# CSE 180 Winter 2023 #4

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| **Number of questions:** | 9 |
| **Positive points per question:** | 3.0 |
| **Negative points per question:** | 1.0 |

Transactions, views, constraints, relational algebra

**1.** Here is a SQL standard trigger on relation R(a,b):

```
CREATE TRIGGER T
AFTER INSERT ON R
REFERENCING NEW ROW AS Newtuple
FOR EACH ROW
WHEN(Newtuple.a * Newtuple.b > 10)
INSERT INTO R VALUES(Newtuple.a - 1, Newtuple.b + 1);
```

When we insert a tuple into R, the trigger may cause another tuple to be inserted, which may cause yet another tuple to be inserted, and so on, until finally a tuple is inserted that does not cause the trigger to fire. Your problem is to examine the behavior of this trigger and determine under what circumstances exactly three tuples are inserted. Demonstrate your understanding by identifying, from the list below, which of the following tuples, if inserted into an initially empty relation R, results, after all instances of the trigger are allowed to execute, in exactly three tuples being present in R(a,b)?

○ a) (11,1) ○ b) (2,6) ○ c) (50,0) ◉ d) (3,8)

**2.** Suppose relation R(A,B,C) has the tuples:

| A | B | C |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 2 | 3 |
| 4 | 5 | 6 |
| 2 | 5 | 3 |
| 1 | 2 | 6 |

and relation S(A,B,C) has the tuples:

| A | B | C |
|---|---|---|
| 2 | 5 | 3 |
| 2 | 5 | 4 |
| 4 | 5 | 6 |

| 1 | 2 | 3 |
|---|---|---|

Compute (R - S) [union] (S - R), often called the "symmetric difference" of R and S. Then, identify from the list below, one of the tuples in the symmetric difference of R and S.

- ○ a) (1,2,3)
- ◉ b) (2,5,4)
- ○ c) (2,5,3)
- ○ d) (4,5,6)

**3.** Suppose relation R(A,B) has the tuples:

| A | B |
|---|---|
| 1 | 2 |
| 3 | 4 |
| 5 | 6 |

and the relation S(B,C,D) has tuples:

| B | C | D |
|---|---|---|
| 2 | 4 | 6 |
| 4 | 6 | 8 |
| 4 | 7 | 9 |

Compute the theta-join of R and S with the condition R.A < S.C AND R.B < S.D. Then, identify from the list below one of the tuples in R $|><|_{\text{R.A < S.C AND R.B < S.D}}$ S. You may assume the schema of the result is (A, R.B, S.B, C, D).

- ○ a) (3,4,4,7,8)
- ◉ b) (3,4,4,6,8)
- ○ c) (1,2,2,6,8)
- ○ d) (5,6,4,6,9)

**4.** Which of the following transactions preserves the consistency of the database that has the constraint "A must be less than B"? (Assume A and B are integers -- not necessarily positive.)

- ○ a) A := A - 1; B := A + B
- ○ b) A := 2*A; B := 3*B
- ◉ c) A := A + 2; B := B + 3
- ○ d) A := A + 1; B := 2*B

**5.** Here are declarations of two relations R and S:

```
CREATE TABLE S(
    c INT PRIMARY KEY,
    d INT
);

CREATE TABLE R(
    a INT PRIMARY KEY,
    b INT REFERENCES S(c)
);
```

R(a,b) currently contains the four tuples (0,4), (1,5), (2,4), and (3,5). S(c,d) currently contains the four tuples (2,10), (3,11), (4,12), and (5,13). As a result, certain insertions and deletions on R and S are illegal. You should develop simple tests for illegal operations of these four kinds. Then, show your understanding by indicating which of the following modifications will **not** violate any constraint.

- ○ a) Inserting (5,6) into R.
- ◉ b) Inserting (3,4) into R.
- ○ c) Deleting (3,5) from R.
- ○ d) Inserting (5,12) into S.

**6.** The relation R(x) consists of a set of integers --- that is, one-component tuples with an integer component. Alice's transaction is a query:

```
SELECT SUM(x) FROM R;
COMMIT;
```

Betty's transaction is a sequence of inserts:

```
INSERT INTO R VALUES(10);
INSERT INTO R VALUES(20);
INSERT INTO R VALUES(30);
COMMIT;
```

Carol's transaction is a sequence of deletes:

```
DELETE FROM R WHERE x=30;
DELETE FROM R WHERE x=20;
COMMIT;
```

Before any of these transactions execute, the sum of the integers in R is 1000, and none of these integers are 10, 20, or 30. If Alice's, Betty's, and Carol's transactions run at about the same time, and each runs under isolation level `READ COMMITTED`, which sums could be produced by Alice's transaction? Identify one of those sums from the list below.

○ a) 1040 ◉ b) 950 ○ c) 1080 ○ d) 1050

**7.** Suppose relation R(a,b,c) has the following tuples: (1,1,3), (1,2,3), (2,1,4), (2,3,5), (2,4,1), (3,2,4), and (3,3,6). Define the view *V* by:

```
CREATE VIEW V AS
    SELECT a+b AS d, c FROM R;
```

What is the result of the query:

```
SELECT d, SUM(c) FROM V
GROUP BY d
HAVING COUNT(*) <> 1;
```

Identify, from the list below, a tuple in the result.

○ a) (2,7) ○ b) (3,5) ○ c) (3,12) ◉ d) (3,7)

**8.** Here are declarations of two relations R and S:

```
CREATE TABLE S(
c INT PRIMARY KEY,
```

```
d INT
);

CREATE TABLE R(
a INT PRIMARY KEY,
b INT REFERENCES S(c)
);
```

R(a,b) currently contains the four tuples (0,1), (7,1), (3,3), and (9,9). S(c,d) currently contains the four tuples (1,4), (7,8), (9,4), and (3,1). Which of the following modifcations will *not* violate any constraint:

- a) Inserting (7, 7) into R
- b) Inserting (9, 2) into S
- c) Inserting (0, 7) into R
- d) Inserting (8, 9) into R

**9.** Consider the following DDL for creating table S:

```
CREATE TABLE S (
    x INT PRIMARY KEY,
    y CHAR(1) NOT NULL,
    z INT NOT NULL DEFAULT (5),
    CONSTRAINT ck CHECK (y IN ('a', 'b', 'c'))
);
```

Which of the following will cause an error?

- a) INSERT INTO S(y, x) VALUES ('c', 77);
- b) INSERT INTO S VALUES (22, 'a', 1);
- c) INSERT INTO S VALUES (44, 'b', 2);
- d) INSERT INTO S(x, z) values (1, 1);

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