

This homework is due at 11:59:59 PM on November 7, 2022 and is worth 3% of your grade.

Name: _____

NUID (with leading zeros): _____

Problem	Possible	Score
1	10	
2	20	
3	30	
Total	60	

1a. What is DNS and why is it important?

(10 pts)

2. In this problem, we will use the useful dig tool available on Unix and Linux hosts to explore the hierarchy of DNS servers. You can read about it using `man dig`. Unfortunately, the Northeastern network has heavy restrictions on DNS traffic; if you do this homework from a location off-campus, then dig will function correctly. If you do this homework from campus, then we recommend using the online version of dig at <https://www.digwebinterface.com/>.

Recall that a DNS server higher in the DNS hierarchy delegates a DNS query to a DNS server lower in the hierarchy, by sending back to the DNS client the name of that lower-level DNS server (assuming no recursion is specified). *Hint: Be sure to use the `+norecurse` option to dig, and remember that you will need to specify different target DNS servers (@) each time.*

- 2a. Starting with a root DNS server (from one of the root servers [a-m].root-servers.net), initiate a sequence of queries using dig for the A record of `www.ccs.neu.edu` without using recursion. Be sure to show the list of the names of DNS servers in the entire delegation chain starting from the root. If there are multiple answers (NS or A records), you may simply choose one of them and proceed. Your answer must include the query sent to each DNS server you use and each server's response.

The first query and the required portion of the response given below:

```
$ dig +norecurse @a.root-servers.net edu
edu. 172800 IN NS a.edu-servers.net.
```

(10 pts)

2b. (cont.) Repeat the same procedure as above for www.google.com.

(10 pts)

3. Dynamic DNS is a protocol that enables a host to inform a DNS name server as its IP changes over time. For example, if a host reserves foo.bar.com, the host will tell the DNS server periodically what its current IP address is, and the server will update the DNS record to reflect this new IP address. This service is well-suited for hosts that do not have a long-lived (static) IP address.

3a. If you were designing Dynamic DNS, how would you prevent returning a stale IP-host name mapping even if the host's IP address frequently changes? (10 pts)

3b. (cont.) Given the answer to the previous question, is there a potential disadvantage of Dynamic DNS in terms of lookup latency performance for clients? (10 pts)

3c. (cont.) Suppose a web server behind a NAT is using Dynamic DNS. Explain what the DNS entry for this web server should look like and how to configure NAT in order to make the server publicly accessible (you may assume the web server uses the port 80). (10 pts)