CS305: Computer Networking
2024 Fall Semester Written Assignment # 2

Q 1. The UDP checksum provides for error detection. Consider the following word with 32 bits:

$$10011001100111111010101010101010 \quad (1)$$

(a) Compute the checksum. (Recall that UDP computes checksum based on 16-bit word.)

(b) How does the receiver check whether the message was transmitted with errors?

(c) If the receiver does not detect any error using the checksum, does it mean that the message was transmitted without any error? Please explain the reason and provide an example.

Q 2. List three main differences between go-back-N and selective repeat.

Q 3. The following figure illustrates the convergence of TCP's additive-increase multiplicative-decrease (AIMD) algorithm.

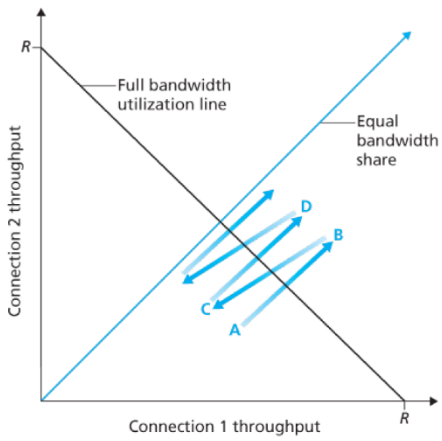
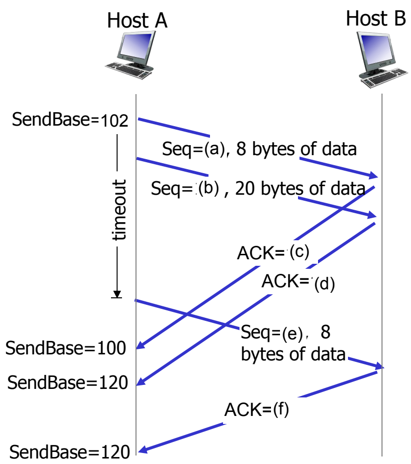


Figure 3.55 Throughput realized by TCP connections 1 and 2

Suppose that instead of a multiplicative decrease, TCP decreased the window size by a constant amount. Would the resulting additive-increase additive-decrease (AIAD) algorithm converge to an equal share algorithm? Justify your answer using a diagram similar to the above figure. (Note: Simply draw the diagram is not sufficient. You need to explain what the diagram shows.)

Q 4. Consider the following figure. Please fill in blanks (a)–(f).



Q 5. Suppose hosts A and B has already established a TCP connection. The maximum segment size (MSS) is 2KB, and round-trip time (RTT) between A and B is 4ms. Suppose there is no congestion occurs. It is recently at congestion avoidance state. How long it takes for the congestion window to increase from 8KB to 32KB.

Q 6. Consider a datagram network using 8-bit host addresses. Suppose a router has four links, numbered 0 through 3, and uses longest prefix matching. It has the following forwarding table:

Prefix Match	Interface
1110****	0
111000**	1
111111**	2
otherwise	3

Consider the longest prefix matching, for each interface,

a) provide the range of destination host address that will be forwarded to each interface, i.e., fill in (A), (B), (C), (D);

b) provide the number of addresses in each range, i.e., fill in x, y, z, w.

Note: you do NOT need to remove the network address, i.e., the address with "*"'s all being zeros. In other words, (A), (B), (C), (D) should cover the entire address range, and $x + y + z + w$ should be equal to 2^8.

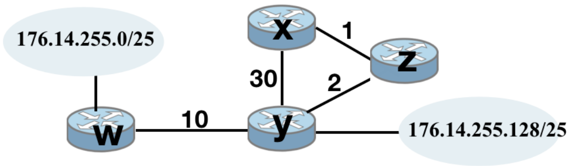
Prefix	Range of destination host addresses	Number of addresses in the range
1110****	(A)	x
111000**	(B)	y
111111**	(C)	z
otherwise	(D)	w

Q 7. Suppose an ISP owns the block of addresses of the form 128.119.40.0/24. Suppose it wants to create four subnets from this block and assign them to four organizations, respectively.

- Organization 1: at least 62 IP addresses
- Organization 2: at least 61 IP addresses
- Organization 3: at least 60 IP addresses
- Organization 4: at least 63 IP addresses

What are the prefixes (of form a.b.c.d/x) for the four subnets?

Q 8. Consider a network as shown in the figure below. Distance vector algorithm is used to calculate the forwarding table.



a) Draw the distance vector table of node z after convergence WITHOUT poisoned reverse. You do not need to draw those tables before convergence.

b) Draw the distance vector table of node z after convergence WITH poisoned reverse.

c) Based on b), draw the forwarding table of node z that contains two entries related to network prefix 176.14.255.0/25 and 176.14.255.128/25. Note: To denote an interface, you can use notation (a,b) to indicate the interface of a connected to b.

d) Based on c), can the two entries be combined into one entry? If yes, what is the combined entry?

e) Consider the case WITHOUT poisoned reverse. Suppose $cost(y, z) = cost(z, y)$ has been changed to 100. (i) Which node(s) will update their distance vector table(s) immediately after the link change? (ii) What is the updated table of node z in the first iteration? (iii) Use this example to explain why "bad news travels slowly".