Assignment 1: Relational Algebra and SQL

Due Date: September 30, Monday, 11:59pm

Part 1: Relational Algebra (50 points)

Given Tables:

Table: Student

Student_ID	NAME	INITIAL	PHONE	GPA	DEPT
110245	Alice	A	9874573124	8	CSE
110243	Bob	R	6513548756	9	ECE
110247	Cat	M	6214538795	7	EEE
110241	Alex	C	5284659513	8	ECE
110242	Sally	K	9531248675	10	CSE
110244	John	S	3001854457	7	CE
110249	Stephany	R	6547513021	9	ECE
110250	Ashley	V	9547862001	10	CSE
110251	Kevin	A	8008952104	8	CE
110252	Mixi	R	9090745432	7	CE

Table: Guide

STUDENT_PHONE	STUDENT_NAME	GUIDE_NAME	GUIDE_ID
9874573124	Alice	Dr. Jack	I-9785
6513548756	Bob	Dr. Jenny	A-754
6214538795	Cat	Dr. Jennifer	S-3021
5284659513	Alex	Dr. Rysten	D-847
9531248675	Sally	Dr. Tyson	B-9548
3001854457	John	Dr. Rock	V-001
6547513021	Stephany	Dr. Jennifer	S-3021
9547862001	Ashley	Dr. Jenny	A-754
8008952104	Kevin	Dr. Jack	I-9785
9090745432	Mixi	Dr. Jack	I-9785

Questions:

1. Find students who are being guided by more than one guide.
2. List the names and department of students who have a GPA that is greater than the average GPA of all students in their department.
3. Find the name of students whose GPA is greater than the GPA of all other students in their department (i.e., the top student in each department).
4. Identify the students who are guided by the same guide and are in different departments.
5. Find the guide with the maximum average GPA among all their assigned students.
6. List the students who have the same phone number in both the `Student` and `Guide` tables.
7. Find the names of guides who guide students from more than one department.
8. Retrieve the names of students who are enrolled in all departments that Dr. Jennifer has students in.
9. Find the guide(s) who guide(s) the highest number of students in the CSE department.
10. For each department, list the names of the students whose GPA is less than the department's median GPA.

Part 2: SQL Commands (50 points)

Installing and Running SQL

Windows:

Download the MySQL Installer from the official website: `https://dev.mysql.com/downloads/`. Follow the installation instructions. Once installed, you can use the MySQL Workbench to run your SQL queries.

Mac:
Use Homebrew: `brew install mysql`. Once installed, start MySQL: `mysql.server start`. You can use the terminal or download a GUI like Sequel Pro or MySQL Workbench to run your SQL queries.

Linux:
Use the package manager for your distribution. For Debian/Ubuntu: `sudo apt-get install mysql-server`. Start the MySQL service: `sudo service mysql start`. Use the terminal or a GUI tool of your choice to run your SQL queries.

Important Notes

1. Ensure your database server is running before attempting to execute any SQL queries.
2. Always backup data before performing operations, especially delete and update operations.
3. Double-check your SQL queries to avoid unwanted data changes or deletions.

Instructions for Submission

1. Prepare a report containing both your SQL queries and the corresponding outputs.
2. Include clear screenshots of each output immediately after its respective query.
3. The report should be compiled and submitted in either Word or PDF format.
4. Submit the report before the deadline to the designated submission in Blackboard.

Requirements

Note: Make sure you read all the tasks before you populate the tables

Schema:

Table: Employees

EmployeeID	FirstName	LastName	Department	Salary	HireDate
1	Alice	Johnson	HR	70000	2020-01-15
2	Bob	Smith	IT	85000	2019-07-22
3	Carol	Davis	Finance	95000	2018-11-30
4	David	Wilson	IT	78000	2021-03-12
5	Eva	Brown	HR	72000	2022-06-20
6	Frank	Taylor	Marketing	68000	2023-05-01
7	Grace	Lee	Finance	98000	2017-10-25
8	Henry	Martin	Marketing	71000	2020-12-10
9	Irene	Harris	IT	80000	2022-01-15
10	John	Clark	HR	75000	2019-08-30

Table: Projects

ProjectID	ProjectName	Lead	Budget
101	Alpha	Alice Johnson	150000
102	Beta	Bob Smith	200000
103	Gamma	Carol Davis	120000
104	Delta	David Wilson	80000
105	Epsilon	Eva Brown	50000

Table 1: Project Details

ProjectID	**ProjectName**	**Lead**	**Budget**	**LastBudgetIncrease**
101	Alpha	Alice Johnson	150000	2020-01-15
102	Beta	Bob Smith	200000	2019-07-22
103	Gamma	Carol Davis	120000	2021-11-30
104	Delta	David Wilson	80000	2018-03-12
105	Epsilon	Eva Brown	50000	2023-06-20

Questions:

1. Query all employees working in the 'IT' department.
2. List projects with a budget exceeding $100,000.
3. Calculate the average salary of employees in each department.
4. Display the names of project leads and the number of projects they lead, for those leading more than one project.
5. Find employees who were hired in the last five years and work on projects with a budget over $50,000.
6. Add 3 new employees and 4 new projects to their respective tables.
7. Update the budget of project 'Alpha' to $160,000.
8. Remove projects that have not had a budget increase for over 3 years.
9. List all employees who work in the 'Marketing' department and have a salary greater than the average salary in the department.
10. Find employees who lead projects and have been working for more than 3 years.

Extra Credit (15 points)

Assume you have a new table `EmployeeSkills` in the `EmployeeDB` database with the following structure:

EmployeeID	Skill
1	SQL
1	$Python$
1	$DataAnalysis$
2	$Java$
2	$Python$
3	SQL
3	$MachineLearning$
4	$Python$
4	SQL
5	$DataAnalysis$
5	$ProjectManagement$

Question:

Write an SQL query to find employees who have a set of at least three unique skills that no other employee possesses in the exact same combination. The employee's skill set should be completely distinct—meaning no other employee should have all the same skills.

Clarification:

- A "unique skill set" means that the employee must have a combination of skills (at least three) that no other employee shares. For example, if Employee A has skills `SQL`, `Python`, and `Data Analysis`, no other employee should have all three of those skills together.
- Think about how you can group employees by their skill sets and check that no other employee has the exact same combination.

Submission Guidelines:

- Solutions should be submitted in a **PDF** format.
- For each SQL query, provide a screenshot of the query result and the query itself.
- Ensure submission before the deadline.