1-1 : Introduction to Course

−Describe the purpose of a relational database
−Describe key business requirements when developing a database
−Use data modeling to architect a relational database
−Develop an entity relationship diagram (ERD) to model data
−Use Oracle SQL Developer Data Modeler to build ERDs
−Create a physical model from a logical model (ERD)
−Write, execute, and save SQL statements in Oracle Application Express

1-2 : Introduction to Database

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, student name, DOB, Gender, address, health records, emergency contact, email address, phone number, grade level, previous school/academic records, 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, Author, publication date, genre, copies, shelf location, book condition
- Customer ID, name, DOB, due date, return date, date of transaction, address, phone number, email, transaction type(borrow, reserve, return, check out)

1-3 : Types of Database Module

a. Hierarchical Module: The hierarchical database model organizes data in a tree-like structure.
- Each child has one parent

b. Network module: The network database model organizes data in a graph-like structure
- records can have multiple parent and child relationships, allows for a complex relationships between records.

c. Object orientated: Data is represented as objects that are instances of classes. Each object contains data and methods.
- entity are object oriented modules

d. Relation module: Collection of tables, organizes data into tables (relations) where each table consists of rows and columns (attributes). Relationships between tables are established through foreign keys.

e. Flat file module: Single table or file without any structured relationships between data. It is essentially a plain text file with records.

1-4 : Business Requirements Practice

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.

- Business Rule 1: Members will pay a membership fee
  - Constraints: there are 3 membership types (corporate, student, and individual).
- Business Rule 2: Student is free. Corporate or individual will pay a membership fee and is entitled to privileges.
  - Constraints: memberships cant be changed

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.

- Business Rule 1: Patients must register with the hospital on their first visit.
  - Constraints: Patients will be assigned a unique ID that starts with the letter PT
- Business Rule 2: Doctors must have a minimum of 7 years of working experience.
  - Constraints: Hospitals will ensure the validity of the doctors experience prior to registration
- Business Rule 3: Each doctor registered with this hospital is assigned a unique ID that starts with the letter DC
  - Constraints: Doctors have to have a DC format for the unique ID

2-1 : Relational Databases

Exercise 1: Analyze the features of a Relational Database
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.
- Table1: Books
  - Fields: Book ID, title, ISBN, year, price, author ID, publisher ID, customer ID
b. For authors, the database keeps the name, address and the URL of their homepage.
- Table2: Authors
  - Fields: Author ID, name, address, URL
c. For publishers, the database keeps the name, address, phone number and the URL of their
Website.
- Table3: Publishers
  - Fields: Publisher ID, Name, Address, Phone Number, Website URL
d. The store has several warehouses, each of which has a code, address and phone number.
- Table4: Warehouses
  - Fields: warehouse ID, code, address, phone number
e. The warehouse stocks several books. A book may be stocked at multiple warehouses.
- Table5: Warehouse
  - Fields: warehouse ID, Book ID,
f. The database records the number of copies of a book stocked at various warehouses.
- Table6: Copies of Book
  - Fields: Book ID, copies stocked,Warehouse ID
g. The bookstore keeps the name, address, email-id, and phone number of its customers.
- Table7: Customers
  - Fields: Customer ID, name, address, email ID, phone numner
h. A customer owns several shopping carts. A shopping cart is identified by a Shopping_Cart_ID
and contains several books.
- Table8: Shopping Carts
  - Fields: Shopping_Cart_ID, Customer ID, book ID, copies
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.
- Table9: Copies
  - Field: Customer ID, Book ID, copies
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.

- Table10: Order
  - Field: Order ID, billing address, shipping address, shipping option, payment method, email address

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.

- Table1: Customer
  - Field: customer ID, customer name, phone number, address, email
- Table2: Product Order
  - Field: Product ID, product name, product detail, preferred supplier
- Table3: Order
  - Field: Order ID, customer ID, quantity, reorder levels, order date

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.

- Table1: Invoice
  - Field: Invoice ID, order ID, Invoice date
- Table2: Back order
  - Field: back order ID, quantity, preferred supplier

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.

- Table1: Invoices
  - Field: Invoice ID, Customer ID, invoice date
- Table2: Payment
  - Field: payment ID, customer ID, Payment date, amount
- Table3: Payment details
  - Field: Payment details, Invoice ID, Payment ID, amount

2-2 : Conceptual and Physical Data Models

1. Provide five reasons for creating a conceptual data model.
- Captures functional and informational needs of a business

- Addresses the needs of business, what is conceptually ideal but not the implementation
- Based on current needs, may reflect future
- Creates entities(objects that become tables)
- Establish the relationship between the entities(each entity have instances)

2. List two examples of conceptual models and physical models.
- Conceptual modules/logical data module
  - Logical data model- includes all entities and the relationship, how it will be be physically implemented, deprived from conceptual
  - entity relationship modules(ERM)-focuses on how the entities relate to each other, does not have attributes or unique identifiers(UID)
  - Illustrated in a ERD
- Physical module
  - Is an extension to a logical data model
  - −Defines table definitions, data types, and precision
  - −Identifies views, indexes, and other database objects *
  - Describes how the objects should be implemented in specific database
  - Shows all table structures, including columns, primary keys, and foreign keys

The conceptual model is concerned with the real-world view and understanding of data. The physical model specifies how it will be executed in a particular database management instance.

2-3 : Entities and Attributes

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 student's attendance details which would decide the eligibility of the student 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

1. Identify Entities
   a. School/university
   b. Departments
   c. Courses
   d. Faculty

      e. Student
      f. Parent
      g. Academic session
      h. Exam
2. Attributes
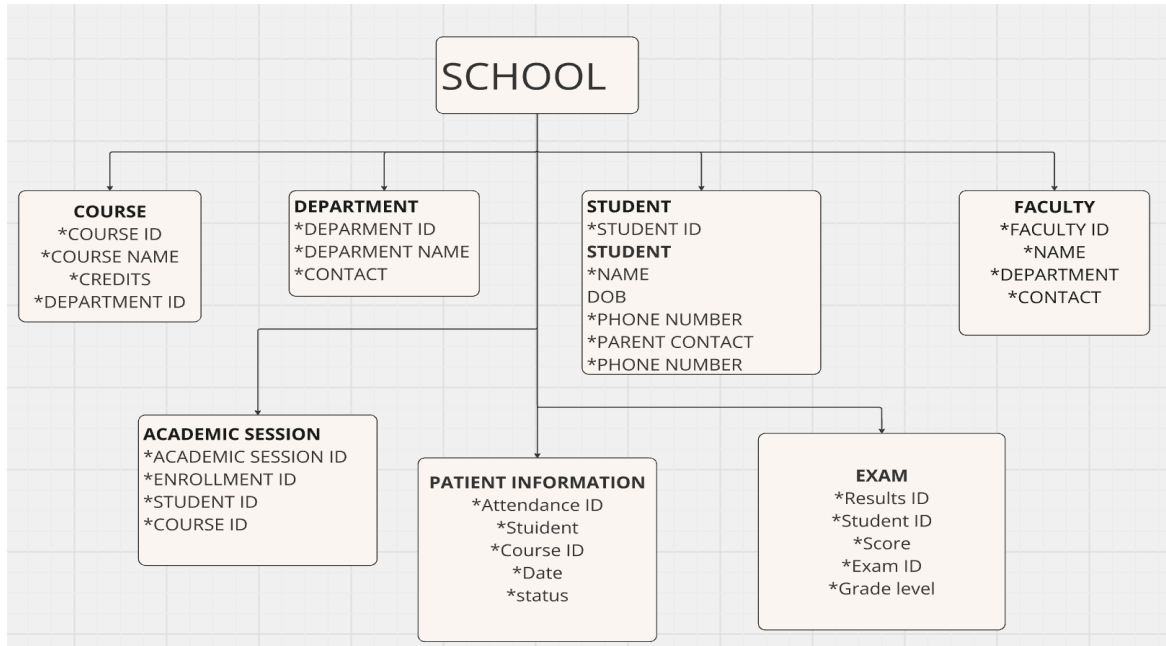
2-4 : Unique Identifiers

Exercise 1: Identify the Unique Identifier and corresponding Primary keys
Identify the unique identifiers and the corresponding primary keys from the given scenarios.
1. How do you find a particular song in the whole collection? What would be a unique identifier
for SONG?
- Song_ID such as S12345

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 such as 1235677

3. For each entity, select the attribute that could be the unique identifier of each entity.
    a. Entity: STUDENT
       Attributes: student ID, first name, last name, address
        - Student ID
    b. Entity: MOVIE
       Attributes: title, date released, producer, director
        - Title
    c. Entity: LOCKER

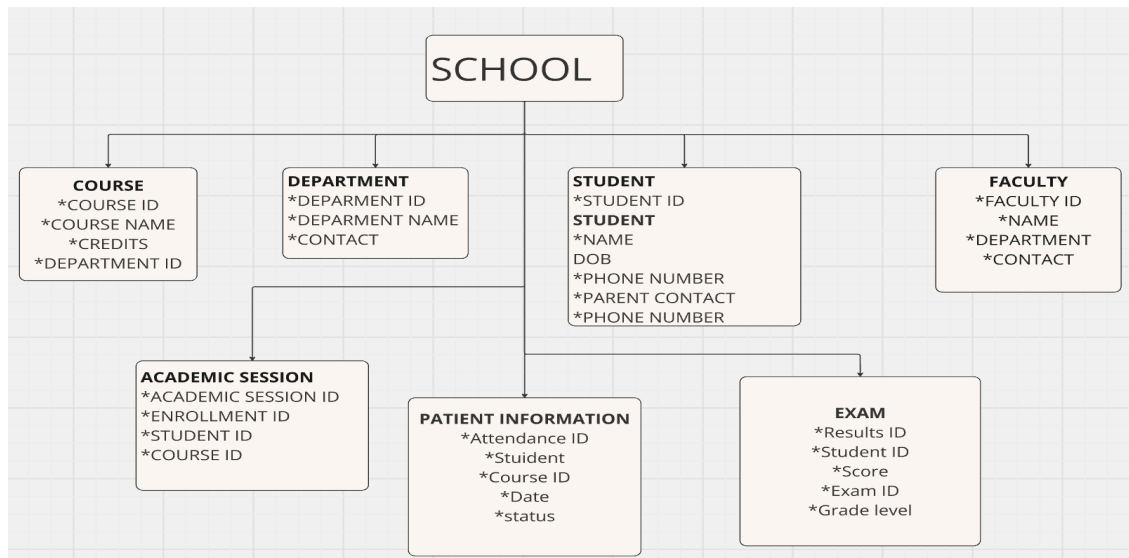Attributes: size, location, number
- Number

Exercise 2: Identify the Unique Identifiers and add to the ERD
In this practice, you will identify unique identifiers and add to an ERD.
1. Use the Academic Database ERD from the previous exercises to identify the following:
   a. Unique Identifiers : Course_ID, Department_ID, Student_ID, Faculty_ID, Academic session_ID, and Results ID
   b. Candidate Unique Identifiers: The primary keys

```
                              SCHOOL
         ┌──────────────┬────────────────┬──────────────────┐
   COURSE          DEPARTMENT          STUDENT              FACULTY
  *COURSE ID      *DEPARMENT ID       *STUDENT ID          *FACULTY ID
  *COURSE NAME    *DEPARMENT NAME      STUDENT              *NAME
  *CREDITS        *CONTACT            *NAME               *DEPARTMENT
  *DEPARTMENT ID                       DOB                 *CONTACT
                                      *PHONE NUMBER
                                      *PARENT CONTACT
                                      *PHONE NUMBER
       ACADEMIC SESSION
      *ACADEMIC SESSION ID      PATIENT INFORMATION       EXAM
      *ENROLLMENT ID             *Attendance ID          *Results ID
      *STUDENT ID                 *Stuident              *Student ID
      *COURSE ID                 *Course ID               *Score
                                  *Date                  *Exam ID
                                  *status                *Grade level
```

2-5 : Relationship Practices

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

```
                    assigned to
  EMPLOYEE ──────────────────────── DEPARTMENT
                    responsible for
```

   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.
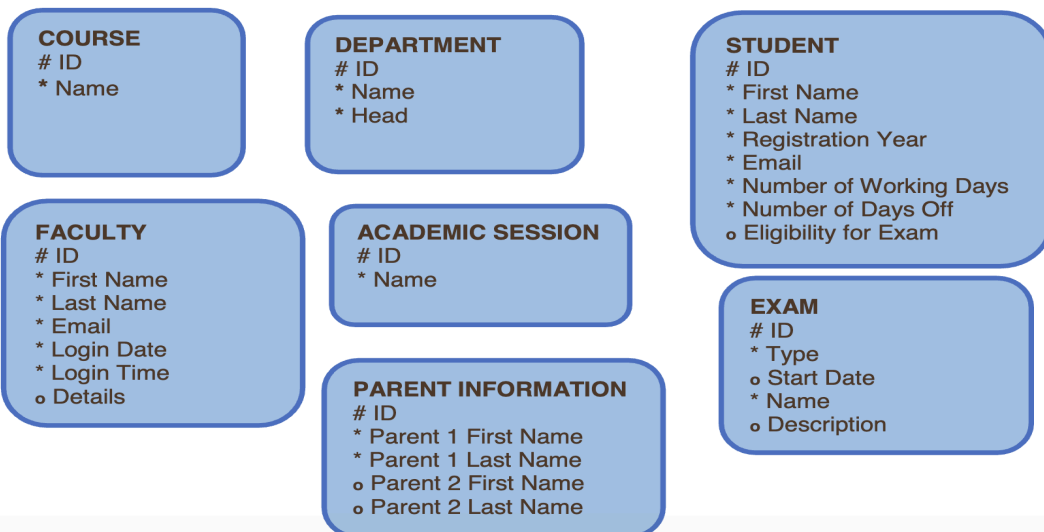
B is the correct answer
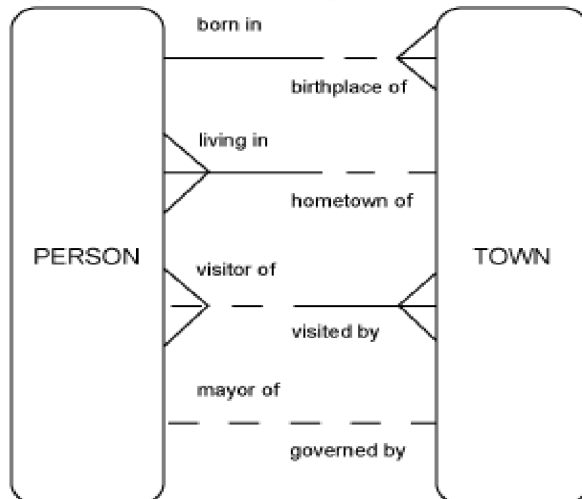
1. Angela must be born in one or more Towns(NYC)
2. NYC may be the Birthplace of one and only one Angela

1. Angela must be living in one and only one Town(NYC)
2. NYC may be the hometown of one or more persons

1. Angela may be a visitor of, one or more visitors of NYC
2. NYC must be visited by Angela and many more visitors

1. Angela may be the major one and only one of NYC
2. NYC may be governed by the one and only one Angela

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.

COURSE
ID
* Name

DEPARTMENT
ID
* Name
* Head

STUDENT
ID
* First Name
* Last Name
* Registration Year
* Email
* Number of Working Days
* Number of Days Off
o Eligibility for Exam

FACULTY
ID
* First Name
* Last Name
* Email
* Login Date
* Login Time
o Details

ACADEMIC SESSION
ID
* Name

EXAM
ID
* Type
o Start Date
* Name
o Description

PARENT INFORMATION
ID
* Parent 1 First Name
* Parent 1 Last Name
o Parent 2 First Name
o Parent 2 Last Name

2-6 : Entity Relationship Modeling (ERDs)

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.

1. Department
   a. Department_ID, Department_Name, Supervisor_ID
2. Supervisors
   a. Supervisor_ID, Name, Contact Information
3. Employee
   a. Employee_ID, Vacation_Status, Name, Contact Information
4. Projects
   a. Project_ID, Project_Name, Project_details, Project_Start, Project_End
5. Employee_Project
   a. Project_ID, Employee_ID, Assignment_Date

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.

"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."

1. Hairstylist
   a. # Hairstylist_ID (Primary Key) - Unique identifier for each hairstylist
   b. *First_Name - Hairstylist's first name
   c. *Last_Name - Hairstylist's last name
   d. o Address - Hairstylist's address (Optional)

e. o Phone_Number - Hairstylist's phone number

f. * Social_Security_Number - Hairstylist's social security number

g. * Salary - Hairstylist's salary

2. Client
   a. # Client_ID (Primary Key) - Unique identifier for each client (Optional, but useful for tracking and managing appointments)
   b. *First_Name - Client's first name
   c. *Last_Name - Client's last name
   d. *Phone_Number
   e. o Preference

ERD relationship:
- One hairstylist must serve one or more clients
- One clients may be assigned to one or more 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.

"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."

1. Teachers
   a. #Teacher_ID(primary key)- unique identifier for each teacher, mandatory
   b. *First_Name - Teacher's first name
   c. *Last_Name - Teacher's last name
   d. o Address - Teacher's address
   e. *Phone_Number
   f. *Email_Address

2. Course
   a. #Course_Code (Primary Key) - Unique identifier for each course -mandatory
   b. *Course_Name
   c. o Course_Description

3. Class
   a. #Class_ID (Primary Key) - Unique identifier for each class (Mandatory)

b. *Course_Code (Foreign Key) - Refers to the course
c. *Teacher_ID (Foreign Key) - Refers to the teacher
d. *Day of Class
e. *Time
f. o Classroom

ERD relationship:
1. Teacher and Class
   - One teacher may teach one or more classes
   - One class must be taught by one and one one teacher
2. Class and Course
   - One course may include one or more classes
   - One class must consists of one and only one course
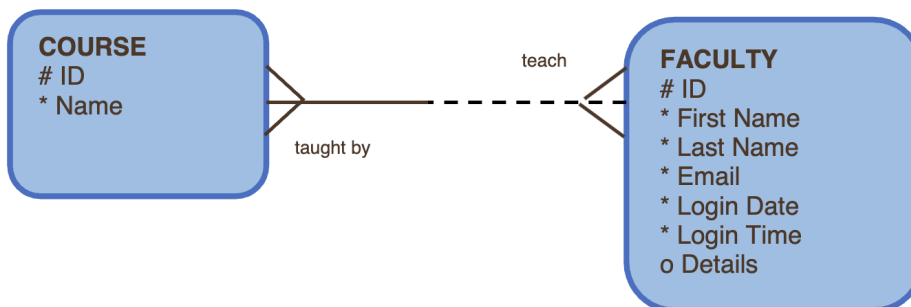
3-1 : More with Relationships

Tasks

1. Resolve M: M relationships between STUDENT and the COURSE using a barred relationship.
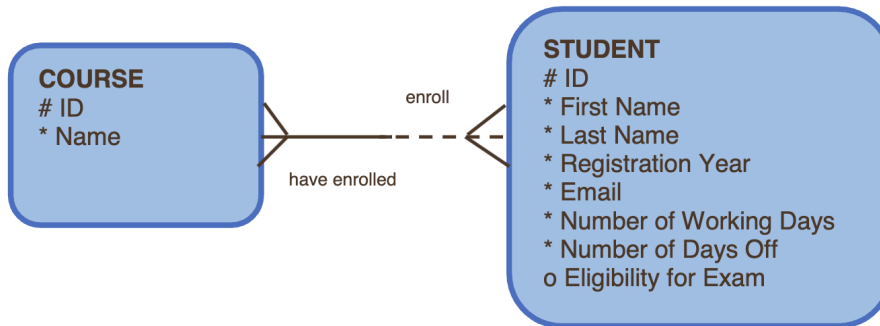
Barred Relationship: Enrollment(add an |, on the relationship line on the new entity)
   - Attributes: Enrollment_ID, Enrollment_Date, Credits, Status, Grade
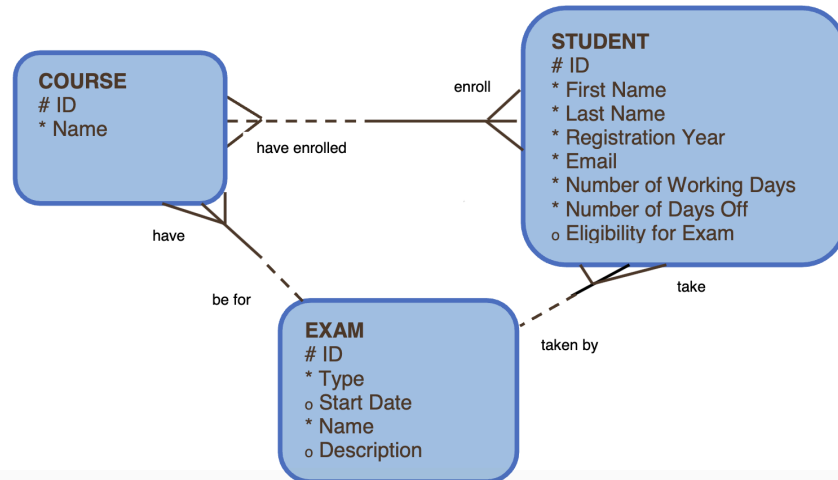
2. Resolve M: M relationships between FACULTY and the COURSE.

Barred Relationship: Teaching_Assignment(add a |, on the relationship line on the new entity)
- Attributes: Faculty_ID (Foreign Key), Cource_ID (foreign key), Teaching_AssignmentID, Role, assignment status, date_due

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

Barred Relationship: Exam_Registration
- Attributes: Exam_ID (FK), Student_ID (FK), Course_ID(FK), score

Exercise 2: Adding nontransferability option to an ERD

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.

Exam-------exam grade: there will be a diamond shape sign on the exam side

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.

Subtype Entity: Full Time
- Attributes: Salary, Insurance plan, pay period, duration

Subtype Entity: Part Type
-    Attributes: Hourly rate, Salary, Duration, Pay period

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 logon id and a password required to enter the COURSE. Model this new information as an Arc in the Academic Database.
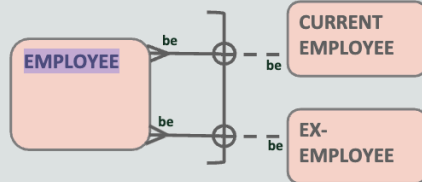
Supertype: Course
Subtype: Online
-    Attributes: logon_ID, password, Cource_ID
Subtype: Seated
-    Attributes: location, building name, room number, date, time, course_ID

replace employee with course, and the subtypes with online and seated

Exercise 5: Model Hierarchical Data
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.
   ●   Hotel→ Floors→ Suites→ Rooms
   ●   Hotel
       ○   Hotel_name, address, owners,
   ●   Floors
       ○   Floor_number, customers on each floor
   ●   Suites
       ○   Suite_number, availability, status
   ●   Rooms

- ○ Room_number, availability, status

Exercise 6: Model Hierarchical Data and Recursive Relationships

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.

- Region
  - ○ RegionCode (Primary Key), RegionName
- District
  - ○ DistrictCode (Primary Key), DistrictName, RegionCode (Foreign Key referencing Region)
- Territory
  - ○ TerritoryCode (Primary Key), TerritoryName, DistrictCode (Foreign Key referencing District)
- SalesArea
  - ○ SalesAreaCode (Primary Key), SalesAreaName, TerritoryCode (Foreign Key referencing Territory)

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.

1. RentalOffice: Manages vehicles and rental agreements.
    a. OfficeNumber (Primary Key): Unique identifier for the rental office.
    b. OfficeName: Name of the rental office.
    c. Address: Address of the rental office.
2. Vehicle: Various attributes based on type.
    a. VehicleID (Primary Key): Unique identifier for each vehicle.
    b. StateOfRegistration: State where the vehicle is registered.
    c. LicensePlateNumber: License plate registration number.
    d. TypeCode: Type of the vehicle
3. Customer: Individual or company customers.
    a. CustomerID (Primary Key): Unique identifier for the customer.
    b. Name: Customer's name.
    c. HomePhone: Home phone number.
    d. Address: Customer's address.
    e. LicenseState: Driver's license state.
    f. LicenseNumber
4. RentalAgreement: Details of each rental agreement.
    a. AgreementNumber (Primary Key): Unique identifier for each rental agreement.
    b. RentalDate: Date the rental agreement was created.
   c. AnticipatedDuration: Anticipated duration of the rental.

d. OfficeNumber (Foreign Key): Rental office where the agreement originated.
e. DropOffOfficeNumber (Foreign Key): Rental office where the vehicle will be dropped off.
f. DepositPaid:
5. VehicleAssignment: Associates vehicles with rental agreements.
a. AssignmentID (Primary Key): Unique identifier for each vehicle assignment.
b. VehicleID (Foreign Key): Vehicle being rented.
c. AgreementNumber (Foreign Key): Rental agreement associated with the vehicle.

3-2: Tracking Data Changes

Tasks

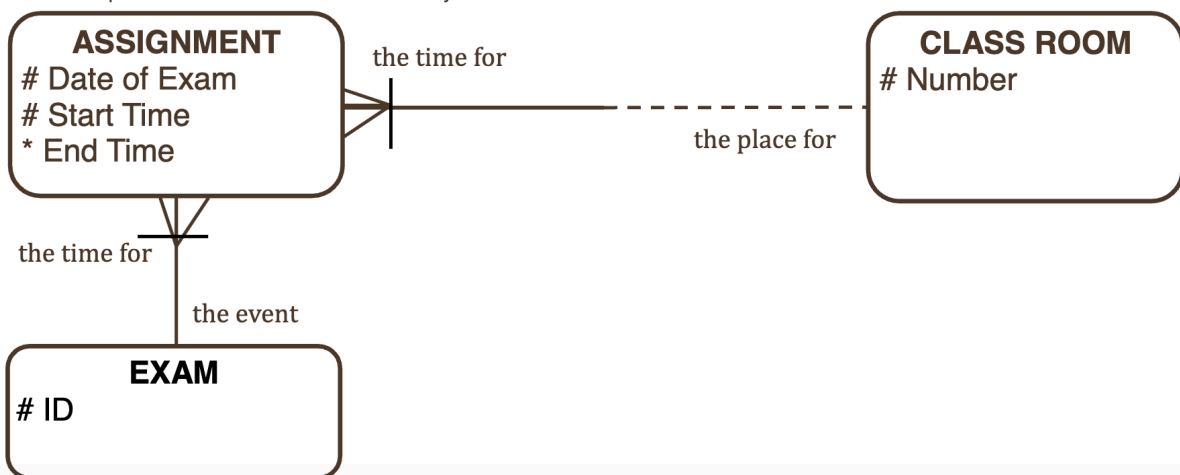1. Construct the ERD for the given scenario.

   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.**

   STUDENT COURSE DETAIL
   # Course ID
   # Student ID
   * Grade
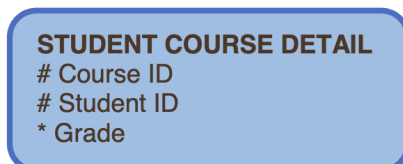
   ● Entity: Grade Modification
     ○ Attribute: Previous_grade, modified Date

2. Examine the ERD that represents classroom assignments for different exams.
   a. Why is start time part of the UID of ASSIGNMENT?
   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.

   ASSIGNMENT
   # Date of Exam
   # Start Time
   * End Time

   the time for

   the place for

   CLASS ROOM
   # Number

   the time for

   the event

   EXAM
   # ID

   a. The Start time is part of the UID because the start time is crucial and unique to the assignment
   b. End time must be later(non-transferable)- otherwise the assignment duration is not valid

Start time of a new assignment must not overlap with an existing time of another assignment(non-transferable)-ensures no 2 assignments are using the same classroom at the same time
The start time and end time must be within the time slots of the classroom for each assignment(non-transferable)-ensures the assignment is within the time slot of the classroom

3-3 : Normalizing and Business Rules

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 | 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 composite primary key made up of the Suppler 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

Create two separate entities
- Store
  - Store ID | Location
  - S1 | New York
  - S2 | Rhode Island
  - S3 | Vermont
  - S3 | Illinois
- Supplier Store
  - Supplier ID | Store ID

- ○ SP001 | S1
- ○ SP001 | S3
- ○ SP002 | S1
- ○ SP003 | S2
- ○ SP004 | S3

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

- ● 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

- ● Category Table:
  - ○ Category ID | Category Desc
  - ○ 1 | Cooking
  - ○ 2 | Travel
  - ○ 3 | Computer

3-4 : Data Modeling Terminology and Mapping

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

Overview

In this practice you identify entities, attributes, instances and their corresponding tables, rows and columns from the given scenarios.

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

- ● Entity→table

- Instance→ row
- Attribute→ column
- Primary UID→primary keys
- Secondary UID→ unique key
- Relationship→ foreign key

2. Identify the table diagram notations listed below.

    a. pk
    b. fk
    c. uk
    d. *
    e. o

- Pk→ primary key
- Fk→ foreign key
- Uk→unique key
- *--> mandatory
- o→ optional

3. Create short names for the terms below based on the naming conventions rules.
    a. Authors
    b. Publishers
    c. Customers

    a. ATS
    b. PBS
    c. CTS

4. Attributes for Entities

Using the entities SONG, EVENT, and CUSTOMER, we'll evaluate which attributes fit each entity.

Here's the table with attributes marked with an X or check mark for each entity:

Attribute	SONG	EVENT	CUSTOMER
Title	✓		
Description	✓		
Venue		✓	
First Name			✓
Phone Number			✓
Release date	✓		
Last Name			✓
Type	✓		
Email address			✓