Q1

HW4 Query 1

Query

```
SELECT
   s.title
   , sd.director
FROM
   series s
   , seriesdirectors sd
WHERE
   s.seriesid = sd.seriesid
   and s.imdbrating <= 5
   and s.seasons >= 15
ORDER BY
   title
   , director
;
```

Index Creation

```
CREATE INDEX serieshw4q1
ON series (imdbrating, seasons, seriesid);
```

Origin Plan

```
Sort  (cost=287.37..287.38 rows=1 width=30)
  Sort Key: s.title, sd.director
  ->  Hash Join  (cost=3.92..287.36 rows=1 width=30)
        Hash Cond: (s.seriesid = sd.seriesid)
        ->  Seq Scan on series s  (cost=0.00..283.39 rows=3 width=21)
              Filter: ((imdbrating <= '5'::double precision) AND (seasons
>= 15))
        ->  Hash  (cost=2.30..2.30 rows=130 width=17)
              ->  Seq Scan on seriesdirectors sd  (cost=0.00..2.30 rows=130
width=17)
```

Full Plan After Index Creation

```
Sort  (cost=19.42..19.43 rows=1 width=30)
  Sort Key: s.title, sd.director
```

```
  ->  Hash Join  (cost=16.77..19.41 rows=1 width=30)
        Hash Cond: (sd.seriesid = s.seriesid)
        ->  Seq Scan on seriesdirectors sd  (cost=0.00..2.30 rows=130
width=17)
        ->  Hash  (cost=16.74..16.74 rows=3 width=21)
              ->  Bitmap Heap Scan on series s  (cost=5.69..16.74 rows=3
width=21)
                    Recheck Cond: ((imdbrating <= '5'::double precision)
AND (seasons >= 15))
                    ->  Bitmap Index Scan on serieshw4q1  (cost=0.00..5.69
rows=3 width=0)
                          Index Cond: ((imdbrating <= '5'::double
precision) AND (seasons >= 15))
```

Conclusion

Plan cost reduced a lot by only doing index scan and read for instead of sequence scan for series table.

HW4 Query 2

Query

```
SELECT
   count(*) as nummovies
FROM
   movies m
WHERE
   m.imdbrating is null
   and m.rottentomatoes is null
   and (m.year is null or m.year>2015);
```

Index Creation

```
CREATE INDEX movieshw4q2
ON movies (imdbrating, rottentomatoes, year);
```

Origin Plan

```
Aggregate  (cost=120.68..120.69 rows=1 width=8)
  ->  Seq Scan on movies m  (cost=0.00..120.61 rows=27 width=0)
        Filter: ((imdbrating IS NULL) AND (rottentomatoes IS NULL) AND
((year IS NULL) OR (year > 2015)))
```

Full Plan After Index Creation

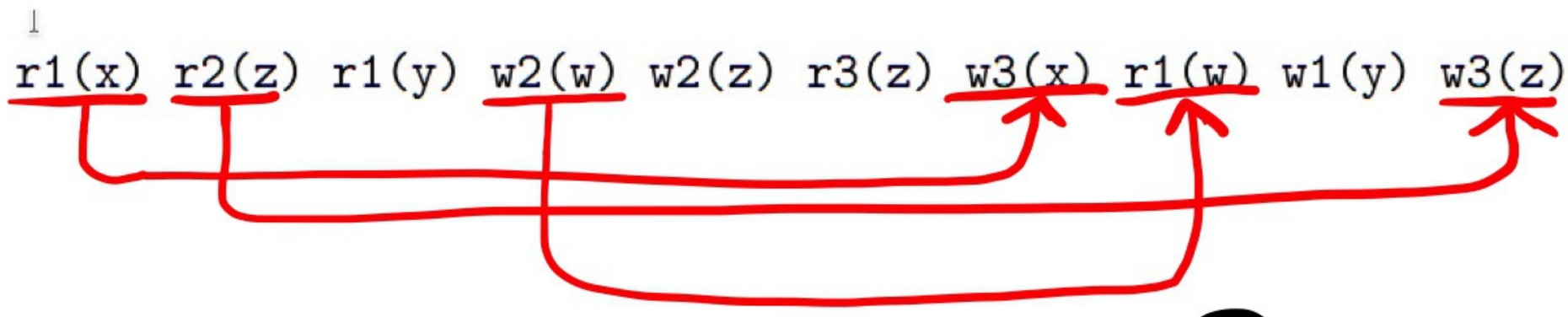
```
Aggregate  (cost=5.52..5.53 rows=1 width=8)
  ->  Index Only Scan using movieshw4q2 on movies m  (cost=0.28..5.45
rows=27 width=0)
        Index Cond: ((imdbrating IS NULL) AND (rottentomatoes IS NULL))
        Filter: ((year IS NULL) OR (year > 2015))
```

Conclusion

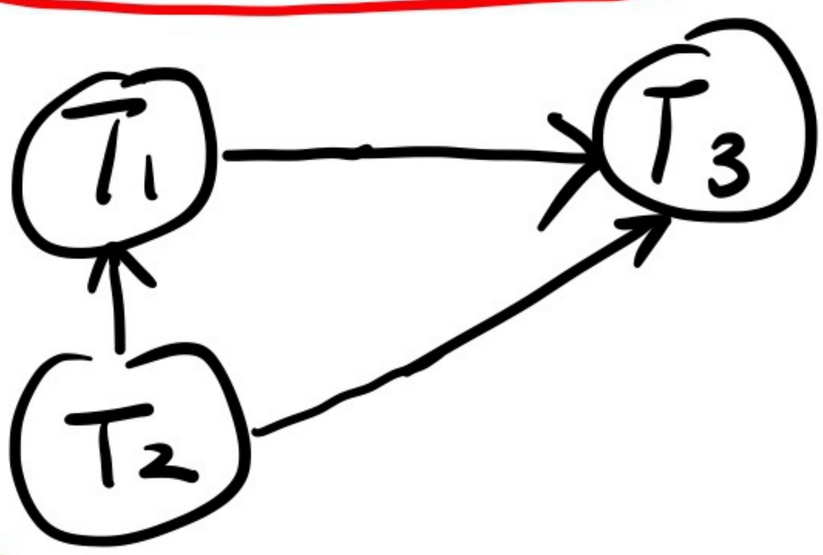
Plan cost reduced significant by only doing index scan instead of sequence scan for movies table.

Q2

S1: r1(x) r2(z) r1(y) w2(w) w2(z) r3(z) w3(x) r1(w) w1(y) w3(z)



a) Conflict Graph:



∴ Serializable

b)

S1: r1(x) r2(z) r1(y) w2(w) w2(z) r3(z) w3(x) r1(w) w1(y) w3(z)

T_1 : unable to acquire lock.

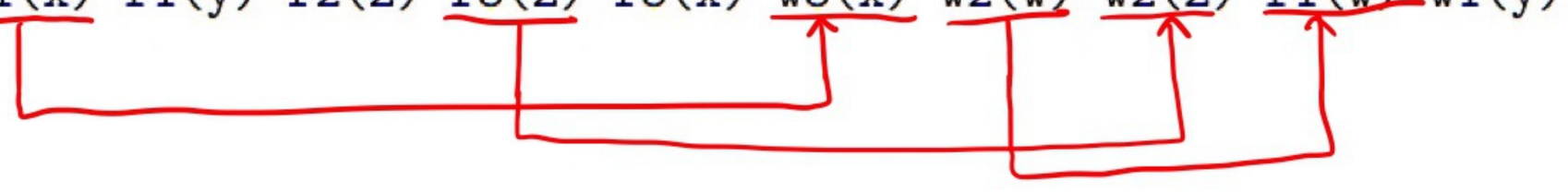
$SL_1(x)$ $SL_2(z)$ $SL_1(y)$ $XL_2(w)$ $XL_2(z)$ $SL_3(z)$ [$UL_1(x)$, $XL_3(x)$]

T_1 shrinking

∴ Not possible to obtain schedule, T_1 will try acquiring SL on W in shrinking phase.

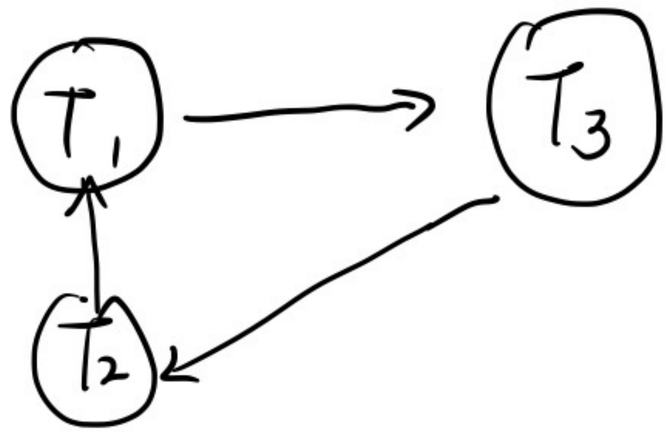
(2)

S2: r1(x) r1(y) r2(z) r3(z) r3(x) w3(x) w2(w) w2(z) r1(w) w1(y)



a)

Conflict Graph :



∴ NOT serializable

b) Not possible, since this schedule is not serializable, there will always a cycle prevent valid schedule.

Q3

LOG:

LSN	Entry
100	T1 update P2
101	T2 update P1
102	T2 commit
103	T3 update P1
104	T3 update P3
105	T1 update P4
106	T3 commit

Data pages:

Data Page	LSN of Last recorded log entry
P1	101
P2	100
P3	104
P4	-

a)

P_2 100

P_3 104

P_1 ~~101~~ 103

P_4 105 →.

T_1 aborted

T_4 should be aborted.

1. First, redo : 103
2. Then, undo: 100

b)

No Force, since T_3 is partically written to data page after commie, which won't happen if force used

c) STEAL used, as T_1 is an uncommited transaction but its changes refleced to the DATA page., also, no force is used, which makes it impossible to be part of the force action.