This homework is due at the beginning of class on March 25, 2015 and is worth 1.5% of your grade.

Name: _____

CCIS Username: _____

Problem	Possible	Score
1	20	
2	15	
3	25	
4	30	
Total	90	

1. In this problem, we will use the useful `dig` tool available on Unix and Linux hosts to explore the hierarchy of DNS servers. `dig` is very similar to the 3600dns client you are implementing in project 3; you can read about it using `man dig`. 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.*

1a. 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 for `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 in answering your query. (10 pts)

1b. (cont.) Repeat the same procedure as above for `www.google.com`. (10 pts)

2. 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.

2a. 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? (5 pts)

2b. (cont.) Given the answer to the previous question, is there a potential disadvantage of Dynamic DNS in terms of lookup latency performance for clients? (5 pts)

2c. (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 should assume the web server uses the port 80). (5 pts)

3. Consider the networking of routers shown below, with the "link weight" for each link written next to the link:
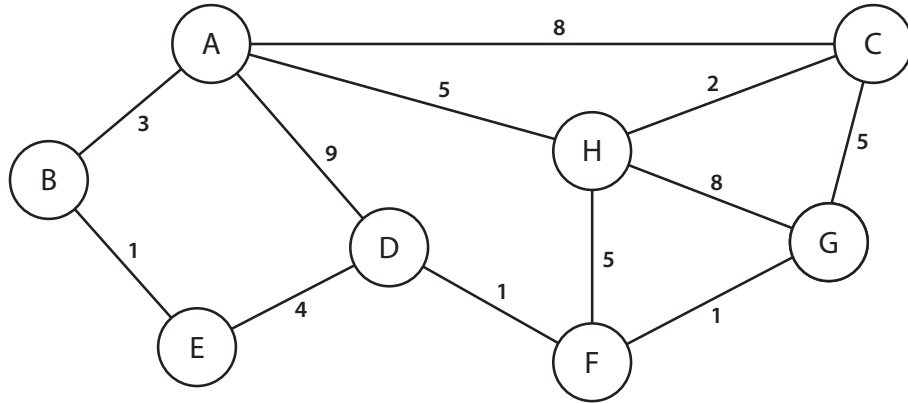

3a. Use Dijkstra's shortest-path algorithm to compute the shortest path from A to all other routers. Show how the algorithm works by filling out the table on the final page, showing both the current cost to each destination ($D(X)$) and the corresponding shortest path ($p(X)$). (15 pts)

3b. Name one way in which distance vector routing is better than link state routing. (5 pts)

3c. Name one in which link state routing is better than distance vector routing. (5 pts)

4. Consider the network shown in the following figure. Assume that if a customer has an equally good choice of providers to send outbound traffic through, the customer will pick the provider with the lowest AS number. Assume the nodes evaluate path choices using the shortest hop count metric.
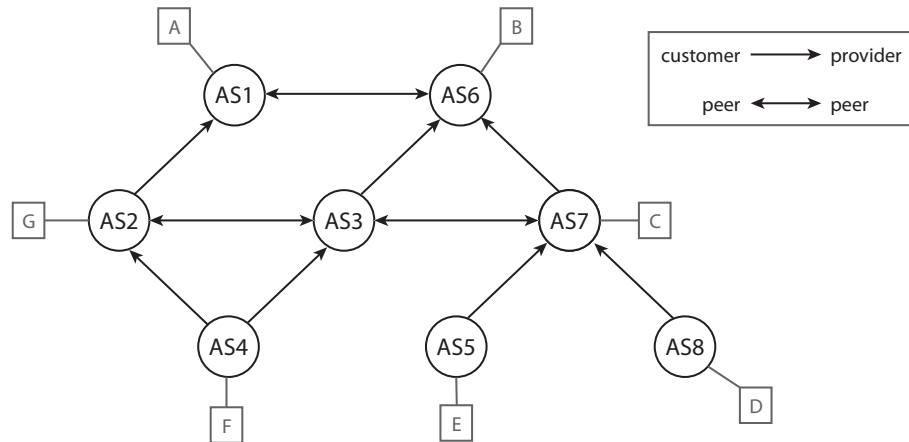
4a. What path would host *F* take to reach host *B*? Justify your answer. (10 pts)

4b. What path would host *E* take to reach host *G*? Justify your answer. (10 pts)

4c. All traffic between *AS*5 and *AS*8 must transit through *AS*7. Suppose *AS*5 and *AS*8 want to avoid paying *AS*7 for this service. What could they do to reduce their cost? (10 pts)

Step	N'	D(B), p(B)	D(C), p(C)	D(D), p(D)	D(E), p(E)	D(F), p(F)	D(G), p(G)	D(H), p(H)
1	A							
2								
3								
4								
5								
6								
7								
8								