San Jose State University

CMPE 138/180B: Database Systems

Spring 2025

Homework 1

Due: 3/7/2025 @11:59pm

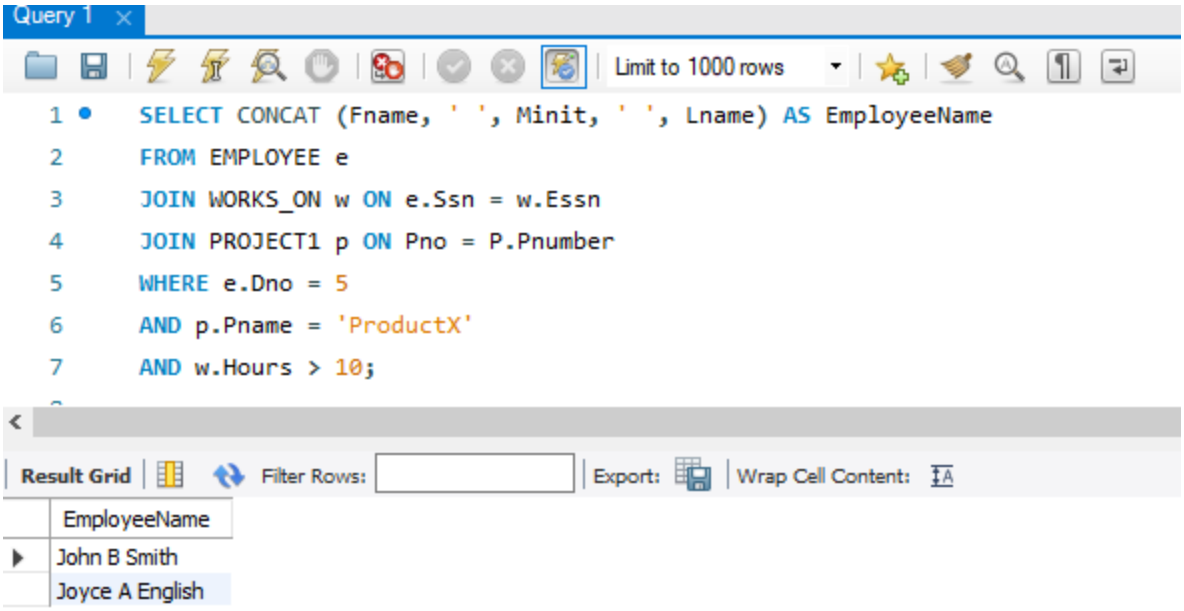
Please submit your solution to Canvas for this assignment, as a PDF document. Follow the homework policy document for instructions on how to submit this homework.

Problem 1 **(10 points)**

Exercise 6.10 (page 203) from the textbook.

Solution:

```
SELECT CONCAT (Fname, ' ', Minit, ' ', Lname) AS EmployeeName
FROM EMPLOYE e
JOIN WORKS_ON w ON e.Ssn = w.Essn
JOIN PROJECT p ON Pno = Pnumber
WHEREe. Dno = 5
AND p.Pname = 'ProductX'
AND w.Hours > 10;
```

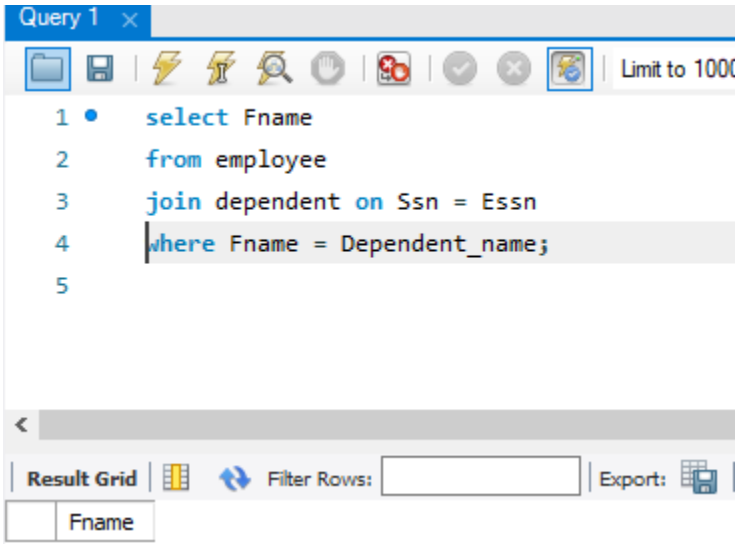


b. select Fname

from employee

join dependent on Ssn = Essn

where Fname = Dependent_name;

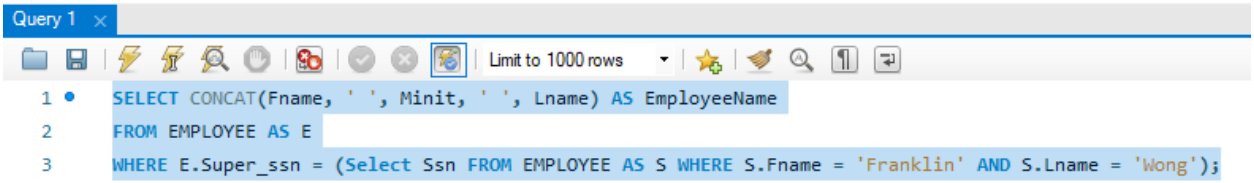


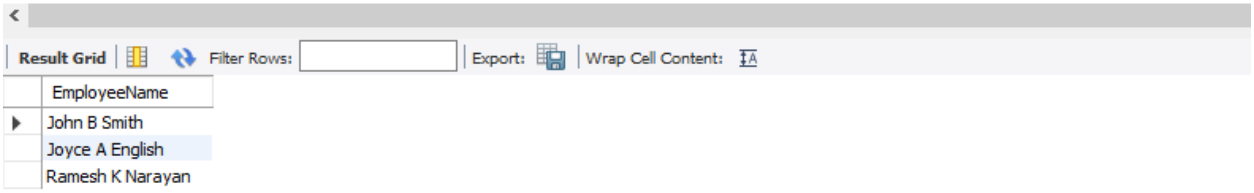
c.

SELECT CONCAT(Fname, ' ', Minit, ' ', Lname) AS EmployeeName

FROM EMPLOYEE AS E

WHERE E.Super_ssn = (Select Ssn FROM EMPLOYEE AS S WHERE S.Fname = 'Franklin' AND S.Lname = 'Wong');





Problem 2 **(15 points)**

Specify the following query on the database in Figure 5.5 in SQL. Show the query results if the query is applied to the database state in Figure 5.6.

- For each project whose average employee salary is more than $27,000, retrieve the project name and the number of employees working on that project.

Solution

SELECT p.Pname, COUNT(w.Essn) as NumEmployees

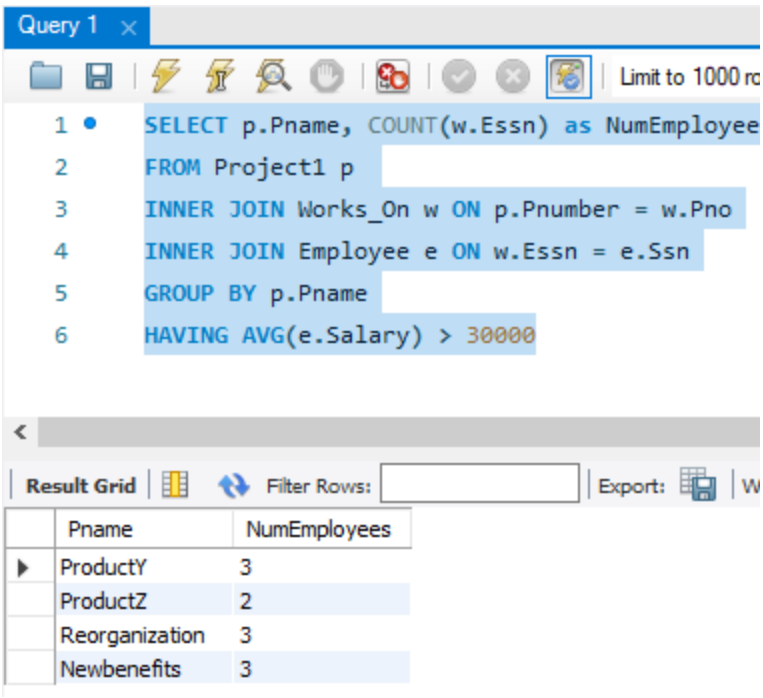
FROM Project1 p

INNER JOIN Works_On w ON p.Pnumber = w.Pno

INNER JOIN Employee e ON w.Essn = e.Ssn

GROUP BY p.Pname

HAVING AVG(e.Salary) > 30000



Problem 3 **(30 points)**

In SQL, show the following queries on the database in Figure 5.5 using the concept of nested queries and other concepts described in chapter 7. Additionally, list the results of these queries.

a. Retrieve the names of all employees who work in the department that has the employee with the highest salary among all employees.
b. Retrieve the names of all employees whose supervisor's supervisor has '123456789' for Ssn.
c. Retrieve the names of employees who make at least $10,000 more than the employee who is paid the least in the company.

Solution:

a)

```
SELECT e.Fname, e.Lname
FROM Employee e
WHERE e.Dno = (
  SELECT d.Dnumber
  FROM Department d
  INNER JOIN Employee e ON d.Dnumber = e.Dno
  WHERE e.Salary = (SELECT MAX(Salary) FROM Employee)
```

);

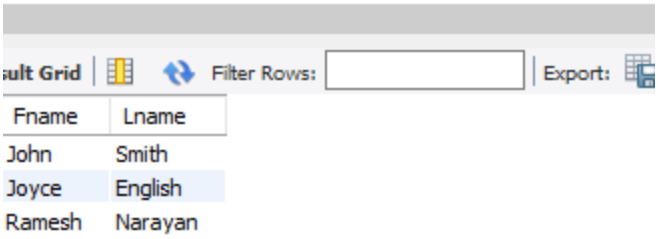
```
2      FROM Employee e
3    WHERE e.Dno = (
4        SELECT d.Dnumber
5        FROM Department d
6        INNER JOIN Employee e ON d.Dnumber = e.Dno
7        WHERE e.Salary = (SELECT MAX(Salary) FROM Employee
8      );
```

Fname	Lname
James	Borg

b.

```
SELECT e.Fname, e.Lname
FROM Employee e
WHERE e.Super_ssn IN (
  SELECT e2.Super_ssn
  FROM Employee e2
  WHERE e2.Ssn = '123456789'
);
```

```
SELECT e.Fname, e.Lname
FROM Employee e
WHERE e.Super_ssn IN (
  SELECT e2.Super_ssn
  FROM Employee e2
  WHERE e2.Ssn = '123456789'
);
```



ult Grid | Filter Rows: | Export:

Fname	Lname
John	Smith
Joyce	English
Ramesh	Narayan

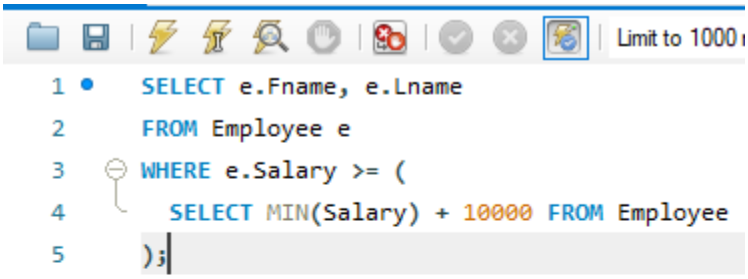
c. SELECT e.Fname, e.Lname

FROM Employee e

WHERE e.Salary >= (

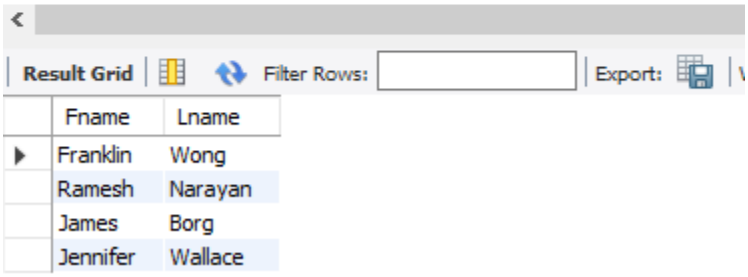
SELECT MIN(Salary) + 10000 FROM Employee

);



Limit to 1000

```
SELECT e.Fname, e.Lname
FROM Employee e
WHERE e.Salary >= (
  SELECT MIN(Salary) + 10000 FROM Employee
);
```



Result Grid | Filter Rows: | Export:

Fname	Lname
Franklin	Wong
Ramesh	Narayan
James	Borg
Jennifer	Wallace

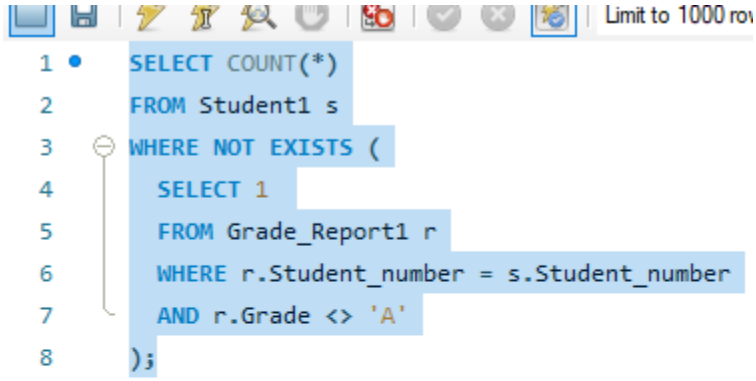
Problem 4 **(20 points)**

Specify the following queries in SQL on the database schema in Figure 1.2.

a. Retrieve the number of all straight-A students (students who have a grade of A in all their courses).
b. Retrieve the names and major departments of all students who do not have a grade of A in any of their courses.

Solution:

```
FROM Student1 s

WHERE NOT EXISTS (

 SELECT 1

 FROM Grade_Report1 r

 WHERE r.Student_number = s.Student_number

 AND r.Grade <> 'A'

);
```



b.

```
SELECT s.Name, s.Major

FROM Student s

WHERE s.Student_number NOT IN (

 SELECT r.Student_number
```

```
 FROM Grade_Report r
 WHERE r.Grade = 'A'
);
```

```
1  SELECT s.Name, s.Major
2  FROM Student1 s
3  WHERE s.Student_number NOT IN (
4    SELECT r.Student_number
5    FROM Grade_Report1 r
6    WHERE r.Grade = 'A'
7  );
```

Result Grid | Filter Rows: | Export:

Name	Major
Smith	CS

Problem 5 **(15 points)**

Imagine you are designing a table to store recent transactions for an online shopping platform and there are 1 trillion transactions. You want to record the following information:

- user id
- user name
- item id
- item name
- transaction id
- amount of money ($) for the transaction (e.g. $7.81, $470.80, etc)

a. What data type should you use for each column? You need to fill one of the following data types: byte, short, int, long, float, double, boolean, char.

Solution:

User id: int or bigint(Long Int: 64 bits)

User name: varchar(U), where U is a limit for the number of characters (1 byte per character)

Item id: Int or bigint

Item name: Varchar(I)

Transaction ID: bigInt

Transaction amount: FLOAT or DOUBLE (32 or 64 bits)

b. What is the size of each row in bytes? Think about the size of each column by selecting proper data types. You need to select the most suitable data type for each column by considering efficiency.

Solution:
Assuming U =15, I = 30; and upper limit when choosing between 32 and 64 bits
8 + 15 + 8+ 30+8+8 = 77 bytes

c. What is the size of the table in TB?
77 *10^12 bytes= 70.03 TB

10 points will be awarded for following the homework guidelines document.