EE-450, HW1 Solutions,

R3.

Standards are the basics of each protocol, in better words they form the frame upon which protocols are built. Some pre-accepted terms on which a protocol is based. They are communication rules make communicating between different ends of a network possible.

R7.

Ethernet cables can support transmission rates of: 10Mbps, 100Mbps, 1Gbps and 10Gbps.

R11.

Considering that there is no propagation delay, each bit will be received by the next hop at the exact time in which it leaves the current one.

The packet length is L and it can be pushed into the transmission line at maximum rate of R1. So the last bit will leave the source by time a=L/R1 and will be received completely by the next router at the same time i.e. a.

When the packet is received completely (t=a), it will be pushed into the next transmission line which has maximum rate of R2. With the same logic, it will be received at destination at time t=a+b where b=L/R2.

The end to end delay will be: L/R1+L/R2.

R18.

L=1000 byte

d = 2.5*10^6 m

s = 2.5*10^8 m/s

R = 2Mbps

t_{prop}= d/s = 0.01 s = 10ms

Propagation time (delay) does not depend on R or L: no,no

P2.

When the first packet leaves the source it take N*(L/R) to reach the destination.

The last bit of the first packet will leave the source at time L/R.

The first bit of the second packet will leave the source at time L/R

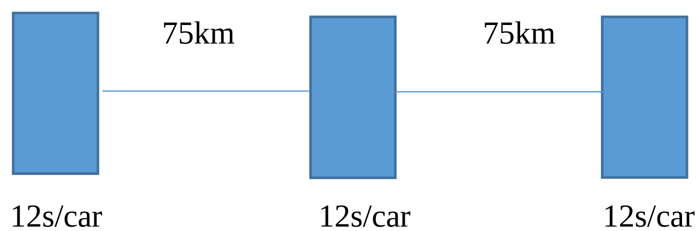
When the last bit of the second packet leaves the source at the same time the last bit of the first packet leaves the next hop.

The first bit of the Pth packet will leave the source at time (P-1)*L/R.

It takes the Pth packet N*(L/R) to get to destination.

Time that takes for all packet to be received by the destination: (N+P-1)*L/R

P5.



a) 10cars
   It takes 120s for the first tollbooth to let them all pass: 2min
   The leave together and all will get to the second tollbooth after 75/100 = 45min
   The second tollbooth spends another 2 min to process all ten.
   They leave off together and get to the last one after 75/100=45min
   And it takes them another 2min to pass the last tollbooth.
   The total time will be: 2min+45min+2min+45min+2min = 96min.
b) With the same approach of part a:
   Dealy = 8*12*3sec+90min = 94min and 48sec

P6.

a) Propagation delay: m/s sec
b) Transmission delay: L/R sec
c) End to end delay: (m/s+L/R) sec
d) The bit has just left the Host A.
e) It is somewhere in between Host A and Host B, It has not yet reached host B since d_prop is greater that d_trans in this problem.
f) The first bit has reached host B.
g) d_trans = L/R = 120/56000 = 3/1400

d_prop = m/(2.5*10^8)

d_prop = d_trans => m = 3*2.5*10^8/1400 meter = 536km

p7.

Data stream: 64kb/sec

Each packet: 56byte = 56*8 bit = 448 bit

Time for each packet to be produced: 448/64000 = 7msec

Time for transmission of the packet in to the line: 448/R = 448/2000000 = 0.224msec

Time to propagate: 10msec

Total time to create a packet and receive it at destination: 17.224msec

P12.

L = 1500*8 bit

R = 2,000,000 bit/sec

Queuing delay: number of waiting packets*L/R = 4.5*1500*8/2000000 = 27msec

P13.

a) The first packet has no queuing delay
   The second has 1*L/R sec queuing delay
   The third has 2*L/R sec queuing delay
   …
   The Nth packet has (N-1)*L/R sec queuing delay.

   The average queuing delay is: (0+1+2+…+N-1)*L/(N*R) = (N-1)*L/(2*R)

b) For each batch it takes N*L/R sec to be transmitted completely so whenever the new batch comes the buffer is empty and the average queuing delay will be the same as above for all batches and the total average queuing delay will be the same as well.