CSE 180, Final Exam, Winter 2021, Shel Finkelstein

Multiple Choice Questions (Part I)
Answered on Scantron Sheet

Test Form letter: A

This first Section (Part I) of the Fall 2021 CSE 180 Final is Multiple Choice and is double-sided. Answer all multiple choice questions <u>on your Scantron sheet</u>. You do not have to hand in this first Section of the Exam, but you <u>must</u> hand in the Scantron sheet, with your Name, email and Student ID on that Scantron sheet. Please be sure to use a #2 pencil to mark your choices on this Section of the Final.

Name and Student ID must also be filled in by shading letters/numbers on the form. You must also mark the **version** ("Test Form letter **A**") of the Multiple Choice section that you took. The box for Test Form letter is at the top of the Scantron sheet, just to the left of the Multiple Choice questions.

The separate second Section (Parts II and III) of the Final is <u>not</u> Multiple Choice and is single-sided, so that you have extra space to write your answers. If you use that extra space, please be sure to write the number of the problem that you're solving next to your answer. Please write your name, email and student id on the second Section of the Exam, which you must hand in. You may use any writing implement on this Section of the Exam.

At the end of the Final, please be sure to hand in **<u>both</u> your Scantron sheet for this first Section of the Exam** and also the separate second Section of the Exam. You must also show your UCSC id when you hand them in.

Part I: (40 points, 2 points each)

Answer the questions in Part I on your Scantron sheets, which should have your name, email and UCSC id on them. Select the **best answer** for each of the following. For some questions, a choice is **"All of the answers are correct"** or "**None of the other answers is correct"**, so be sure to read answer choices <u>carefully</u>.

Question 1: If an instance of the relation R(a, b, c) has 6 different tuples in it, and an instance of the relation S(c, d) has 4 different tuples in it, then how many tuples are there in the result if the following SQL query is executed on those instances?

        SELECT *
        FROM R, S
        WHERE R.c = S.c;

a) 0
b) Exactly 10
c) Exactly 24
d) Between 0 and 10. Could be 0 or 10, but could be values other than 0 and 10.
e) Between 0 and 24 Could be 0 or 24, but could be values other than 0 and 24.

Question 2: We discussed ACID properties of transactions. What does <u>Durability</u> (the "D" in ACID) refer to for transactions?

a) Transaction execution is as if they were executed one at a time.
b) Transactions happen completely or not-at-all.
c) If a transaction commits, its changes are permanent, even if there are failures.
d) Business rules are always maintained by the database system.
e) Uncommitted (dirty) values from one transaction are never read by any other transaction.

Question 3: R(A,B,C,D) is a relation. A's domain has 5 values, B's domain has 7 values, C's domain has 9 values and D's domain has 11 values. (A, B) is the Primary Key of R. C is UNIQUE and can be NULL, and D is UNIQUE and can't be NULL. What is the maximum number of different tuples that can be in an instance of R?

a) 9
b) 10
c) 11
d) 12
e) 35

Question 4: If the value of age1 is NULL and the value of age2 is 18, then for which of these conditions is the value UNKNOWN?

a) age1 IS NOT NULL AND age2 > 30
b) age1 IS NULL OR age2 > 30
c) age1 > 30 AND age2 > 30
d) age1 > 30 OR age2 <= 30
e) None of the other answers is correct.

Question 5: For an instance of the relation Employees(name, age, salary), suppose that there are no employees whose salary is less than 5000, but there are employees whose salary is 5000 or more. Which employee names will appear in the result of the following query?

```
SELECT e1.name
FROM Employees e1
WHERE e1.age > ALL
        ( SELECT e2.age
           FROM Employees e2
           WHERE e2.salary < 5000 );
```

a) There will be no employee names in the result.
b) All of the employee names will be in the result.
c) The result will be NULL.
d) The result will be UNKNOWN.
e) The query will cause a runtime error.

Question 6: Which statement is true for Relational Algebra Operations?

a) If C1 and C2 are conditions on the attributes of R, then
$$\sigma_{C2} (\sigma_{C1} (R)) = \sigma_{C1} (\sigma_{C2} (R))$$
b) Difference is Commutative (for union-compatible relations):
      R - S = S - R
c) Difference is Associative (for union-compatible relations):
      (R - S) - T = R - (S - T)
d) Union is Distributive over Product:
      $R \cup (S \times T) = (R \cup S) \times (R \cup T)$
e) All of the answers are correct

Question 7: Students(student_id, name, address, age, major) is a table in which student_id is the Primary Key. If (5678, 'Kylo Ren', 'Solo Place', 21, 'BIO') is a tuple in that table, and the following is executed, with no other work going on:

BEGIN TRANSACTION;

UPDATE Students
SET age = age + 1
WHERE name = 'Kylo Ren';

UPDATE Students
SET major = 'CSE'
WHERE age = 21;

ROLLBACK TRANSACTION;

then afterwards, what will be in the tuple that has student_id 5678?

a) (5678, 'Kylo Ren', 'Solo Place', 21, 'BIO')
b) (5678, 'Kylo Ren', 'Solo Place', 22, 'BIO')
c) (5678, 'Kylo Ren', 'Solo Place', 21, 'CSE')
d) (5678, 'Kylo Ren', 'Solo Place', 22, 'CSE')
e) None of the other answers is correct

Question 8: The relational model has physical independence. Which of the following illustrates "physical independence" for the relational model?

a) You don't have to rewrite your SQL queries when the data in a table is stored in a different representation.
b) You don't have to rewrite your SQL queries when you create a new view.
c) You can port a Relational Database System onto different processors and operating systems, and it will still run.
d) Transactions have ACID properties.
e) None of the other answers is correct.

Question 9: Suppose that our database schema contains a table Movies, whose key is (title, year). where title is CHAR(40) and year is INTEGER.

Movies(title, year, length, genre, studioName, producerC#)

Our database schema also has a view DisneyMovies defined by:

CREATE VIEW DisneyMovies AS
SELECT title , year
FROM Movies
WHERE studioName = 'Disney ';

Assuming that no movie with title 'Encanto' is in the Movies table, when will execution of the following statement:

INSERT INTO DisneyMovies VALUES ('Encanto', 2021);

result in an error?

a) It will result in an error whenever there are no Movies that have studioName 'Disney' because DisneyMovies will be empty.
b) It will result in an error whenever at least one of the attributes length, genre, studioName, and producerC# doesn't have a default value.
c) It will result in an error whenever at least one of the attributes length, genre, studioName, and producerC# can't be NULL.
d) It will result in an error whenever at least one of the attributes length, genre, studioName, and producerC# doesn't have default value, and that attribute also can't be NULL.
e) It will never result in an error.

Question 10: For the relations Slopes(slopeid, color) and Activities(cname, slopeid, date), what does the following Relational Algebra query do?

$\pi_{\text{Slopes.color}} (\sigma_{\text{Slopes.slopeid = Activities.slopeid}}(\text{Slopes X Activities}))$

a) Find all the colors that appear in the Slopes relation.
b) Finds all the colors that appear in the Activities relation.
c) Finds the slopeid values of slopes in Slopes for which there was at least one activity in Activities.
d) Finds the colors of slopes in Slopes for which there was at least one activity in Activities.
e) Finds the colors of slopes in Slopes for which there was more than one activity in Activities.

Question 11: Which statement about indexes is true?

a) Indexes can only be defined on one attribute of a table.
b) Relational systems can use an index on the Primary Key of a table to ensure that the Primary Key has no duplicates.
c) If an UPDATE statement is executed on a table, then all indexes on that table will have to be updated.
d) If some indexes on a table are dropped, then all applications using that table have to be updated.
e) INSERT statements on a table run faster if there are indexes on all attributes of that table.

Question 12: Employees(name, age, salary) is a table in which name is the Primary Key. How could a tuple-based CHECK require that if someone's salary is greater than or equal to 8000 then their age must be NULL?

a) CHECK (salary >= 8000 OR age = NULL)
b) CHECK (salary >= 8000 OR age IS NULL)
c) CHECK (salary >= 8000 OR age IS NOT NULL)
d) CHECK (salary < 8000 OR age = NULL)
e) CHECK (salary < 8000 OR age IS NULL).

Question 13: Customers(<u>cid</u>, cname, age) is a table in your database. What happens when the following statement is executed?

DELETE FROM Customers;

a) The Customers table and all the tuples in the Customers table are deleted.
b) All the tuples in the Customers tables are deleted, but the Customers table still exists.
c) The Customers table is deleted, but all the tuples in the Customers tables still exist.
d) The statement causes a runtime error if there are any tuples in the Customers table.
e) The statement causes a runtime error if there are no tuples in the Customers table.

Question 14: Sells(<u>bar, beer</u>, price) and Beers(<u>name</u>, manufacturer) are tables in a database schema, with Primary Keys underlined. You look at a million different instances of the database. Here are two statements:

   i.   Sells.beer must be a Foreign Key corresponding to Beers.name if (for all million instances) every beer in Sells.beer also appears in Beers.name

   ii. Beers.name must be a Foreign Key corresponding to Sells.beer if (for all million instances) every beer in Beers.name also appears in Sells.beer

Which of the following is correct?

a) Both statements are True.
b) The first statement is True and the second statement is False.
c) The first statement is False and the second statement is True.
d) Both statements are False.
e) None of the other answers is correct.

Question 15: Relations R(A,B,C,D) and S(A,B,C,D) have all attribute names in common. For this R and S, which of the following always equals R ⋈ S, the Natural Join of R and S?

a) R ∪ S
b) R ∩ S
c) R x S
d) R – S
e) R / S

Question 16: Assume that a cursor has been declared in a PL/pgSQL Stored Function. If we want to try to get the first tuple corresponding to the result of that cursor, what do we need to do in that Stored Function?

a) FETCH a tuple using the cursor.
b) OPEN the cursor.
c) OPEN the cursor and then FETCH a tuple using the cursor.
d) Use PQexec on the connection with a SELECT statement.
e) Execute a SELECT statement with CURRENT OF CURSOR.

Question 17: T1(A,B) and T2(A,B) are Union-compatible tables, which may have duplicates. Attributes A and B have datatype INTEGER in both tables.

Here are two queries, Q1 (on the left) and Q2 (on the right) on those tables. Which statement is correct for the multiset results of those queries?

```
( SELECT DISTINCT *                    ( SELECT *
   FROM T1                                FROM T1
   WHERE A > 50 )                         WHERE A > 50 )


    UNION ALL                              UNION

( SELECT DISTINCT *                    ( SELECT *
   FROM T2                                FROM T2
   WHERE B <= 800 );                      WHERE B <= 800 );
```

a) Q1 and Q2 are equivalent.
b) The number of tuples in result of Q1 will always be less than or equal to the number of tuples in the result of Q2, but Q1 and Q2 are not equivalent.
c) The number of tuples in result of Q2 will always be less than or equal to the number of tuples in the result of Q1, but Q1 and Q2 are not equivalent.
d) The result of Q1 will always be the empty set.
e) The result of Q2 will always be the empty set.

Question 18: Which statement about On-Line Analytical Processing (OLAP) is correct?

a) A Fact table must have a row for every combination of Dimension table values.
b) Aggregates of a Dependent attribute in a Fact table are automatically calculated and stored in the database.
c) Fact tables can have only one Dependent attribute.
d) Roll-up of a Fact table corresponds to performing SQL ORDER BY and aggregation.
e) None of the other answers is correct.

Question 19: Why might there be a runtime error when the following statement is executed on relations Customers(cname, age) and Activities(cname, slopeid, date)?

```
SELECT  Customers.cname
FROM Customers
WHERE Customers.cname =
        ( SELECT DISTINCT Activities.cname
          FROM Activities );
```

a) Some customers may have participated in no activities.
b) Some customers may have participated in exactly one activity.
c) There might be more than one different cname in the Activities table.
d) For some cname in Customers, there might be no customer with that cname in Activities.
e) For some cname in Customers, there might be more than one customer with that cname in Activities.

Question 20: R(A,B,C,D) is a relation, and the Functional Dependency AB → CD holds for that relation. Determine which of the following 4 Functional Dependencies must also hold for R(A,B,C,D), and answer based on the choices below.

    i.   A → CD
   ii.   B → CD
  iii.   AB → C
  iv.   AB → D

a) All of them must hold.
b) Only i and ii must hold.
c) Only iii and iv must hold.
d) Only i and iii must hold.
e) Only ii and iv must hold.