CS3550 DBMS-I Exam - 1, Fall 2025

(Closed Book, 1.5 hrs, 35 marks)

Name _____ ID _____

Instructions:
- Return the question paper along with the answers written in the empty spaces provided.
- Use the provided extra sheets to do the rough work and not on the question paper.
- Be precise and concise in the answers. If you make any additional assumptions, write them clearly.
- The marks for each question is given in square brackets in bold font.

Q1 [6*1 = 6 marks] Mark true/false for the following questions. Correct answer: +1 & Wrong answer: -0.5

[TRUE/FALSE] Hierarchical data model cannot be used to capture many-to-many relationship between entities.

[TRUE/FALSE] Both SQL and relational algebra are declarative query languages.

[TRUE/FALSE] In SQL, the WHERE and HAVING clauses are evaluated before the GROUP BY clause.

[TRUE/FALSE] A correlated subquery runs once per row of the outer query.

[TRUE/FALSE] Primary keys are unique within a table, but different tables can reuse the same values.

[TRUE/FALSE] In relational algebra, a selection followed by projection is always equivalent to a projection followed by selection.

Q2 [5*2 = 10 marks] Pick the correct choice(s). If more than one option is correct, marks will be awarded only if, only and all the correct options have been marked. No negative marking.

1. In relational data model, the data constraints are specified at:
   a. Physical schema level
   b. View level
   c. Logical schema level
   d. All of the above

2. Which of the following is/are not part of the DBMS storage manager?
   a. Buffer manager
   b. File Manager
   c. Query evaluation engine
   d. Data integrity manager

3. Given the following relations, which of the following queries cannot be expressed using basic relational algebra operations (U, -, x, π, σ, ρ)?
   employee (name, salary, deptno)
   department (deptno, deptname, address)

    a. Department address of every employee

    b. Employees whose name is the same as their department name

    c. The sum of all employees' salaries

    d. All employees of a given department

4. Given relations r1(a, b) and r2(c, d), the following query will give exactly the same result as r1, provided:

    SELECT DISTINCT a, b
    FROM r1, r2

    a. r1 has no duplicates and r2 is non-empty

    b. r1 and r2 have no duplicates

    c. r2 has no duplicates and r1 is non-empty

    d. r1 and r2 have the same number of tuples

5. Consider the following query on the relation R (A, B, C, D)
    SELECT [...]   FROM R GROUP BY A, B
    I. MIN(C+D)　　　II. A,B　　　III. C,D
    Assume A,B,C, D take integer values. Which of the following can appear in the position marked as [...]

    a. II only.　　　　b. I and II only.　　　　c. I, II, and III.　　　d. None.

Q3 [8 marks] Short answer or fill in the blanks.

[2 marks] Consider two relations r and s. Rewrite the relational algebra expression r ∩ s, using other fundamental operations of relational algebra.

[2 marks] The data model that is mainly used for database design is _____

[4 marks] Consider the following three relations and the partial SQL query. Complete the query to find the cid of courses for which the count of students over age 20 who took that course is more than 50.

    Student (sid, name, age)
    Take (sid, cid, grade)
    Course (cid, title)

SELECT T.cid
FROM Student S, Take T
WHERE S.age > 20 AND S.sid = T.sid
GROUP BY _____
HAVING _____;

Q4 [7 marks] Consider the following student database schema, which contains information about students and their academic advisors. Primary keys are denoted by underline, and foreign keys are shown in bold (note that the fid field may be null for students who have no advisor):

Student (<u>sid</u>, name, salary, **fid**);   Faculty (<u>fid</u>, name, salary);

[4 marks] Write SQL DDL statements to create the Student and Faculty tables. Be sure to identify primary and foreign keys as appropriate. You may choose any reasonable SQL types for the attributes.

[3 marks] What does the following query do? Write in 1-2 sentences.

```
SELECT F.fid, F.name
FROM Faculty F, Student S
WHERE F.fid = S.fid
GROUP BY F.fid, F.name
HAVING COUNT(*) > 3
```

Q5 [4 marks] The relation book (title, price) contains the titles and prices of different books. Assuming that no two books have the same price, what does the following SQL query do? Write in 1-2 sentences.

```
SELECT title
 FROM book as B
  WHERE (SELECT count(*)
                FROM book as T
    where T.price > B.price) < 5
```