

P538 Computer Networks

Homework 3

Due Online, Friday, April 20, 2018, 11:59 pm

Instructions: You may discuss the questions with your classmates, but not your answers. Please explain all answers and show all work. This assignment covers Network and Datalink Layers.

- 1) [10 pts] IP Subnetting
 - a. [2 pts] Consider a subnet with prefix 128.119.30.128/26. Give an example of one IP address (of the form xxx.xxx.xxx.xxx) that can be assigned to this network.
 - b. [8 pts] Suppose an ISP owns the block of addresses of the form 128.119.40.64/26, and the ISP want to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets?
- 2) [10 pts] Assume that you are interested in detecting the number of hosts behind a NAT. You observe that the IP layer stamps an identification number sequentially on each IP packet. The identification of the first IP packet generated by a host is a random number, and the identification numbers of the subsequent IP packets are sequentially assigned.
 - a. [6 pts] Based on this observation, and assuming you can sniff all packets sent by the NAT to the outside, outline a simple technique that detects the number of unique hosts behind a NAT. Justify your answer.
 - b. [4 pts] If the identification numbers are not sequentially assigned, but randomly assigned, would your technique work? Justify your answer.
- 3) [10 pts] Routing
 - a. [5 pts] What is BGP High Jacking? Explain how a network prefix can be hijacked. If no authentication methods are used, does advertising a prefix cause a BGP peer to accept the new advertisement?
 - b. [5 pts] Explain the fundamental difference between link state and distance vector routing algorithms. Your explanation should discuss the centralized or distributed nature of the algorithm(s).
- 4) [10 pts] Suppose nodes A and B are on the same 10 Mbps broadcast channel, and the propagation delay between the two nodes is 245 bit times. Suppose A and B send Ethernet frames at the same time, the frames collide, and then A and B choose different values of K in the CSMA/CD algorithm. Assuming no other nodes are active, can the retransmissions from A and B collide? When answering this question, suppose A and B begin transmission at $t=0$ bit times. They both detect collisions at $t=245$ bit times. Suppose $K_A=0$ and $K_B=1$. At what time does B schedule its retransmission? At what time does A begin transmission? (Note: The nodes must wait for an idle channel after returning to Step 2 – see protocol.) At what time does A's signal reach B? Does B refrain from transmitting at its scheduled time?