Université Libanaise
Faculté d'Information
Br I

كلية الاعلام
الفرع الاول

الامتحانات النهائية للفصل الثاني
من العام الجامعي 2021- 2020

المرحلة: اجازة	المادة: Database
السنة المنهجية: الاولى	المدة: ساعة ونصف
الاختصاص: علم البيانات	الأستاذ: د. نور عاصي

Consider the following schema for an email database in a company.

```
Employee(id, name, email_address)
Email(emailId, senderId, receiverId, subject)
EmailDetails(emailId, date, status)
```

- The relation Employee stores the id, name and email addresses of all employees
- The relation Email stores the id of the email (emailId), the id of the employee who sent the email (senderId), the id of the employee who received the email (receiverId) and the email subject (subject). For simplicity, assume that an email can be sent to only one receiver.
- The relation EmailDetails stores the id of the email (emailId), the date at which the email is sent (date) and the email status (status) which can be 'Urgent', 'Important' or NULL in case the email is not urgent nor important.

Part I: SQL Queries (30pts)

Write the SQL queries for the following questions

1. Find the id, name and email address of employees who sent an email with the subject 'Hiring'
2. Find the id of employees who sent or received an email on 4-5-2020.
3. Find the number of emails sent by each employee. The query should return the id of each employee and the number of emails sent by that employee. Sort the results in ascending order (smallest number of emails appear first).
4. Find the id of employees who sent at least 2 important emails (status= 'important').
5. Two employees are "connected" if they sent an email to each other. Find all pairs of employees who are connected (return their id).

Part II: Nested SQL Queries (30pts)

1. Consider the following two SQL queries. Explain in two sentences (one sentence for each query) what each of the two queries does.

A.
```
SELECT * FROM Employee E
  WHERE not exists (SELECT *
                    FOM WorksAt W, Department D WHERE
                    E.empId = W.empId and E.deptId = D.deptId and
                    Dept.name = 'Information Management')
```

B.
```
SELECT empId FROM Employee E
  WHERE 2 <= (SELECT count(deptId) FROM Department D
                WHERE E.empId = D.managerId)
```

2. Consider the SQL queries below

A.
```
SELECT * FROM Employee E
  WHERE salary < (SELECT min(salary) FROM Employee E1, worksAt W1
                    WHERE E1.empId = W1.empId and
                          position = 'Assistant Professor')
```

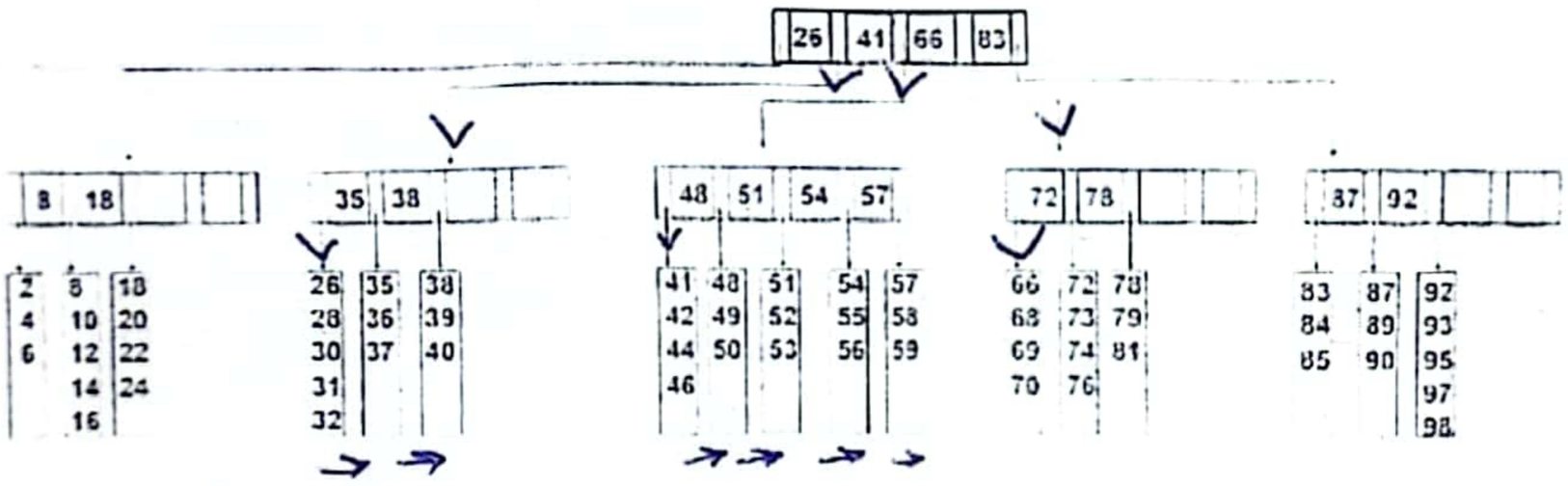
B.
```
SELECT empId FROM Employee E
  WHERE exists (SELECT * FROM Department
                  WHERE empId = managerId)
```

Which of the below statements describe the above queries correctly? Answer with true or false.

a) Query A returns all employees whose salary is less than the minimum salary of any assistant professor
b) Query A returns all employees who are assistant professors and have the lowest salary
c) Query B returns all employees who are managers
d) Query B returns all employees who worked in at least one department

Exercise 3: Indexing and Transactions (40)

1. Consider the following B-tree index on the attribute age of a table in a relational database.



What is the search path of the condition: age < 66 and age > 26?

2. Consider the following table Books(name, price) and assume that the following values exist in the database: ('Connolly', 40); ('Elmasri', 50); ('Garcia-Molina', 60). Consider the following two transactions:

```
T1: BEGIN TRANSACTION
S1: UPDATE Books SET price=22 WHERE name='Connolly'
S2: INSERT INTO Books VALUES ('Date', 0)
S3: UPDATE Books SET price=38 WHERE name='Connolly'
COMMIT;

T2: BEGIN TRANSACTION
S4: SELECT AVG(price) AS average-price FROM Books
COMMIT;
```

a. The two transactions above hit the DBMS roughly at the same time. What are the possible value(s) for the average price?
b. Which schedules are serializable with respect to either T1T2 or T2T1?