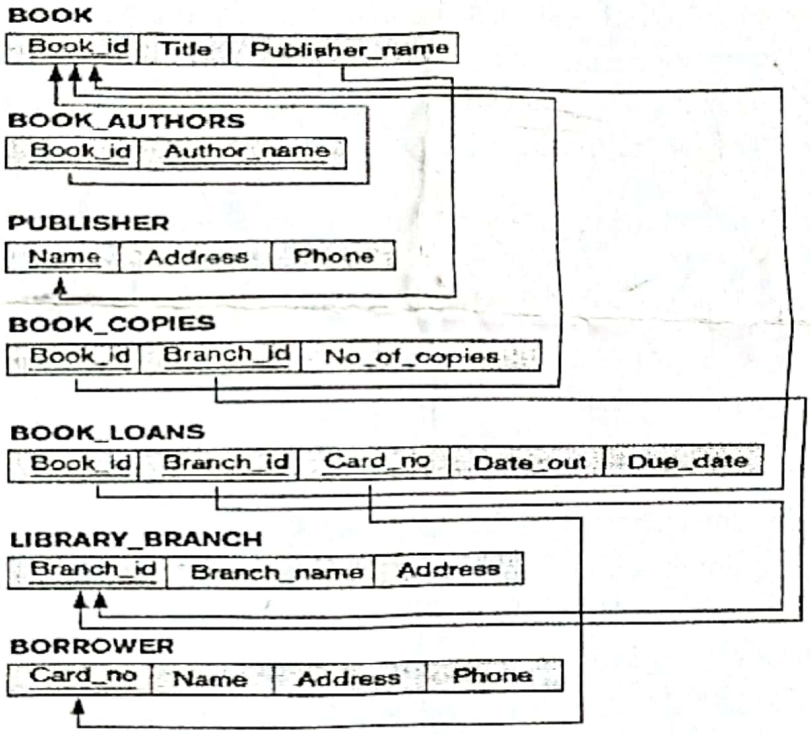
Cairo University
Faculty of Computers and Artificial Intelligence

Midterm Exam

Course Name: Introduction to Database Systems/ Database Systems-1	**Semester:** Spring 2021-2022
Course Code: IS211	**Date:** 14-4-2022
Instructors: Dr. Noha Nagy & Dr. Dina Ezzat	**Exam Duration:** 1 Hour

Answer the following questions:

Question 1: Given the following database schema, write **SQL** statements to express each of the following queries. [8 Marks]



1. Create table Book.
2. Add a new Book with the following data: 1, Database Systems and Hindawi.
3. Change the publisher's name of the book whose title is Database Systems to McGraw.
4. Remove the table Borrower.
5. Retrieve all books that have titles that contain "IS".
6. Get the total number of books found in Giza branch.
7. Create a list of books containing the number of copies of each book in every branch. Sort the result alphabetically by the branch name.
8. Using sub queries, list all the branches which do not have books written by 'Omar'.

Question 2: Given the following database schema of banking system, write the **relational algebra expressions** to express each of the following queries. [8 Marks]

Branch (branch_name, branch_city, assets)
Customer (customer_name, customer_street, customer_city)
Account (account_number, branch_name, balance)
Loan (loan_number, branch_name, amount)
Depositor (customer_name, account_number)
Borrower (customer_name, loan_number)

1. Find all loans of over 1200.
2. Find the account number for each account having a balance greater than 3000.
3. Find the names of all customers who have a loan, an account, or both, from the bank.
4. Find the names of all customers who have a loan at the Cairo branch.

Question 3: State whether the following statements are True or False. [2 Marks]

1. Every relation schema should have a foreign key.
2. Relation **R** has n tuples and relation **S** has m tuples, then **R x S** has $n + m$ tuples with unknown degree for the result.
3. A relation schema may have several foreign keys but exactly one primary key.
4. The foreign key can be composite.

Question 4: Rewrite the following Relational Algebra expression in SQL [2 Marks]

$$\sigma_{(Salary < 10000)} (\pi_{Name, Salary} (\sigma_{(Age < 40)} (EMPLOYEE)))$$

Question 5: Assume we have two database tables R & S with the same degree. $|R| = 100$, $|S| = 10$ with the following characteristics: [3 Marks & 2 bonus]

1. There is a relationship between R & S (Referential Relationship from R to S).
2. Number of distinct values in the foreign key column in S = 10 values.
3. When applying any operation OPERN on R and S; R will be the first mentioned table. Except for Question 2 below.
4. All R's Fields are Type Compatible with S's fields.
5. $|R| = 100$; means R has 100 tuples, and $|S| = 10$ means S has 10 tuples.

A database operation OPERN is applied to get data from both R and S. You are required to name the operation OPERN which applied if the number of tuples retrieved as results to OPERN is:

- Note: More than one operation may give the same result. You must name ALL the alternative operations corresponding to OPERN along with the Relational Algebra Symbol to represent OPERN.

1. 100 tuples.
2. Zero Tuples (here S comes first)
3. 10 tuples.
4. 90 tuples.
5. 1000 tuples.