

CSC343 Worksheet 6 Solution

June 22, 2020

1. Exercise 6.6.1:

```
a) SET TRANSACTION READONLY;
2 BEGIN TRANSACTION;
3     SELECT model, price FROM PC
4     WHERE speed = speed AND
5         ram=ram
6 COMMIT;
7
```

Notes:

- Transactions
 - is a collection of one or more operations that must be executed atomically
 - COMMIT causes the transaction to end successfully
 - ROLLBACK causes the transaction to abort. Any changes are undone
 - SET TRANSACTION READ ONLY
 - * tells the database that it will not be modified
 - * Must be declared before transaction
 - * Is useful when one user is running multiple queries while other is updating the same table

Example:

```
1 BEGIN TRANSACTION;
2
3 UPDATE accounts
4 SET balance = balance - 1000
5 WHERE account_no = 100;
6
7 UPDATE accounts
8 SET balance = balance + 1000
9 WHERE account_no = 200;
10
11 INSERT INTO account_changes(account_no,flag,amount,
    changed_at)
```

```
12     VALUES (100, '-', 1000, datetime('now'));
13
14     COMMIT;
15
16     // Example - SET TRANSACTION READONLY
17     SET TRANSACTION READONLY;
18     BEGIN TRANSACTION;
19         ...
20     COMMIT;
21
```

```
b) BEGIN TRANSACTION;
2  DELETE FROM PC
3  WHERE model=<model number>
4
5  DELETE FROM Product
6  WHERE model=<model number>
7
8  COMMIT;
9
```

```
c) BEGIN TRANSACTION;
2
3  UPDATE PC
4  SET price=price - 100
5  WHERE model=<model number>
6
7  COMMIT;
8
```

```
d) BEGIN TRANSACTION;
2
3  IF (<model> IN (
4      SELECT <model> FROM Product
5      NATURAL JOIN PC)
6
7      PRINT 'Error occurred';
8  ELSE
9      INSERT INTO PC
10     VALUES (<model>, <speed>, <ram>, <hd>, <price>)
11
12     INSERT INTO Product
13     VALUES (<maker>, <model>, <type>)
14 COMMIT;
15
```

2. Exercise 6.6.2:

For all cases, when system crashes, the operations in transaction are aborted and database is reverted back to pre-transaction state.

3. Exercise 6.6.3:

The following would be observed

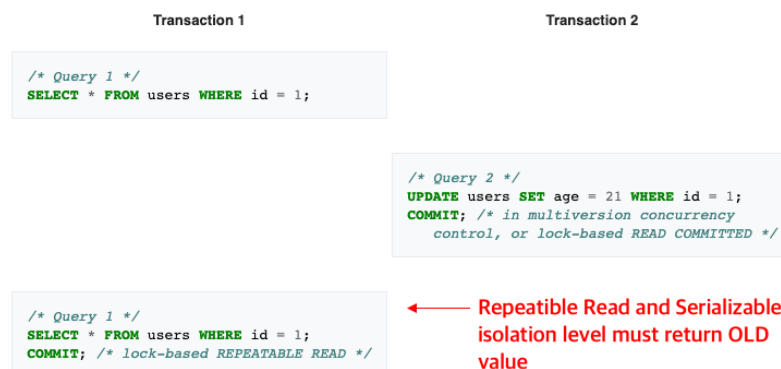
- Reading data modified by another transaction (Dirty Read)
- Repeated retrieval of rows resulting in different values (Non-repeatable read)
- Insertion/deletion of data (Phantom)

Notes:

- Dirty Reads
 - A dirty read occurs when a transaction is allowed to read data from a row that has been modified by another running transaction and not yet committed.



- Non-repeatable Reads
 - A non-repeatable read occurs when, during the course of a transaction, a row is retrieved twice and the values within the row differ between reads.



- Phantom Reads

- A phantom read occurs when, in the course of a transaction, new rows are added or removed by another transaction to the records being read.



- Isolation Levels

- SET TRANSACTION ISOLATION LEVEL READ UNCOMMITTED;
 - * is the lowest isolation level
 - * allows to read a transaction that's not yet committed
 - * transactions are not isolated from each other
- SET TRANSACTION ISOLATION LEVEL READ COMMITTED;
 - * Does not allow to read a transaction that's not yet committed
 - * Prevents other transactions from reading, updating or deleting while commit
- SET TRANSACTION ISOLATION LEVEL REPEATABLE READ;
 - * Is the higher level of isolation
 - * Guarantees everything of READ COMMITTED level
 - * Can read unchanged data in subsequent reads
- SET TRANSACTION ISOLATION LEVEL SERIALIZABLE
 - * Is the highest level of isolation
 - * Guarantees everything of READ REPEATABLE READ;
 - * No new data can be seen by a subsequent read.

Isolation Level	Dirty Reads	Nonrepeat-able Reads	Phantoms
Read Uncommitted	Allowed	Allowed	Allowed
Read Committed	Not Allowed	Allowed	Allowed
Repeatable Read	Not Allowed	Not Allowed	Allowed
Serializable	Not Allowed	Not Allowed	Not Allowed

References:

- * Stack Overflow: Difference between 'read committed' and 'repeatable read', [link](#)

* Wikipedia: Isolation (database systems), link

4. Exercise 8.1.1:

```
a) CREATE VIEW RichExec AS
2   SELECT * FROM MovieExec
3   WHERE netWorth >= 100000000;
4
```

Notes:

- Virtual Views
 - **Syntax:** CREATE VIEW < view-name > AS < view-definition >
 - Contrasts to database that exists in physical storage
 - Exists in RAM
 - Is created using query
 - can be used like a relation

Notes:

```
1   CREATE VIEW ParamountMovies AS
2   SELECT title, year
3   FROM Movies
4   WHERE studioName = 'Paramount';
5
```

```
b) CREATE VIEW StudioPres AS
2   SELECT * FROM Movies
3   INNER JOIN Studio ON cert# = presC#;
4
```

```
c) CREATE VIEW ExecutiveStar AS
2   SELECT * FROM MovieExec
3   NATURAL JOIN MovieStar;
4
```

5. Exercise 8.1.2:

```
a) SELECT name, gender FROM ExecutiveStar;
2
```

```
b) SELECT name FROM RichExec WHERE netWorth > 100000000;
2
```

```

c)  SELECT name FROM StudioPres
    2  NATURAL JOIN ExecutiveStar
    3  WHERE netWorth > 50000000
    4

```

6. Exercise 8.2.1:

RichExec is updatable.

Notes:

- Updatable View Conditions
 - The WHERE clause in CREATE VIEW must not be a subquery
 - The FROM clause has only one occurrence of R
 - The SELECT clause must include enough attributes
 - NOT NULL attributes must have default values
 - * A solution to this is by including the attribute without default value in CREATE VIEW

Example:

```

1  Movies(title, year, length, genre, studioName, producerC#)
2  Suppose studioName is NOT NULL but has no default value.
   Then, a fix is:
3
4  CREATE VIEW Paramount AS
5      SELECT studioName, title, year
6      FROM Movies
7      WHERE studioName = 'Paramount';
8

```

7. Exercise 8.2.2:

a) No. It is not updatable. Since,

1. studioName attribute in Movies is NOT NULL without default value

```

b)  CREATE TRIGGER DisneyComediesInsert
    2  INSTEAD OF INSERT ON DisneyComedies
    3  REFERENCING
    4      NEW ROW AS NewTuple
    5  FOR EACH ROW
    6  INSERT INTO Movies(title, year, length, genre, studioName)
    7  VALUES(NewTuple.title, NewTuple.year, NewTuple.length, 'comedy',
    8  'Disney');

```

Notes:

- Using Trigger in VIEW
 - Uses INSTEAD OF in place of BEFORE or AFTER
 - When event causes the trigger, the trigger is done instead of the event

Example:

```

1      CREATE VIEW ParamountMovies AS
2          SELECT title, year
3          FROM Movies
4          WHERE studioName = 'paramount';
5
6      CREATE TRIGGER ParamountInsert
7      INSTEAD OF INSERT ON ParamountMovies
8      REFERENCING NEW ROW AS NewRow
9      FOR EACH ROW
10         INSERT INTO Movies(title, year, studioName)
11         VALUES(NewRow.title, NewRow.year, 'Paramount');
12

```

```

c)      CREATE TRIGGER DisneyComediesInsert
2      INSTEAD OF INSERT ON DisneyComedies
3      REFERENCING
4          NEW ROW AS NewTuple
5          OLD ROW AS OldTuple
6      FOR EACH ROW
7      UPDATE Movies
8      SET length=NewTuple.length
9      WHERE title=OldTuple.title AND year=OldTuple.year;
10

```

8. Exercise 8.2.3

- a) No. the view is not updatable. Because for it to be updatable, only one relation must exist in FROM

```

b)      CREATE TRIGGER NewPCInsert
2      INSTEAD OF INSERT ON NewPC
3      REFERENCING
4          NEW ROW AS NewTuple
5          OLD ROW AS OldTuple
6      FOR EACH ROW
7      INSERT INTO PC(model speed, ram, hd ,price)
8      VALUES (NewTuple.model, NewTuple.speed, NewTuple.ram, NewTuple.hd
, NewTuple.price);
9
10     INSERT INTO Product(maker, model, type)
11     VALUES (NewTuple.maker, NewTuple.model, 'pc');
12

```

c)

```
1 CREATE TRIGGER NewPCUpdate
2   INSTEAD OF INSERT ON NewPC
3   REFERENCING
4     NEW ROW AS NewTuple
5   FOR EACH ROW
6   UPDATE PC
7   SET model=NewTuple.model
8       speed=NewTuple.speed,
9       ram=NewTuple.ram,
10      hd=NewTuple.hd,
11      price=NewTuple.price;
12
13 UPDATE Product
14 SET maker=NewTuple.maker,
15     model=NewTuple.model,
16     type='pc';
17
```

Correct Solution:

```
1 CREATE TRIGGER NewPCUpdate
2   INSTEAD OF UPDATE ON NewPC
3   REFERENCING
4     NEW ROW AS NewTuple
5   FOR EACH ROW
6   UPDATE PC
7   SET model=NewTuple.model
8       speed=NewTuple.speed,
9       ram=NewTuple.ram,
10      hd=NewTuple.hd,
11      price=NewTuple.price;
12
13 UPDATE Product
14 SET maker=NewTuple.maker,
15     model=NewTuple.model,
16     type='pc';
17
```

d)

```
1 CREATE TRIGGER NewPCDelete
2   INSTEAD OF DELETE ON NewPC
3   REFERENCING
4     NEW ROW AS NewTuple
5   FOR EACH ROW
6   DELETE FROM PC
7   WHERE model=NewTuple.model;
8
9   DELETE FROM Product
10  WHERE model=NewTuple.model;
11
```


9. a) `CREATE INDEX studioNameIndex Studio(name)`

Notes:

- Indexes
 - **Syntax (Create Index):**
CREATE INDEX < index-name > R(< attributes >)
 - **Syntax (Drop Index):**
DROP INDEX < index-name >
 - Used to find tuples in a very large database
 - * Is efficient
 - Can be thought as (key, value) pair in a binary search tree
 - e.g. Declaring Index

```
1 CREATE INDEX KeyIndex ON Movies(title, year);
2
```

- e.g. Dropping index

```
1 CREATE INDEX KeyIndex ON Movies(title, year);
2
```

b) `CREATE INDEX movieExecAddressIndex MovieExec(address)`

c) `CREATE INDEX movieKeyIndex Movies(genre, length)`

10. Exercise 8.4.1:

Action	No Index	Star Index	Movie Index	Both Indexes
Q_1	100	4	100	4
Q_2	100	100	4	4
I	2	4	4	6
Average	$2 + 100p_1 + 100p_2$	$4 + 96p_2$	$4 + 96p_1$	$6 - 2p_1 - 2p_2$

Notes:

- Database Tuning
 - Index speeds up queries that can use it
 - Index should NOT be created when modifications are the frequent choice of action

11. Exercise 8.4.2:

Omitted for the time being

12. Exercise 8.5.1:

```

1  UPDATE MovieProd
2  SET name='New Name'
3  WHERE (title, year) IN
4  (
5      SELECT title, year FROM Movies
6      INNER JOIN MovieExecs
7      ON Movies.productC# = MovieExec.cert#
8      WHERE cert# = '4567'
9  );
10

```

Notes:

- Materialized Views
 - Is also known as a summary
 - Is also known as black-box abstraction
 - Stores view in physical storage
 - Useful when storing expensive operation like AVG or COUNT

13. Exercise 8.5.3

The following modifications to base tables require the modification of the materialized view

- PC: Updates(model, speed, ram, hd, price), Delete
- Product: Updates(maker, model, type), Delete

Implementing modifications

- Updates

```

1  UPDATE NewPC
2  SET maker='new-maker'
3      model='new-model-number'
4      speed='new-speed'
5      ram='new-ram'
6      hd='new-hd'
7      price='new-price'
8  WHERE model = 'old-model-number';
9

```

- Delete

```

1  DELETE FROM NewPC WHERE model = 'old-model-number'
2

```

Notes:

- Materialized view of NewPC

```

1  CREATE MATERIALIZED VIEW NewPC AS
2      SELECT maker, model, speed, ram, hd, price
3      FROM Product, PC
4      WHERE Product.model = PC.model AND type = 'pc';
5

```

14. Exercise 8.5.3

The following modifications to base tables require the modification of the materialized view

- Classes: Insert, Updates(class, country, displacement), Delete
- Ships: Insert, Updates(class), Delete

- Insert

```

1  INSERT INTO ShipStats
2  VALUES (
3      SELECT country, AVG(displacement), COUNT(*)
4      FROM Classes, Ships
5      WHERE Classes.class = ships.class
6      GROUP BY country
7      HAVING country='name-of-country'
8  )
9

```

- Updates

```

1  DELETE FROM ShipStats WHERE country = 'name-of-country';
2  INSERT INTO ShipStats
3  VALUES (
4      SELECT country, AVG(displacement), COUNT(*)
5      FROM Classes, Ships
6      WHERE Classes.class = ships.class
7      GROUP BY country
8      HAVING country='name-of-country'
9  )
10

```

- Delete

```

1  DELETE FROM ShipStats WHERE country = 'country'
2

```

15. Exercise 8.5.4

Query Q #1: The title of all movies created by movie exec 'Max Bialystock'

```
1 SELECT title
2 FROM Movies, MovieExec
3 WHERE producerC# = cert# name = 'Max Bialystock'
4
```

Query Q #2: The title of all movies created in 2019

```
1 SELECT title
2 FROM Movies, MovieExec
3 WHERE producerC# = cert# year = 2019
4
```

Query Q #3: The name of all producers whose movie was created in 2019

```
1 SELECT name
2 FROM Movies, MovieExec
3 WHERE producerC# = cert# year = 2019
4
```

Query Q #4: The name of all producers whose movie was created in 2019

```
1 SELECT name
2 FROM Movies, MovieExec
3 WHERE producerC# = cert# year = 2019
4
```

Query Q #5: The name of star in movie created by producer 'John Wilks'

```
1 SELECT starName
2 FROM Movies, MovieExec
3 WHERE producerC# = cert# name = 'John Wilks'
4
```

Query Q #6: The name of star in movie created by producer 'John Wilks'

```
1 SELECT starName
2 FROM Movies, MovieExec
3 WHERE producerC# = cert# name = 'John Wilks'
4
```

Notes:

- Rewriting Queries to use Materialized View
 - Conditions under which we can replace part of the query Q by the view V

- (a) The relations in list R_v all appear in the list R_Q
 - (b) The condition C_Q is equivalent to C_V AND C for some condition C . As a special case, C_Q could be equivalent to C_V , in which case the "AND C " is unnecessary.
- Once the conditions are met, Q can be re-written to V as follows
- * Replace the list R_Q by V and the relations that are on list R_Q but not on R_V
 - * Replace C_Q by C . If C is not needed (i.e. $C_V = C_Q$), then there is no WHERE clause