# Tutorial 2 (Week 5)

**Note: Some questions are from past exams. We are providing questions to prepare you for the final exam which will have mostly short questions.**

Q1.

In the slow-start mode, the congestion window doubles in size each transmission round. During the fourth round when the congestion window equals to 8 MSS, all 8 transmitted packets are lost. Hence, the sender determines the losses via a timeout, sets the threshold to 4 MSS, and reduces the congestion window to 1 MSS. Staring from the fifth round, the sender retransmits the lost data (starting from segment No 8) and then transmits the remaining portion of the file. The congestion window doubles until it becomes equal to the threshold (i.e., 4 MSS) during the seventh transmission round. Then, the TCP connection switches to the congestion-avoidance mode and increases the congestion window by 1 MSS per transmission round. Host A finishes the delivery of the 32- MSS file during the tenth round:

| *Round* | *Congestion window (MSS)* | *Transmitted data (MSS)* | *Delivered data (MSS)* | *Cumulative delivered data (MSS)* |
|---|---|---|---|---|
| *1* | *1* | *1* | *1* | *1* |
| *2* | *2* | *2* | *2* | *3* |
| *3* | *4* | *4* | *4* | *7* |
| *4* | *8* | *8* | *0* | *7* |
| *5* | *1* | *1* | *1* | *8* |
| *6* | *2* | *2* | *2* | *10* |
| *7* | *4* | *4* | *4* | *14* |
| *8* | *5* | *5* | *5* | *19* |
| *9* | *6* | *6* | *6* | *25* |
| *10* | *7* | *7* | *7* | *32* |

Q2.

(a) 28.8.128.252 – Port 3

(b) 128.8.128.5 – Port 4

(c) 128.8.25.223 – Port 2

(d) 155.128.45.21 – Port 5

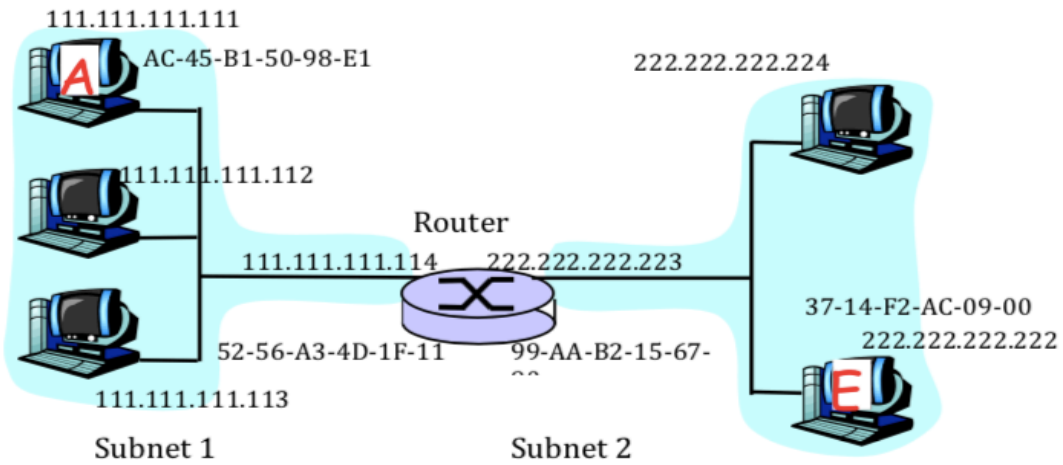
Q3.

| N' | D(s), p(s) | D(t), p(t) | D(u), p(u) | D(v), p(v) | D(w), p(w) | D(y), p(y) | D(z), p(z) |
|---|---|---|---|---|---|---|---|
| x | Inf | Inf | Inf | 3,x | 1,x | 6,x | Inf |
| xw | Inf | Inf | 4,w | 2,w | | 6,x | Inf |
| xwv | Inf | 11,v | 3,v | | | 3,v | Inf |
| xwvu | 7,u | 5,u | | | | 3,v | Inf |
| xwvuy | 7,u | 5,u | | | | | 17,y |
| xwvuyt | 6,t | | | | | | 7,t |
| xwvuyts | | | | | | | 7,t |
| xwvuytsz | | | | | | | |

The forwarding table is as follows:

| Destination | Link |
|---|---|
| w | xw |
| v | xw |
| u | xw |
| y | xw |
| t | xw |
| s | xw |
| z | xw |

Q4.




(a) If the network part of the address is 24 bits (/24) then all interfaces in subnet 1 must be of the form 111.111.111.xxx while all interfaces in subnet 2 must be of the form 222.222.222.xxx. The IP addresses are shown in the figure.

(b) LAN addresses are 48 bits long and written in hexadecimal-colon notation. These are very different from the 32-bit addresses from part a.

(c)

1) In the IP datagrams from A to the router the addresses are as follows: source 111.111.111.111, destination: 222.222.222.222. In the IP datagrams from the router to E the source and destination addresses does not change.
2) TTL, Upper layer protocol field, Checksum, Options etc
3) Using ARP (address resolution protocol)

(d)

1) The IP addresses of A and E would have to have the same network prefic since they are now part of the same subnet.
2) There is no need to change the physical (LAN) addresses.
3) The switch uses backward learning algorithm. When a host sent a frame through the switch, the switch would observe the LAN address of the sender and the interface through which it has arrived and record this value in its forwarding table.

Q5.

(a) The one-way propagation delay (including the repeater delays) between A and B is:
$(900m/2x10^8 m/sec) + 4 \times 20bits/10x10^6$ bps
$= (4.5 \times 10^{-6} + 8 \times 10^{-6})$ sec
= 12.5usec

(b).

- At time t = 0, both A and B transmit
- At time t = 12.5 usec A detects a collision
- At time t = 25 usec last bits of B's aborted transmission arrives at A.
- Since A draws K=0 in the backoff algorithm, it can immediately start the retransmission at time t = 25 usec.
- At time t=37.5 usec first bit of A's transmission arrives at B. Note that this time is smaller than 512 bit times that B has to wait for backoff. Hence, B does not begin its transmission since it detects A's transmission (in CSMA, the node senses the channel before transmit).
- At time t = 37.5 usec + $1000bits/10x10^6$bps = 137.5 usec A's packet is completely delivered to B.

Q6.

(a) A is sending data to B.

(i) Yes, because C does not hear A

(ii) No, because C has heard the CTS sent by B

(b) B is sending data to A.

(i) No, because C has heard the data transmission from B

(ii) Yes, because C has not heard the CTS from A, even if it heard the RTS from B