King Fahd University of Petroleum and Minerals

Information and Computer Science Department

ICS 334: Database Systems
Semester 041

Major Exam 1 – 18%

ID:

Name:

Section:

Grades		
Section	Max	Scored
A	5	
B	25	
C	10	
D	10	
E	20	
F	30	
TOTAL	100	

Section A – True False Questions   [5 marks - 1 mark per question]

Circle the correct answer.

1. A foreign key must always refer to a unique key.

    a. TRUE
    b. FASLE

2. If a Primary key consists of more than one attribute, one of its component attributes can be null

    a. TRUE
    b. FASLE

3. A relation can have duplicate rows.

    a. TRUE
    b. FALSE

4. SQL can result in duplicate rows.

    a. TRUE
    b. FALSE

5. In an SQL SELECT statement, we can have HAVING clause even with out GROUP BY clause.

    a. TRUE
    b. FALSE

Section B - Multiple Choice Questions [25 marks – 2.5 marks each]

In the following multiple choice questions, more than one choice may be correct. Circle all correct answers.

1. **Which of the following is a result of a DML statement**

   a. Changing the number of tuples in a relation
   b. Retrieving tuples from a relation
   c. Creating a new relation
   d. Changing the domain of an attribute
   e. Changing the value of an attribute

2. **Which of the following is/are TRUE about foreign keys**

   a. A foreign key is always a primary key in the owner relation.
   b. A foreign key can be null
   c. A foreign key must be unique and not necessarily a primary key in the owner relation.
   d. A foreign key must be part of the primary key
   e. A foreign key must be unique

3. **Which of the following does NOT change a database state**

   a. Changing the degree of a relation
   b. Changing the cardinality of a relation
   c. Adding a constraint
   d. Creating a new table
   e. Retrieving records from a database

4. **Which of the following is/are TRUE**

   a. Each value in a tuple is atomic
   b. Each tuple has distinct values.
   c. Order of tuples in a relation has no significance.
   d. Each relation must have an alternate key
   e. None of the above

5. **Which of the following is TRUE about superkeys**

   a. If you reduce the number of attributes in a superkey it will still be a super key.
   b. If you increase the number of attributes in a superkey it will still be a superkey.
   c. A superkey will always identify one tuple in a relation
   d. If you increase the number of attributes in a candidate key it will no longer be a candidate key but it will still be a superkey.
   e. Some candidate keys are not superkeys

6. **Which of the following statements is/are TRUE**

    a. Logical data independence is the capacity to change the internal schema without having to change the conceptual schema.
    b. Physical data independence is the capacity to change the internal schema without having to change the conceptual schema.
    c. Logical data independence is the capacity to change the conceptual schema without having to change the external schema or application programs
    d. Physical data independence is the capacity to change the conceptual schema without having to change the external schema or application programs
    e. Physical and logical data independence is not a characteristic of file-based data management approach.

7. **Which of the following statements does NOT change a database schema**

    a. Changing the degree of a relation
    b. Changing the cardinality of a relation
    c. Adding a constraint
    d. Changing the domain of an attribute
    e. Changing a value of an attribute

8. **Which of the following is NOT a result of a DDL statement**

    a. Reducing the number of tuples in a relation
    b. Changing the domain of an attribute
    c. Changing the value of an attribute
    d. Dropping or creating a table
    e. Adding a constraint\

9. **Which of the following is a component of a DBMS**

    a. Data Manager
    b. Disk Manager
    c. Run-time database processor
    d. Query compiler
    e. Process manager

10. **Which of the following statements is TRUE**

    a. It is impossible to have a foreign key in a database if there is only one table in the database.
    b. A table may or may not have a primary key.
    c. Some alternate keys are not really superkey
    d. The UNION ALL operation may result in duplicate rows.
    e. In a SELECT statement the GROUP BY clause is done before the WHERE clause.

Section C – Answer all the following questions

1. **Use the following two tables to answer the next question.**

LECTURER

LID	Fname	Lname	Age
111	Amin	Al-Hashem	22
222	Ali	Al-Eid	33
333	Sadiq	Al-Marhoon	44
444	Hani	Al-Tawfiq	55

SUBJECT

CODE	Name	LID
ICS101	Fortran	333
ICS102	Java	222
ICS202	Data structures	111
ICS334	Databases	222
ICS431	Operating Systems	333

<u>Business Rule</u>: *The age of a lecturer must be between 18 and 65.*

Match each DML statement in table B with all the integrity constraints it violates from table A. Write your answers in the second column of B.

[10 points]

A

Label	Integrity Constraint
1	Entity
2	Domain
3	Key
4	Referential
5	No integrity Violation

B

DML Statements	Violated Constraint Label
INSERT(111, 'Hussain', 'Al-Olaiyan', 28) INTO LECTURER	
UPDATE LECTURER SET LID=555 WHERE LID=333	
UPDATE SUBJECT SET LID = 444 WHERE LID = 222	
DELETE FROM LECTURER WHERE LID=222	
INSERT(777, 'Ali', 'Al-Duwais', 66) INTO LECTURER	

Section D – Answer the following question.

1. What is the use of a foreign key constraint? **[3 points]**

2. Explain the self describing characteristics of a DBMS. **[4 points]**

3. One of the DBMS advantages is flexibility. What does it mean? **[3 points]**

Section E – Consider the following relational schema

Department (<u>Deptno</u>, DName, Loc)

Student (<u>StuID</u>, FirstName, LastName, Address, City, CourseID)

Course (<u>CourseID</u>, Name, Deptno)

Teach (<u>CourseID</u>, <u>FacID</u>)

Faculty (<u>FacID</u>, FirstName, LastName, RoomNo, TelNo, Deptno)

Assume attributes with the same name are related.

Give relational Algebraic expression to answer the following queries: [20 Points, 4 points each]

1. List of faculty names, department names and location having location "New Campus".

2. List of student name, address, city and course name having department number is 321.

3. List of course id (use rename as Course Code), course name, faculty name and department name with department number 318.

4. Get the list of faculty names that are teaching courses.

5. Get the names of all lecturers (or faculty members) who teach student 895241.

Section F – Write down SQL statements of the following queries

(Use appendix's sample tables to evaluate this question)

1. List of employee's name, hiredate, salary and department name with no commission. **[3 points]**

2. List of employees (employee number, salary, hiredate) with job titles Clerk, Salesman and Manager. **[3 points]**

3. List of employee's name and job title with name contains letters 'ar'. **[4 points]**

4. List of job titles that are assigned to more than one employee other than job title Clerk. **[4 points]**

5. List of employees with salary equals to maximum salary of employee (s).   **[4 points]**

6. Create table for the following structure

   Doctor (<u>EmpID</u>, FirstName, MiddleName, LastName, Address, City, TelNos)
   Where EMPID is a primary key and LastName must not be null.   **[4 points]**

7. Add a column called **Salary** to the **Doctor** table that you created in question 6.   **[4 points]**

8. List of employees who have same job title and same manager (supervisor) as employee number 7369.
          [4 points]

APPENDIX:

DEPTNO is a PK in DEPT and EMPNO is a PK in EMP, whereas DEPTNO is a FK in EMP table


```
SQL> select * from dept;

    DEPTNO DNAME          LOC
---------- -------------- -------------
        10 ACCOUNTING     NEW YORK
        20 RESEARCH       DALLAS
        30 SALES          CHICAGO
        40 OPERATIONS     BOSTON

SQL> select * from emp;

     EMPNO ENAME      JOB            MGR HIREDATE          SAL       COMM     DEPTNO
---------- ---------- --------- ---------- ----------- ---------- ---------- ----------
      7369 SMITH      CLERK          7902 17-DEC-1980        800                    20
      7499 ALLEN      SALESMAN       7698 20-FEB-1981       1600        300         30
      7521 WARD       SALESMAN       7698 22-FEB-1981       1250        500         30
      7566 JONES      MANAGER        7839 02-APR-1981       2975                    20
      7654 MARTIN     SALESMAN       7698 28-SEP-1981       1250       1400         30
      7698 BLAKE      MANAGER        7839 01-MAY-1981       2850                    30
      7782 CLARK      MANAGER        7839 09-JUN-1981       2450                    10
      7788 SCOTT      ANALYST        7566 19-APR-1987       3000                    20
      7839 KING       PRESIDENT           17-NOV-1981       5000                    10
      7844 TURNER     SALESMAN       7698 08-SEP-1981       1500          0         30
      7876 ADAMS      CLERK          7788 23-MAY-1987       1100                    20
      7900 JAMES      CLERK          7698 03-DEC-1981        950                    30
      7902 FORD       ANALYST        7566 03-DEC-1981       3000                    20
      7934 MILLER     CLERK          7902 23-JAN-1982       1300                    10
      7935 EJAZ       ANALYST        7782                  12000        500

16 rows selected.
```