Principles of Information and Database Management 198:336 Week 11 – Apr 18

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Outline

Transactions

- Concepts
- Implementation
- Shortcuts

Web data

- Hubs and authorities
- Google PageRank

Transaction

Definition: an execution of a user program, seen by the DBMS as a series of read and write operations.

ACID properties of transactions

Atomic

Consistent

Isolated

Durable

Atomicity

Either all actions in a transaction execute or none of them do.

– Needs to be guaranteed by DBMS

Consistency

When run by itself – any transaction will leave the DB in a good state

Isolation

Each transaction is protected from the effects of other transactions that might be running at the same time

- – No transaction can “tell” that other transactions are running

Durability

Once the DBMS informs the user that a transaction completed, its effects persist

Design choice

Transaction can be **aborted** by DBMS

- Terminated unsuccessfully
- May be bounced back
  - in this case none of it ever happened
- May be retried
  - DBMS starts over and makes it work

Transaction details

Oracle details

- In SQLPLUS, everything you do is one xact
- To end a transaction, use SQL commands
  - COMMIT
  - ROLLBACK

Transaction details

In MySQL command interface

- Need InnoDB tables, and transaction mode
  - set autocommit=0;
- Transactions have to be explicitly started
  - Start transaction;
- Then finish transactions as usual
  - COMMIT
  - ROLLBACK

Transaction details

In JDBC, part of the connection interface

- Need to start up transaction mode
  - conn.setAutoCommit(false);
- Like oracle, everything is in current xact
- Just need to end xact
  - conn.commit();
  - conn.rollback();

How transactions help

Actions by one process can put database in temporary, inconsistent state.

- need to make sure other processes don’t use this inconsistent state

Example – “midnight bank transfer”

Transfer $100 from account A to account B

- read A
- write A-$100
- read B
- write B+$100

Halfway through is an inconsistent state

- $100 has “gone missing”

“Midnight bank transfer”

Suppose it’s time to pay interest

Algorithm

```
  read A
  write A * 1.05
  read B
  write B * 1.05
```

Bad soup!

Suppose you pay interest in the moment when $100 is missing!

Either A or B gets ripped off.

Transactions

Let DB program say what should happen

- First
  - start transaction
  - r A, w A-$100, r B, w B+$100
  - commit
- Second
  - start transaction
  - r A, w A*1.05, r B, w B*1.05
  - commit

Transactions

Underlying DBMS makes sure xacts are only interleaved correctly (if at all).

Kinds of things to worry about

Reading uncommitted data

- “dirty read”
- write-read conflicts

Unrepeatable reads

- T2 changes the value of A while
- T1, in progress, has already read A

Kinds of things to worry about

Overwriting uncommitted data

- write-write conflicts
- complementary writes leave DB in bad state

Aside

select … **for update**

- required to say that you’re using information to compute a change to the database.
- otherwise xact may retry with stale values

Shortcuts

Creating IDs in Oracle

```
create sequence my_id_sequence start with 1;
insert into my_table values
(my_id_sequence.nextval, 0);
select my_id_sequence.currval from dual;
```

Shortcuts

Creating IDs in MySQL

- autoincrement feature
- use null as primary key
- select last_insert_id() from any_table;

Page Rank

PR(A) = (1-d) +
d * (PR(t1)/C(t1) + … + PR(tn)/C(tn))

t1..tn are the pages that link to A

C(ti) is the number of links out of page ti

d is a “fudge factor” (google’s is 0.85)

Metaphor

Pigeons randomly surfing the internet

- random start point
- click randomly on links
- restart after 1/(1-d) clicks
- what percentage of the time do they end up on each page?

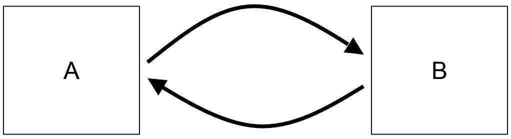
Metaphor

Pages vote for their neighbors

- Like stockholders meeting
- You get votes according to your importance
- You can split your votes among any number of candidates

Tricky

Requires an iterative calculation



PR(A) = .15 + .85 * (PR(B)/C(B))

PR(B) = .15 + .85 * (PR(A)/C(A))

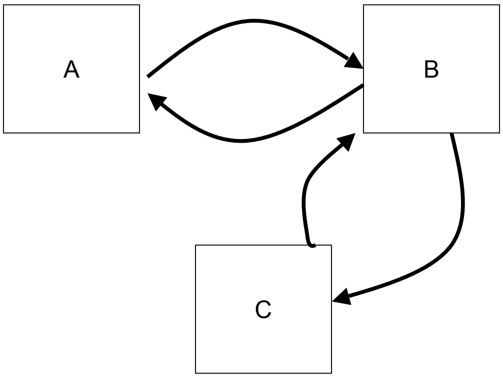
In the end

PR(A) = PR(B) = 1.

Check by

- pigeon metaphor
- solution to equations

Other examples



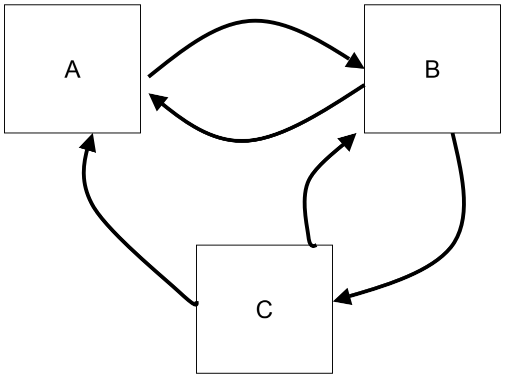
Rank

PR(A) ~ .77

PR(B) ~ 1.46

PR(C) ~ .77

Other examples



Rank

PR(A) ~ 1

PR(B) ~ 1.3

PR(C) ~ 0.7

Issues with real web sites

- Reachability
- Aliases
- Spam

Google police

- Require pages to be different
  - identify spam
- Penalize links to spam