COMSATS UNIVERSITY ISLAMABAD
Department of Computer Science
1st Sessional Examination, Spring-2021

Course: Database Systems – I (CSC371) **Time Allowed (mins) / Total Marks: 60 / 10**
Instructors: Qasim Malik / Rashid Mehmood **Date: April 01, 2021**

Student Name: _____ **Registration no:** _____

1- [CLO-C1] Multiple Choice Questions [3]

1a. Relational algebra query produces relations that may contain duplicate rows. **[0.25]**
(a) True
(b) False ✓

1b. A primary key is always made up of a single attribute. **[0.25]**
(a) True
(b) False ✓

1c. A foreign key attribute may contain null values. **[0.25]**
(a) True ✓
(b) False

1d. SQL is also used to query non-relational databases. **[0.25]**
(a) True
(b) False ✓

1e. Relational model is based on mathematical concepts of: **[0.25]**
(a) Game theory
(b) Graph theory
(c) Set theory ✓
(d) All of these
(e) None of these

1f. Schema of the relation means: **[0.25]**
(a) Structure of the relation ✓
(b) Tuples in the relation
(c) Data in the relation
(d) All of the above
(e) None of the above

1g. *Class, Attribute, Object* in object-oriented data model corresponds to which of the following triples in relational data model: **[0.25]**
a) Schema, Data, Instance
b) Tuple, Attribute, Relation
c) Relation, Attribute, Tuple ✓
d) Data, Constraint, Key
e) Entity set, Attribute, Entity

1h. The result of which binary relational algebra operator contains all possible pairs of tuples from the operand relations, regardless of whether the common attribute values match: **[0.25]**
a) Theta Join
b) Cross product ✓
c) Natural Join
d) Union
e) Intersection

1i. In a relational database management system, a constraint that ensures that values of a certain attribute remain unique throughout the table is called a: **[0.25]**
(a) Primary key constraint
(b) Referential integrity constraint
(c) Unique constraint

(d) Check constraint
(e) Both (a) and (c) ✓

1j. A referential integrity constraint policy that ensures that records with a foreign key are updated when the primary key of the referring record in the reference relation is updated is called a: **[0.25]**

(a) Restricted delete
(b) Restricted update
(c) Cascading delete
(d) Cascading update ✓
(e) No such policy exists

1k. While constructing ER diagrams, the double ovals are used to denote: **[0.25]**

(a) Multivalued key
(b) Multivalued entity
(c) Multivalued attribute ✓
(d) Derived attribute
(e) Composite attribute

1l. An entity set, that may not have sufficient attributes to form a primary key, is called a: **[0.25]**

(a) Strong entity set
(b) Weak entity set ✓
(c) Keyless entity set
(d) Owner entity set
(e) Composite entity set

2- [CLO-C1] Here are SQL declarations for two tables S and T:

```
CREATE TABLE S(c INT PRIMARY KEY, d INT);
CREATE TABLE T(a INT PRIMARY KEY, b INT, CHECK(b IN (SELECT c FROM S)));
```

Suppose S(c, d) and T(a, b) contains the following tuples:

S

c	D
2	10
3	11
4	12
5	13

T

a	B
0	4
1	5
2	4
3	5

For each of the following modifications, specify if they will violate any constraint? If yes, which constraint? **[1]**

2a. Updating (2, 4) in T to be (2, 8)

Solution:

Yes, Check constraint

2b. Inserting (7, 3) into T

Solution:

No

2c. Inserting (3, 3) into T

Solution:

Yes, Primary key constraint

2d. Inserting (4, 13) into S

Solution:

Yes, Primary key constraint

3- [CLO-C2] Given the following relational database schema for keeping track of course registration:

Course (CourseCode, Title, DeptID)
Student (CNIC, Name, DeptID)
Semester (SemesterID, Title, StartDate)
Registered (CourseCode, CNIC, SemesterID, GPA)
Department (DeptID, Name, Address)

Write relational algebra queries for the following needs on the above schema: **[3]**

3a. Retrieve the name, CNIC, and gpa of all students registered in course titled "Database Systems-I" during semester titled "Fall 2020"

Solution:

π Name,CNIC,GPA
(σ Course.Title='Database Systems-I' $\wedge$ Semester.title='Fall 2020' $\wedge$ Registered.CourseCode=Course.CourseCode $\wedge$ Registered.CNIC=Student.CNIC $\wedge$ Registered.SemesterID=Semester.SemesterID (Registered $\times$ Course $\times$ Semester $\times$ Student))

3b. Retrieve the name and CNIC of all "Computer Science" department students, along with the title of the courses they are registered in, during "Spring 2021"

Solution:

π Student.Name,CNIC,Course.Title
(σ Department.Name='Computer Science' $\wedge$ Semester.title='Spring 2021' $\wedge$ Registered.CourseCode=Course.CourseCode $\wedge$ Registered.CNIC=Student.CNIC $\wedge$ Registered.SemesterID=Semester.SemesterID $\wedge$ Course.DeptID=Deparment.DeptID (Registered $\times$ Course $\times$ Semester $\times$ Student $\times$ Department))

3c. Retrieve the name and CNIC of all the students who registered themselves in course titled "Database Systems-I" during "Fall 2020" and re-registered themselves again during "Spring 2021"

Solution:

π Name,CNIC
(σ Course.Title='Database Systems-I' $\wedge$ Semester.title='Fall 2020' $\wedge$ Registered.CourseCode=Course.CourseCode $\wedge$ Registered.CNIC=Student.CNIC $\wedge$ Registered.SemesterID=Semester.SemesterID (Registered $\times$ Course $\times$ Semester $\times$ Student))
$\cap$
π Name,CNIC
(σ Course.Title='Database Systems-I' $\wedge$ Semester.title='Spring 2021' $\wedge$ Registered.CourseCode=Course.CourseCode $\wedge$ Registered.CNIC=Student.CNIC $\wedge$ Registered.SemesterID=Semester.SemesterID (Registered $\times$ Course $\times$ Semester $\times$ Student))

4- [CLO-C3] In Malam Jaba, there is a store that rents pair of skis and also sells snowboard to the tourists. The store is interested in automating its sale and rental process. The store owner has gathered the following requirements and wants you to design the database.

The store contains two types of equipment: Pair of skis and snowboard. They are identified uniquely by their equipment ID. For both the equipment, their model needs to be stored. In addition, for pair of skis, their rental price, while for snowboard their sale price needs to be stored.

Tourists that visit the store are identified by their passport numbers. In addition, their name, nationality and multiple contact numbers also need to be stored.

There can be two types of tourist: skier or snowboarder. For skiers we want to store their years of experience too. Skiers rent pair of skis while snowboarders purchase snowboard.

A Skier may rent one or more pair of skis and a pair of skis can be rented by many skiers throughout the course of its life. For each rental, the store also wants to record the rental date and return date.

A Snowboarder may purchase one or more snowboards. For each purchase, the store wants to record purchase date too. **[3]**

4a. Identify the entity sets along with their attributes from the above set of requirements.

4b. Identify the relationships among the entity sets from the above set of requirements.

4c. Draw an ER diagram depicting the entity sets, their associated attributes, and the relationships among them.

Solution: