الجامعة اللبنانية
كلية الاعلام
الفرع الاول

Université Libanaise
Faculté d'Information
Br I

امتحان الفصل الثاني - نهائي
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المرحلة: الإجازة	الإختصاص: علم البينات	المادة: Database-2
السنة المنهجية:الاولى	المدة: 120 دقيقة	عدد المسائل : 4 | عدد الصفحات:2
الأستاذ : د. حسن سرحال	الدورة: الأولى	التاريخ: التوقيت:

Instructions: *- Please read all questions carefully.* *- Answer all questions in the spaces provided.*
- Show all steps in your relational algebra expressions. *- No electronic devices are permitted.*

Question 1 (3 pts) : Multiple Choice Questions: Circle the correct answer.

1. Relational Algebra is:
   a) A non-procedural query language
   b) A procedural query language
   c) A data definition language
   d) A data control language
2. What does SQL stand for?
   a) Structured Query Language
   b) Standard Query Language
   c) Simple Query Language
   d) Sequential Query Language
3. Which of the following is a unary operation in relational algebra?
   a) Union (∪)
   b) Cartesian Product (X)
   c) Project (∏)
   d) Intersection (∩)
4. Which of the following is NOT a valid keyword in SQL?
   a) SELECT
   b) DELETE
   c) WHERE
   d) INCLUDE
5. The operation that retrieves specific columns from a table is called:
   a) Select (σ)
   b) Project (∏)
   c) Join (⋈)
   d) Rename (ρ)
6. For the Union operation (R ∪ S) to be valid, R and S must:
   a) Have the same name
   b) Have the same number of tuples
   c) Be Union Compatible
   d) Have a foreign key relationship
7. The output of a Cartesian product between a relation with 4 tuples and another with 5 tuples will have:
   a) 9 tuples
   b) 20 tuples
   c) 4.5 tuples
   d) 1 tuple
8. A Natural Join (⋈) is a special case of:
   a) Theta Join
   b) Equi Join
   c) Left Outer Join
   d) Cartesian Product
9. Which outer join operation returns all tuples from the left relation, and matching tuples from the right relation, filling with NULLs where no match exists?
   a) Right Outer Join (⟖)
   b) Full Outer Join (⟗)
   c) Left Outer Join (⟕)
   d) Inner Join
10. What is the purpose of the SQL keyword "DISTINCT" in a SELECT statement?
    a) To retrieve unique values from a column
    b) To filter NULL values
    c) To delete duplicate records
    d) To sort the result set
11. A Theta Join (θ) allows which types of conditions in its join predicate?
    a) Only equality (=)
    b) Only inequality (<, >, ≤, ≥)
    c) Any comparison operator (=, <, >, ≤, ≥)
    d) Only logical operators (AND, OR)
12. Which of the following is basis for SQL?
    a) SQL Server
    b) DBMS
    c) RDBMS
    d) Oracle

Question 2 (2 pts): True or False. Write "True" or "False" next to each statement.

1. The Project operation (∏) automatically eliminates duplicate tuples in its output.
2. The Set Difference operation (-) is commutative, meaning R - S = S - R.
3. In an Equi Join, the resulting relation always contains two identical columns.
4. The Division operation (÷) is typically used in queries that involve "all" or "every".

Question 3 (5 pts): Use the following database schema to write **relational algebra expressions** for the queries below.

Schema: - STUDENT(ROLL, NAME, AGE) - EMPLOYEE(EMPLOYEE_NO, NAME, AGE)

Data for Reference:

STUDENT			EMPLOYEE		
ROLL	NAME	AGE	EMPLOYEE_NO	NAME	AGE
1	Aman	20	E-1	Anant	20
2	Atul	18	E-2	Ashish	23
3	Baljeet	19	E-3	Baljeet	25
4	Harsh	20	E-4	Harsh	20
5	Prateek	21	E-5	Pranav	22
6	Prateek	23			

1. Retrieve the details (ROLL, NAME, AGE) of all students who are 20 years old.
2. List the NAMES of all employees.
3. Find the NAMES of all people (from both STUDENT and EMPLOYEE) without duplicates.
4. Find the NAMES of students who are NOT employees.
5. Find the NAMES and AGES of students who are 20 years old. Rename the output relation to "STUDENT_20".

Question 4 (10 pts): Consider the relational database "Library Management System". Formulate the following **queries in SQL**.

BOOKS

Column	Type
book_id	INT (PK)
title	VARCHAR(100)
author	VARCHAR(100)
category	VARCHAR(50)
price	DECIMAL(8,2)
publication_year	INT

MEMBERS

Column	Type
member_id	INT (PK)
first_name	VARCHAR(50)
last_name	VARCHAR(50)
city	VARCHAR(50)
registration_date	DATE

BORROWINGS

Column	Type
borrow_id	INT (PK)
member_id	INT (FK)
book_id	INT (FK)
borrow_date	DATE
return_date	DATE

PK= Primary key
FK= Foreign Key

1. Display all books sorted by price in descending order.
2. Display the titles and authors of books published after 2020.
3. Find all members who live in 'Paris'.
4. Display the number of books in each category.
5. Show the average price of all books.
6. Display the member's full name and the title of each borrowed book.
7. Display all books that have never been borrowed.
8. Display the total number of borrowings for each member.
9. Display the most borrowed book.
10. Find books whose price is greater than the average book price (subqueries).
11. Display the member(s) who borrowed the highest number of books (subqueries).
12. Create a view named `borrowed_books_view` containing: borrow_id , member full name, book title, borrow_date and return_date.