

Information and Database Management Systems I

(CIS 4301)

Spring 2022

Instructor: Dr. Markus Schneider

TA: Kyuseo Park

Homework 1

Name:	
UFID:	
Email Address:	

Pledge (Must be signed¹ according to UF Honor Code)

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

Student signature

¹Each student is obliged to print out this page, fill in the requested information in a handwritten and readable manner, make the *handwritten* signature, scan this page into PDF, and put this page as the first page of the PDF submission.

Question 1 (ER Model)

[20 points]

Design an Entity-Relationship diagram that models a department management system and considers the requirements listed below. That means that you have to identify suitable entity sets, relationship sets, attributes, keys of entity sets (if not specified), and so on. Further, add the cardinalities (1:1, 1:m, m:1, m:n) to the relationship sets and write down your assumptions regarding the cardinalities if there could be a doubt.

Consider the following requirements about a car dealership system:

- An employee has an ID which is unique, email address, name, date of birth, and age. Age is a derived attribute.
- There are two types of employees in a system: Salesperson and Mechanic.
- Employees belong to a department that has a departmentID, name, and the chair name.
- A salesperson may sell many cars, but each car is sold by only one salesperson.
- A customer may buy many cars, but each car is bought by only one customer.
- A customer has an email, name, date of birth, age (derived), and phone number.
- A salesperson writes a single invoice for each car he or she sells. An ID, date, and price are stored in the invoice.
- A customer gets an invoice for each car he or she buys.
- When an invoice is written, the information of the car is stored. A serial number, make, model, color, and year are stored for each car.
- A customer may come in to have his or her car serviced.
- When a customer takes one or more cars in for repair or service, a mechanic writes one service ticket for the owner of the car. Date, reason for service, mechanics who work on, and price of the service are stored.
- A car brought in for service can be worked on by many mechanics, and each mechanic may work on many cars.

NOTE: Use [ERDPlus](#) to draw your ER diagram. This will help you become prepared for Exam 1 where we will use ERDPlus. Create an account on the ERDPlus web page to be able to store ER diagrams so that you can continue or modify them later. Notice that the graphical notation is slightly different compared to Chen's notation. ERDPlus uses the *crow's foot* notation. The textbooks will help you understand and distinguish the two different notations.

Question 2 (ER Model)

[20 points]

Design an Entity-Relationship diagram that models a department management system and considers the requirements listed below. That means that you have to identify suitable entity sets, relationship sets, attributes, keys of entity sets (if not specified), and so on. Further, add the cardinalities (1:1, 1:m, m:1, m:n) to the relationship sets and write down your assumptions regarding the cardinalities if there could be a doubt.

Consider the following requirements about a car dealership system:

- A professor has a SSN, name, age, rank, and specialty.
- A department has a department number, name, and office.
- A graduate has a SSN, name, age, and degree progress.
- A project has a project ID, sponsor, start date, end date, and budget.
- There is a professor who runs a department.
- A professor may advise many graduates and a graduate can be advised by one professor.
- A professor can be belonged to many departments and a participation time for each department is stored.
- A graduate majors in a department.
- A graduate must have another graduate as an advisor.
- A project is managed by a professor.
- A project is worked in by many professors.
- Many graduates may work on many projects.

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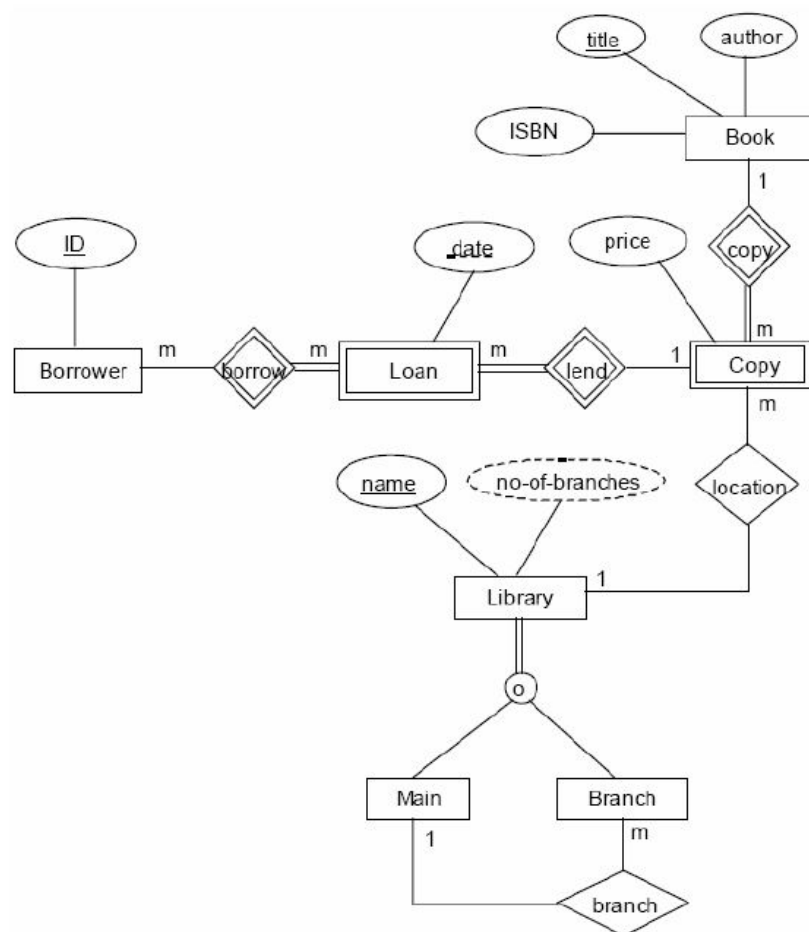
Question 3 (ER Model)

[15 points]

- (a) [10 points] The New York Public library service wants to create a database to store details of its libraries, books, and borrowers. A requirements analysis has provided the following information:

A book has a unique ISBN number, a title, and one or more authors. The library service may own several copies of a given book, each of which is located in one of the service's libraries. A given library contains many books, and in order to distinguish different copies of the same book a library assigns a different copy number to each of its copies of a given book. The price that was paid for each copy is also recorded. Every library has a unique name and is either a main library or a branch library. A main library may have zero or more branch libraries and every branch library is a branch of exactly one main library. A borrower has a name and a unique ID code. A borrower can have many books on loan, but each copy of a book can only be on loan to one borrower. A borrower could borrow the same book on several occasions, but it is assumed that each such loan will take place on a different date.

The ER diagram below illustrates a preliminary design of an Entity-Relationship model intended to meet the above specification. Unfortunately, this design is afflicted with errors. List as many errors as you can. Describe each error and clearly state both the nature of the problem and its solution.



- (b) [5 points] Let us assume any three entity sets E_1 , E_2 , and E_3 as well as the four relationship sets $R(E_1, E_2, E_3)$, $R_1(E_1, E_2)$, $R_2(E_1, E_3)$, and $R_3(E_2, E_3)$. While R is a ternary relationship set, R_1 , R_2 , and R_3 are binary relationship sets. Can the ternary relationship R be represented by the three binary relationships R_1 , R_2 , and R_3 ? In other words, is the modeling of R on the one hand and R_1 , R_2 , and R_3 on the other hand semantically equivalent? Explain and argue.

Question 4 (Oracle)

[45 points]

Consider the following table 'emp' (the information of employees).

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-10	800	(null)	20
7499	ALLEN	SALESMAN	7698	20-FEB-11	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-11	1250	200	30
7566	JONES	MANAGER	7839	02-APR-11	2975	30	20
7654	MARTIN	SALESMAN	7698	28-SEP-11	1250	300	30
7698	BLAKE	MANAGER	7839	01-APR-11	2850	(null)	30
7782	CLARK	MANAGER	7839	01-JUN-11	2450	(null)	10
7788	SCOTT	ANALYST	7566	09-OCT-12	3000	(null)	20
7839	KING	PRESIDENT	(null)	17-NOV-08	5000	3500	10
7844	TURNER	SALESMAN	7698	08-SEP-11	1500	0	30
7876	ADAMS	CLERK	7788	12-JAN-13	1100	(null)	20
7900	JAMES	CLERK	7698	03-OCT-11	950	(null)	30
7902	FORD	ANALYST	7566	03-OCT-11	3000	(null)	20
7934	MILLER	CLERK	7782	23-JAN-12	1300	(null)	10

Use your CISE Oracle account to create this table and perform the operations below. Provide **SQL statements** for all operations. IMPORTANT: Show your SQL queries *and* the outputs of all results as **screen snapshots** from the user interface of the Oracle SQL Developer.

In some SQL statements we will use the logical connectives AND and OR to connect sub-conditions: <condition1> AND <condition2>, <condition1> OR <condition2>.

The ORDER BY statement followed by a comma separated list of attribute names allows one to order tuples. This statement may only appear *at the end* of a SQL statement. Sorting is performed for each attribute separately and consecutively from right to left in the attribute list. This means that attributes listed first have higher order priority than attributes following them. Adding the keywords ASC or DESC behind each attribute means that the values of the corresponding attributes are sorted in *ascending* or *descending* order respectively. Example:

ORDER BY Name ASC, Gender DESC

This statement should be distinguished from the statement:

ORDER BY Gender DESC, Name ASC

Due to their different semantics (try it out and see!), both commands yield different table results.

Further, you will need information about the *like* command for string pattern search. Please look it up online in Oracle manuals or SQL tutorials when the command is needed.

- [5 points] Create the table 'emp', show afterwards that the table is empty at this point, then insert all records into the table, and show afterwards that and how the table is filled with tuples.
- [5 points] Find the names, salaries and hire dates of employees who were hired before 2012. Sort all tuples in ascending order regarding the date.
- [5 points] Find the names of employees whose name has 'AR' or 'ES' in it.
- [5 points] Find the information of employees whose department number is neither 20 nor 30.

- (e) [5 points] It has been decided that employees in department number 10 are going to receive 13% of salary as a bonus. Display names, salary, bonus, and department number.
- (f) [5 points] Find the number of employees whose hire date is before 2012 and who receive salary more than \$2400.
- (g) [5 points] Display the average, minimum, and maximum salary of employees in department 10.
- (h) [5 points] Reorganize the tuples of the table in the sense that all tuples are sorted in ascending order regarding the department. For the same department, the tuples should be sorted by manager number in descending order and then for the same manager by hired date in descending order. Output the sorting attributes as well as the employees names.
- (i) [5 points] Increase the salary of employees whose salary is less than 2000 by 20%. Show the updated table.