Due Tue., Oct. 14, 2014 in class by the end of class.

Only hand in the following problems: 2, 5, 8, 11, 14

1. Problem 1.13 from the Leon-Garcia/Widjaja textbook (2nd ed.)
2. Problem 1.14 from the Leon-Garcia/Widjaja textbook (2nd ed.). For both parts (a) and (b) just show your calculation for the circuit board and the continent.
3. Problem 1.15 from the Leon-Garcia/Widjaja textbook (2nd ed.). Just show your calculation for the circuit board and continent operating at 10 Gbps for 1000-byte messages.
4. A signalling process represents 1's and 0's with sinc pulses. If we send these pulses through a channel with a channel bandwidth (aka link bandwidth) of 5.6 MHz, what data rate can we expect to achieve?
5. A message consisting of 1024 Bytes is transmitted over a network with links operating at a rate of 2.048 Mbps. The message is split into 4 packets (each with 10 bytes of overhead) and encounters 5 nodes (routers) en route to its destination. What is the overall transmission time of the message?
6. A router processes packets at a rate of 2345 packets per second. It is dealing with a packet arrival rate of 2000 packets per second. On average, when a new packet arrives how many packets are ahead of it in the router (i.e. being processed or waiting to be processed)?
7. A 15-KB file is to be sent from H1 to H2 through a network consisting of 4 routers. Each link is a long optical fiber cable with a propagation time of 10 μs and operates at a rate of 10 Mbps. The file is broken up into an integer number of 1.2-KB packets (ignore headers). What is the packet *transmission time* at each link?
8. For the system (and file) outlined in the question above assume that the packet transmission time is 110-μs and that each router takes 50 μs for to decide which interface to send a packet to. What is the throughput experienced in sending the file in bps (bits-per-second)?
9. For a system with a queue having an arrival rate λ and a processing (service) rate μ_1 by how much must we increase the service rate (i.e. what is $\mu_2 - \mu_1$) if we want to halve the mean packet delay from T_1 (in the original system to $T_2 = T_1/2$.
10. Plot (just a sketch conveying the characteristics) the normalized delay ($T/\bar{H} = \mu T$) versus the offered load $G = \rho = \lambda/\mu$ for a network exhibiting the characteristics of a M/M/1 queue.
11. Problem 5.3 from the Leon-Garcia/Widjaja textbook (2nd ed.)
12. Problem 5.15 from the Leon-Garcia/Widjaja textbook (2nd ed.) just (a) and (b). For (b) calculate your answer for $N = 80$
13. Problem 2.4 from the Leon-Garcia/Widjaja textbook (2nd ed.)
14. Problem 2.6 from the Leon-Garcia/Widjaja textbook (2nd ed.)
15. Problem 2.10 from the Leon-Garcia/Widjaja textbook (2nd ed.)
16. In which layer of the OSI model is the Ethernet layer best placed? *Hint: The answer appears in the form of a question in the PROBLEMS section of Ch. 2 of the Leon-Garcia textbook.*
17. Problem 2.19 from the Leon-Garcia/Widjaja textbook (2nd ed.)
18. Problem 2.20 from the Leon-Garcia/Widjaja textbook (2nd ed.)

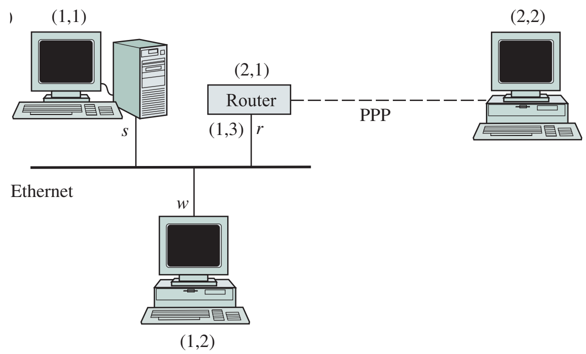

Figure 1: A simple network.

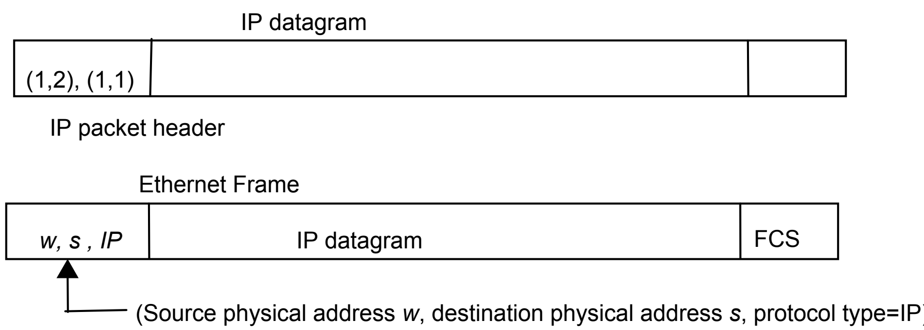

Figure 2: Packet and segments used in a workstation-to-server communication.

19. The following is Problem 2.25 form the Leon-Garcia/Widjaj text (2nd ed.). Consider the simple network sketched in Fig. 1. Sketch the sequence of IP packets and Ethernet and PPP frames that are generated for **server-to-PC** and **PC-to-server** connections. Note, the server's (abstract) IP address is (1,1) and the PC's IP address is (2,2). The workstation's IP address is (1,2). To get you started Fig. 2 the solution to the **workstation-to-server** connection.

    As shown the communication consists of the workstation constructing an IP *packet* (packets passed through a connectionless network are often referred to as *datagrams* in the network literature) and encapsulating it in an Ethernet *frame*. The packet's header consists of information about the sender's (workstation) IP address, (1,2), and the intended receiver's (server) IP address, (1,1). The IP addresses used follow the (netID, hostID) notation used in the textbook. In the Ethernet frame the physical addresses, for the workstation (w) and server (s) are placed in the header along with the identifier, IP, of the protocol used within the payload.

    Hint: Your sequence will be longer (i.e. require you to show more than 2 PDUs as in the example above) for the two scenarios you are asked to solve as the server and the PC are not in the same LAN.

20. Problem 2.28 from the Leon-Garcia/Widjaja textbook (2nd ed.)

21. Problem 2.33 from the Leon-Garcia/Widjaja textbook (2nd ed.)

22. Problem 2.34 from the Leon-Garcia/Widjaja textbook (2nd ed.)

23. For the simple internet shown in Fig. 3 (with simplified IP addresses shown) suppose that all traffic from network 1 to network 3 is to be routed directly through R1. In this case what routing table entries should be present in the network 1 hosts and in R2?

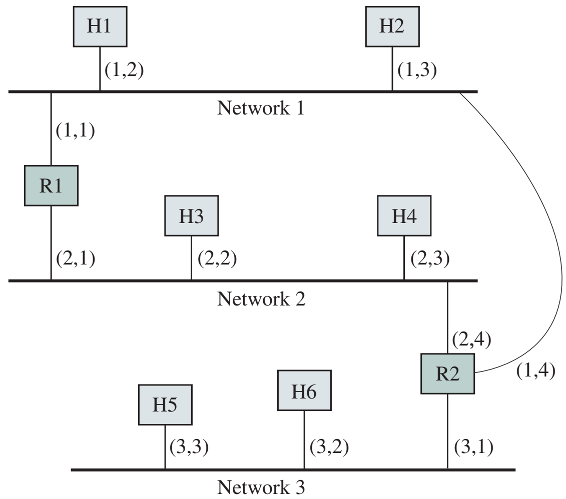

Figure 3: A simple internet.

As an example, the table below shows the routing table entries for all hosts in network 3 and in R2 in a case where all traffic from network 3 that is destined to H1 is to be directly routed through router R2 and where all other traffic from network 3 is to go to network 2.

Table 1: An Example Routing Table Solution

H5		H6		R2	
Destination	Next Hop	Destination	Next Hop	Destination	Next Hop
Default	(3,1)	Default	(3,1)	(1,2)	(1,4)
				(1,0)	(2,1)
				(2,0)	(2,4)
				(3,0)	(3,1)

Note how the router addresses communication to the other networks by only noting an address with the network ID (i.e. (1,0), or (2,0) or (3,0)). The network ID is also referred to as the prefix. Employing only the prefix in routing tables saves memory space, and is thus an immediate benefit of a hierarchical addressing scheme. Only in the special case noted in the question of making connections directly to the host (1,2), is the full address employed in the routing table. (Problem 2.39 from the textbook).

24. Problem 8.29(a). For MSS see pg. 606 and pg. 613.