



**CSE 4/560**

**Fall 2024**

**Databases and Query Languages Homework 1**

**Total Marks 100**

*Topics Covered: Introduction to database, relational Model, SQL*

## Instructions:

1. Write the answers to each problem in a separate MS Word file, and save it as a single PDF file. Upload the PDF file in BrightSpace
2. Write your name and your UBIT number top of the HomeWork
3. Handwritten (paper and pen written then scanned) will not be accepted.
5. Multiple submissions will be allowed before the due date. However, we will consider the last submission.
6. **Submission Deadline: 9/24/2024**  
**(No late submission will be accepted and will be graded '0' ) ;**

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### Problem 1 [5X1=5 points]

Define the following terms: relation, *relation schema*, *database*, *database schema*, *Domain*.

### Problem 2 [5 points]

*What is a foreign key constraint? Why are such constraints important?*

### Problem 3 [5+5X2=15 points]

Consider the Movie database example.

Movies (title , year, length , genre, studioName, producerC#)

StarsIn (movieTitle, movieYear, starName)

MovieStar (name, address, gender, birthdate )

MovieExec(name, address, cert# , netWorth)

Studio(name, address, presC#)

- a. Identify the primary keys for each relations
- b. Write the following queries in SQL
  1. Find the address of MGM studios.
  2. Find Sandra Bullock's birthdate.

3. Find all the stars that appeared either in a movie made in 1980 or a movie with “Love” in the title.
4. Find all executives worth at least \$10,000,000.
5. Find all the stars who either are male or live in Malibu (have string Malibu as a part of their address).

Fig:1 Bank database

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```

branch(branch_name, branch_city, assets)
customer (ID, customer_name, customer_street, customer_city)
loan (loan_number, branch_name, amount)
borrower (ID, loan_number)
account (account_number, branch_name, balance)
depositor (ID, account_number)

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**Problem 4 [3X5=15]**

Consider the bank database of Figure 1 Give an expression in the **relational algebra** for each of the following queries:

- a. Find each loan number with a loan amount greater than \$10000.
- b. Find the ID of each depositor who has an account with a balance greater than \$6000.
- c. Find the ID of each depositor who has an account with a balance greater than \$6000 at the “Uptown” branch.

Answer each of the following questions briefly. The questions are based on the following relational schema:

**Problem 5 [5X5=25]**

Consider the following relations containing airline flight information.

```

Flights(fldno: integer, from: string, to: string,
        distance: integer, departs: time, arrives: time)
Aircraft(aid: integer, aname: string, cruisingrange: integer)
Certified(eid: integer, aid: integer)
Employees(eid: integer, ename: string, salary: integer)

```

Write the following queries in **relational algebra**.

- a) Find the *eids* of pilots certified for some Boeing aircraft.
- b) Find the *names* of pilots certified for some Boeing aircraft.
- c) Find the *aids* of all aircraft that can be used on non-stop flights from Bonn to Madras.

- d) Identify the flights that can be piloted by every pilot whose salary is more than \$100,000.
- e) Find the names of pilots who can operate planes with a range greater than 3,000 miles but are not certified on any Boeing aircraft.

### Problem 6: [5X2=10]

| <i>sid</i> | <i>sname</i> | <i>rating</i> | <i>age</i> |
|------------|--------------|---------------|------------|
| 18         | jones        | 3             | 30.0       |
| 41         | jonah        | 6             | 56.0       |
| 22         | ahab         | 7             | 44.0       |
| 63         | moby         | <i>null</i>   | 15.0       |

Figure 5.1 An Instance of Sailors

Consider the instance of the Sailor relation shown in Figure 5.1.

- a. Write SQL queries to compute the average rating, using AVG; the sum of the ratings, using SUM; and the number of ratings using COUNT.
- b. If you divide the sum just computed by the count, would the result be the same as the average? How would your answer change if these steps were carried out with respect to the *age* field instead of *rating*?

### Problem 7: [5X3=15]

Consider the following relational schema. An employee can work in more than one department; the *pct\_time* field of the Works relation shows the percentage of time that a given employee works in a given department. Write triggers to ensure each of the following requirements is considered independently.

Emp(*eid*: integer, *ename*: string, *age*: integer, *salary*: real)

Works(*eid*: integer, *did*: integer, *pct\_time*: integer)

Dept(*did*: integer, *dname*: string, *budget*: real, *managerid*: integer)

- a. Define a table constraint on Emp that will ensure that every employee makes at least \$10,000.
- b. Define a table constraint on Dept that will ensure that all managers are *age* > 30.
- c. Create a trigger to ensure that whenever an employee is given a raise, the manager's salary must be increased to at least as much.

### Problem 8: [5X2=10]

Discuss the strengths and weaknesses of the trigger mechanism.