

COMP 360 — Homework 5

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1 Questions

1. Consider the following DNS records. On their basis, answer the questions below.

The authoritative root name server contains the following entries:

```
com.                172800  IN   NS    a.gtld-servers.net.
a.gtld-servers.net. 300    IN   A      192.5.6.30
```

The authoritative name server for `com` contains the following entries:

```
google.com.        172800  IN   NS     ns1.google.com
ns1.google.com.    300    IN   A      216.239.3
```

The authoritative name server for `google.com` contains the following entries:

```
www.google.com.    300    IN   A      66.102.7.10
mail.google.com.   300    IN   A      66.102.7.83
```

- (a) What is the hostname and IP address of Google's authoritative name server?
- (b) Suppose that there is a client *C* and a local name server *L*. Client *C* wants to lookup the address for `www.google.com`. List the sequence of DNS queries and responses that must happen. Assume that all name servers already knows the address of the authoritative root server. Assume that all name servers initially have an empty cache. You may assume either a recursive or an iterative lookup.

Your answer should be in approximately the following level of detail:

```
Name server X contacts name server Y to resolve foo.com
Name server Y returns records A, B, C
etc, etc, ...
```

- (c) Following the previous query, client C wants to lookup the address for `mail.google.com`. List the sequence of queries and responses. Assume that results from the previous query are cached with long TTLs.
- Due to changes in DNS configuration, the name of your colleague's favorite web server can't be resolved. Your colleague is anxious because he can't access his favorite web site. Explain to him the cause of the problem, as well as when and how it will be resolved.
 - Suppose that you are using Paxos to ensure consistent replication of bank records among three computers. All Acceptors currently agree that the last proposal number was 16. Proposer A issues a Prepare messages with proposal number 17, whose value is the command "deposit \$3 into Pat's bank account." At the *same time*, Proposer B issues a Prepare message with proposal number 18, whose value is the command "withdraw \$3 from Pat's bank account." Assuming that neither Proposer will retry any request. What are the possible outcomes of this situation? Can either or both proposals be Accepted? Consider various possible interleavings of messages.
 - Consider the following executions. Determine if each execution is sequentially consistent. If not, explain why. All variables are initially set to zero.

For example, consider this execution:

P1: $W(x, 1)$;
P2: $R(x, 0)$; $R(x, 1)$

Here, we see that process $P1$ executes a write on variable x with value 1. Concurrently, process $P2$ execute a read on variable x , yielding 0, followed by a read on variable x , yielding 1. This execution is sequentially consistent, since the effective sequence is $P2: R(x, 0)$; $P1: W(x, 1)$; $P2: R(x, 1)$.

(a) P1: $W(x, 1)$;
P2: $R(x, 1)$; $R(x, 0)$;

(b) P1: $W(x, 1)$;
P2: $W(x, 2)$;
P3: $R(x, 1)$; $R(x, 2)$;

(c) P1: $W(x, 1)$;
P2: $W(x, 2)$;
P3: $R(x, 2)$; $R(x, 1)$;
P4: $R(x, 1)$; $R(x, 2)$;

(d) P1: W(x, 1);
 P2: W(x, 2);
 P3: R(x, 1); R(x, 2);
 P4: R(x, 1); R(x, 2);

(e) P1: W(x, 1);
 P2: R(x, 1); W(x, 2);
 P3: R(x, 2); R(x, 1);
 P4: R(x, 1); R(x, 2);

5. For each of the above executions, determine if the execution demonstrates causal consistency, assuming that we have monotonic reads.