	FIRST_NAME
	*	LAST_NAME
	*	EMAIL

FULL TIME

Key type	Optionality	Column name
fk	*	Faculty_ID
	*	SALARY
	*	INSURANCE_PLAN

PART TIME

Key type	Optionality	Column name
fk	*	Faculty_ID
	*	HOURLY_RATE

FACULTY COURSE DETAIL

Key type	Optionality	Column name
pk	*	CONTACT_HOURS

FACULTY LOGIN DETAIL

Key type	Optionality	Column name
fk	*	Faculty_ID
fk	*	Course_ID
	*	LOGIN_DATE/TIME

COURSE

Key type	Optionality	Column name
pk	*	ID
	*	NAME

ONLINE

Key type	Optionality	Column name
pk	#	Log_on_ID
	*	Password

SEATED

Key type	Optionality	Column name
pk	#	BUILDING
pk	#	ROOM
pk	#	DATE/TIME

ACADEMIC SESSION

Key type	Optionality	Column name
pk	*	ID
	*	NAME

EXAM RESULT

Key type	Optionality	Column name
fk	*	Student_ID
fk	*	Exam_ID
	*	GRADE

EXAM

Key type	Optionality	Column name
pk	#	Exam_ID
	o	Start_Date

EXAM TYPE

Key type	Optionality	Column name
pk	#	Exam_type
	*	Exam_name
	o	Description

