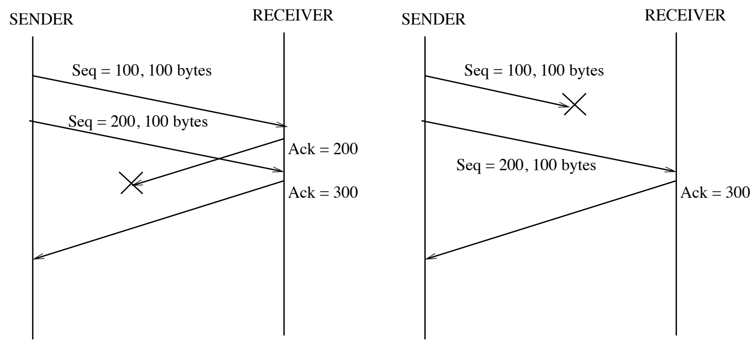
Tutorial 2 (Week 12 Lab)

Note: Some questions are from past exams

1) Assume that the window size N = 10 in this question.



(a) Lost ack (b) Lost packet

(a) Consider scenario in Figure (a) above. Suppose this scenario where an Ack from the receiver is lost, happens 10% of the time. Assume that each Ack is 40 Bytes and each packet is 100 Bytes. Compare the two protocols, GBN and SR, in terms of the average number of packet transmissions in both directions when transferring a file of size 1 MByte.

(b) Consider the scenario in Figure (b) above. In this scenario, a packet is lost in the forward direction with a probability of 0.01. Compare the two protocols in terms of number of packet transmissions for transferring a 1 MByte file. Assume that no Acks are lost.

2) Host A uses TCP Reno to transfer a file to host B. The file contains 32 MSS of data. During the first transmission round, the congestion window is equal to 1 MSS. During the fourth round when the connection is still in the slow-start mode, all the transmitted packets are lost (and, therefore, host A transmits less during the fifth round). There is no packet loss during any other round. During what round does host B receive the complete file?

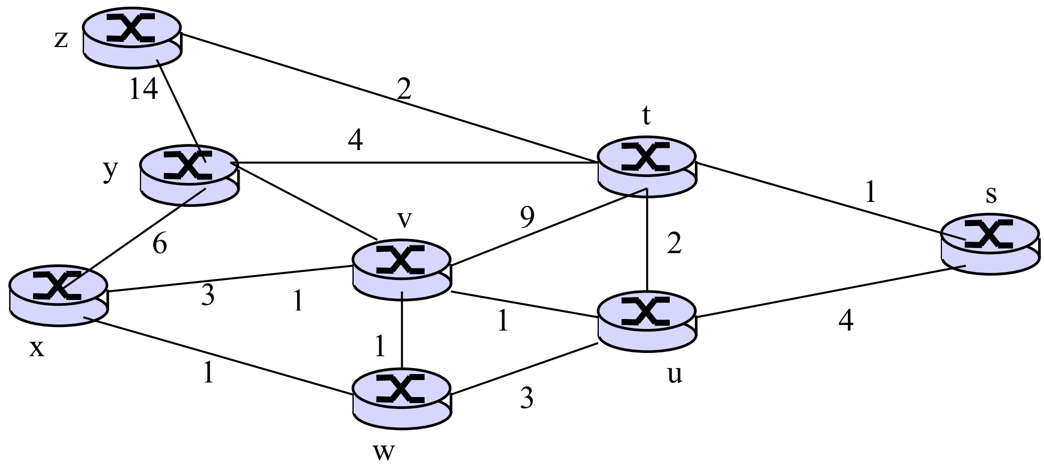
3) Consider the following forwarding table for a router.

Destination	Interface
128.8.16.0/20	Port 1
128.8.24.0/21	Port 2
128.8.128.0/24	Port 3
128.8.128.0/28	Port 4
Default	Port 5

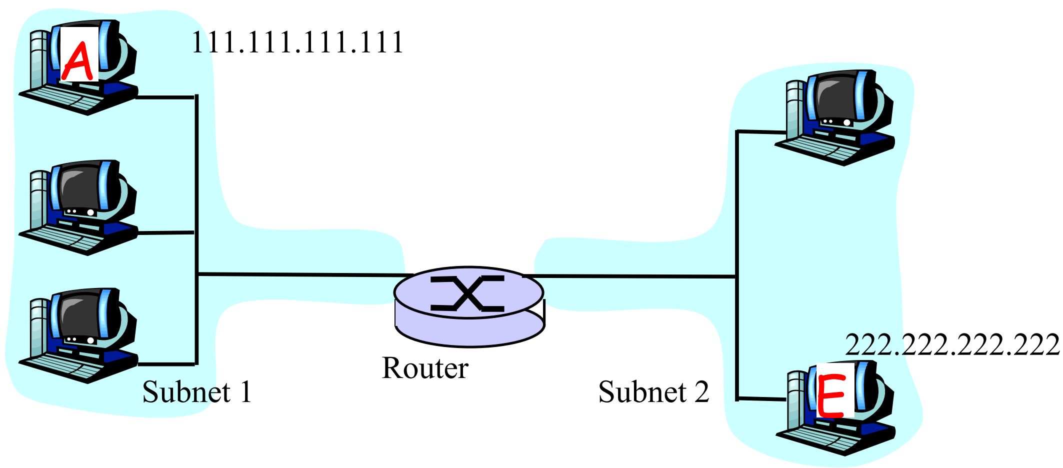
For each of the following destination IP addresses, indicate which port the packet is sent out on:

(a) 128.8.128.252
(b) 128.8.128.5
(c) 128.8.25.223
(d) 155.128.45.21

4) Consider the following network with the indicated link costs. Use Dijkstra's shortest-path algorithm to compute the shortest path from node x to all network nodes. Show the final forwarding table.



5) Consider the simple network shown in the figure below:



a) Write down an IP address for *all* interfaces at all hosts and routers in the network. The IP addresses for A and E are as given. Both, Subnet 1 and Subnet 2 make use of 24 bit network prefixes. You should assign IP addresses so that interfaces on the same sub-network have the same network-part of their IP address.

b) Choose physical addresses (LAN addresses) for only those interfaces on the path from A to E. Can these addresses be the same as in part a)? Why?

c) Now focus on the actions taken at both the network and data link layers at sender A, the intervening router, and destination E in moving an IP datagram from A to E:

- (i) What, specifically, are the source and destination addresses in the IP datagram that flows from A to the router. What, specifically, are the source and destination addresses in the IP datagram that flows from the router to E?
- (ii) Name any three other fields found in an IP datagram?
- (iii) How do A, E and the router determine the physical (LAN) addresses needed for the data link layer frame?

d) Suppose that the router in the figure above is replaced by a bridge (layer 2 switch).

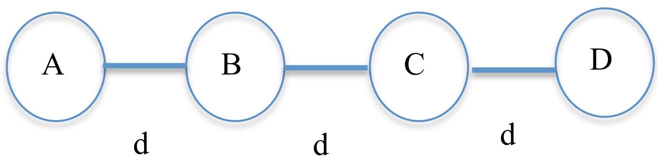
- (i) How would the IP addresses of the hosts change in this case? (You do not have to specify the changed IP addresses, just provide a verbal explanation)
- (ii) How would the physical (LAN) addresses change in this case?
- (iii) How does a learning bridge learn the physical addresses of the attached hosts?

6) Suppose that nodes A and B are attached to the opposite ends of a 900 m Ethernet cable and that they each have one 1000 bit frame (including all headers and preambles) to send to each other. Suppose that there are four repeaters between A and B, each inserting a 20-bit delay (this is the time taken to transmit 20 bits on the Ethernet cable) and that the transmission rate is 10 Mbps. Assume that CSMA/CD with backoff intervals of multiples of 512 bit time (i.e. each backoff interval is a multiple of the time taken to transmit 512 bits on the Ethernet cable) is used. Assume that there is a collision when both A and B transmit their packets simultaneously at time t = 0 sec. After the collision, A draws K=0 whereas B draws K=1 in the exponential backoff protocol. Ignore the jam signal and the 96-bit time delay.

   a. What is the one-way propagation delay (including the repeater delays) between A and B in seconds? Assume that the signal propagation speed is 2×10^8 m/sec.

   b. At what time (in seconds) is A's packet completely delivered at B?

7)



Consider the above wireless network in which each node has a radio range of distance *d.* In the figure, two nodes are in each other's range, if there is an edge between them.

Consider three collision resolution schemes:

- CS: This is a pure carrier sense scheme in which a node does not send when it hears someone else transmitting, but otherwise can send whenever it wants.

- 802.11: This uses carrier sensing as in CS. In addition, nodes wishing to communicate use an RTS-CTS-Data-ACK exchange. Nodes overhearing an RTS wait to allow the CTS to be sent. If no CTS is heard, the node can transmit. If a CTS is heard (even if no earlier RTS is heard), the node is quiet for the entire duration of the data transmission.

Assume that A and B are in the midst of a communication and C has been listening to their exchange so far (and so has heard whatever RTS or CTS packets that B may have sent if any). While A and B are in the "sending data" part of their exchange, C decides that it wants to communicate with D. Consider the following cases: (explain all answers)

(a) A is sending data to B.

(i) If scheme CS is used, would C be allowed to send a message to D?

(ii) If scheme 802.11 is used, would C be allowed to send a message to D?

(b) B is sending data to A.

(i) If scheme CS is used, would C be allowed to send a message to D?

(ii) If scheme 802.11 is used, would C be allowed to send a message to D?

8) An RSA public-key algorithm is used for communicating characters of the English alphabet with plaintext 1 representing A, 2 representing B, 3 representing C and so on. Plaintext 27 represents a blank space. The public key pair is $(e,n) = (27, 55)$, i.e. ciphertext C is obtained from the plaintext P using the formula $C = P2^{7} \ mod\ 55$. Determine the plaintext message corresponding to the following ciphertext. Each number in parenthesis corresponds to a single plaintext character.
(2)(1)(36)(36)(20)(3)(2)(5)(23)(4)(49)(1)(20)(24)

9) Is the message associated with a message digest encrypted? Explain your answer.