SFWRENG 3DB3 Fall 2024
Midterm Practice Questions

These are a few sample questions for the midterm. This is not representative of the length, distribution or coverage of questions, but is representative of the type of questions that will be asked. Solutions will be covered during the review session (Q1-Q5), but we recommend you try to solve the problems yourself first.

Practice Exercises from the textbook:
(Solutions to odd-number exercises can be found in the Practice Midterm folder.)

- Relational and ER models: Ex. #2.3, 2.5, 3.7, 3.9, 3.13.
- SQL: 5.1, 5.3, 5.5.
- Indexes: 8.5 (no I/O costing needed), 8.7.

Question 1. For each of the following statements, indicate whether they are true (**T**) or false (**F**).

a) In SQL, there can be multiple `primary key` declarations in one `create table` statement.

b) A relation $R(A, B, C)$ may have at most three (minimal) keys (not superkeys).

c) Let R be a bag over the attributes A, B. If A is a key for R, then R is necessarily a set.

d) In SQL, there can be multiple `unique` (key) declarations in one `create table` statement.

e) The value of any arithmetic operation involving a null value (e.g., `'5-Null'`) is null.

f) In SQL, DDL stands for *Data Definition Language* and DML stands for *Data Management Language*.

g) A weak entity set has one or more many-many relationships to other (supporting) entity sets.

h) An update to a virtual view must eventually be synchronized to its base tables.

Question 2. Consider the following relational schema. Create an ER diagram modelling the same information. If the ER diagram cannot capture all dependencies, explain.

```
create table Books (ISBN   char(10) primary key,
                    author char(30) foreign key references Authors,
                    title  char(50),
                    qty    int)

create table Authors (name char(30) primary key,
                      institution char(30))

create table Borrowers (cardno  int primary key,
                        name  char(30))

create table Loans (cardno int foreign key references Borrowers,
                    isbn   char(10) foreign key references Books,
                    due    date,
   primary key (cardno,isbn,due))
```

Question 3.

- `Product(maker, model, price)`
- `PC(model, speed)`
- `Printer(model, type)`

The constraints are as follows:

- `model` is the primary key for all relations.
- The only possible values of `type` are "laser" and "ink-jet".
- Every PC model and every printer model is a Product model (that is, every PC or printer must be referenced in the relation `Product`).
- The price of a product should not be more than 10% higher than the average price of all products. You may assume that the average price of all products is given by the value avgPrice.

a) Write `CREATE TABLE` statements for this schema. Assume model and price are of type integer and all other attributes of type char(20).

b) Write the following query in SQL. *Find makers from whom a combination (PC and printer) can be bought for less than $2,000.*

c) Write the following query in SQL. *For each maker, find the minimum and maximum price of a (PC, ink-jet printer) combination.*

Question 4.

Given the instance of two relations:

R:

A	B
1	2
3	4
1	3

S:

B	C
1	3
2	4

a) What is the result of the following query:

```
SELECT DISTINCT R.A
FROM R
WHERE R.A NOT IN (SELECT DISTINCT S.B AS A
                  FROM S
                  WHERE S.B = S.C)
```

b) What is the result of the following query:

```
SELECT R.A, S.C, avg(R.B) as av
FROM R, S
WHERE R.B < 4
GROUP BY R.A, S.C
HAVING max(R.B) >= 2
```

Question 5.

Consider the following `CREATE TABLE` definition:

```
CREATE TABLE Midterm
  (A INT NOT NULL,
   B INT NOT NULL,
   C INT NOT NULL,
   PRIMARY KEY (A),
   FOREIGN KEY (B) REFERENCES Midterm(A) ON DELETE CASCADE ON UPDATE CASCADE,
   FOREIGN KEY (C) REFERENCES Midterm(A) ON DELETE CASCADE ON UPDATE RESTRICT)
```

Consider the following instance table `Midterm`:

A	B	C
4	3	3
3	4	3

a) **What is the result** of the following statement:

```
UPDATE Midterm
SET B = B+1
WHERE B in (SELECT A FROM Midterm)
```