Problem 8 (4 points)
The *dig* tool allows you to query Domain Name Service (DNS) servers around the Internet. For more information on how to use dig, consult the man page.

When running dig for the purpose of this question, you should use the following format:

dig +norecurse @name.of.dns.server record-type domain-name

- *name.of.dns.server* is the hostname of the DNS server you wish to query.
- *record-type* is the type of DNS record you wish to retrieve, such as ANY, MX, HINFO, A, or SOA.
- *domain-name* is the name of the host or domain you seek information on.

The DNS is a distributed architecture that uses hierarchical delegation. At the top of the system are the root name servers, who know which DNS server is responsible for each of the top-level domains (such as .com, .ca, and .edu). If you send a root server a query for a particular machine, you will receive a reply listing the servers that have been delegated authority for those top-level domains, and you can recursively ask those servers to resolve the name.

Part A.
To discover an actual chain of delegation, run a series of NS queries for WWW.CS.WISC.EDU. You may start with any of the root servers, and you should continue your sequence of queries until you stop getting new delegations (in some domains, this is indicated by a DNS server returning you a delegation pointing to itself, and in other domains this is indicated by a DNS server returning you a SOA record instead).

Delegation chain for: AOL.COM:

Server queried	NS delegations to
A.ROOT-SERVERS.NET	A.GTLD-SERVERS.NET, G.GTLD-SERVERS.NET
G.GTLD-SERVERS.NET	dns-01.ns.aol.com, dns-02.ns.aol.com, dns-06.ns.aol.com, dns-07.ns.aol.com
dns-02.ns.aol.com	dns-01.ns.aol.com, dns-02.ns.aol.com, dns-06.ns.aol.com, dns-07.ns.aol.com

This was produced by running the following commands:
dig +norecurse @a.root-servers.net NS aol.com
dig +norecurse @G.GTLD-SERVERS.NET NS aol.com
dig +norecurse @dns-02.ns.aol.com NS aol.com

Generate the delegation chain for WWW.CS.WISC.EDU. Present your results in a table like the one above. Each NS query will typically return two or more answers; choose among them at random. If you query a server and get a timeout, choose an alternate server.

Part B.

The DNS is also used to translate IP addresses into hostnames. Again, the database is distributed in a hierarchical fashion, with a wrinkle. The most specific part of a domain name is on the left (i.e. WWW in WWW.CS.WISC.EDU) and the top level is on the right (.edu), but the reverse is true of IP addresses (i.e., in 137.82.56.165 -- 137 is top level. Thus, address-to-name mapping is handled by reversing the bytes of the IP address and making queries in a special domain.

To turn 128.2.198.101 into a hostname, various servers are sent queries seeking PTR records for 101.198.2.128.in-addr.arpa. The first query would be:

dig @a.root-servers.net PTR 101.198.2.128.in-addr.arpa

You will know you're done when your query gives you back a PTR record in addition to (or instead of) NS records. Fill in a table like the one above showing a query chain for the IP address

129.97.167.96

What is the first command you use?