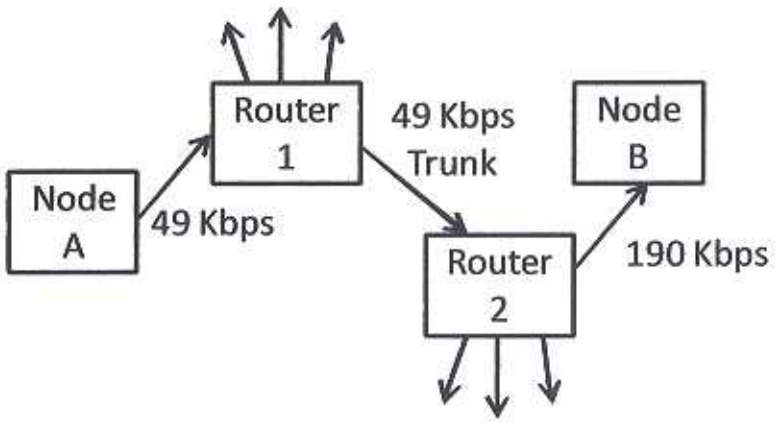
ECEN4533 Quiz #1 February 2011 Name Solution

1a) [10] Given the network shown, **compute the time it will take to deliver 10 packets** from Node A to Node B. Time starts when the leading edge of packet #1 is injected onto the access link at Node A and ends when the trailing edge of the 10th packet is received at Node B. Assume the following:



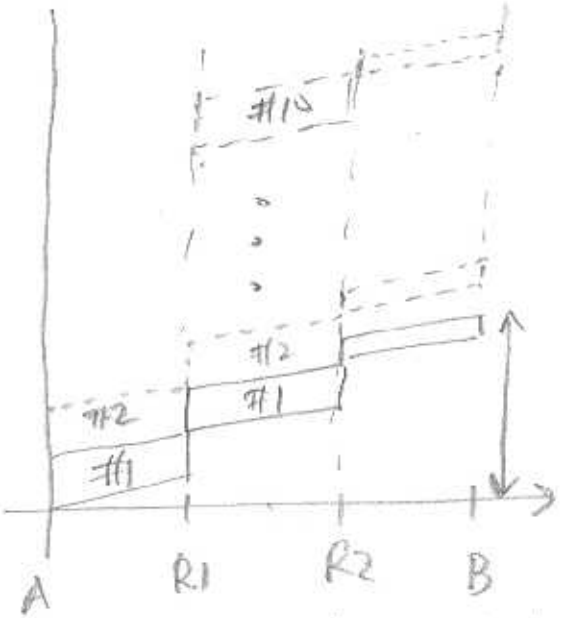
*Each packet is 50 bytes.
*All packets are ready to be moved from Node A at t = 0.
*Packets may be injected back-to-back on all links.
*The propagation delays between Node A and Router 1, Router 1 and Router 2, and Router 2 and Node B are 1 msec, 7 msec, and 1 msec respectively.
*No other traffic is on the system.
*All routers are store and forward devices with zero processing delays.

1b) [5] Suppose IPv6 is used instead of IPv4. This will increase the IP header size from 20 to 40 bytes and bump the packet size to 70 bytes. **Compute the time** it will now take to deliver the 10 audio packets.

1c) [5] Repeat the analysis in part A using IPv4 and 50 byte packets, but this time with additional traffic on the trunk. Three equal sized 1300 byte packets are received and processed by Router 1 and are ready to be moved over the trunk at times t = 30 msec, 43 msec, and 650 msec. At Router 2, these packets will exit the system on a link other than that to Node B. Assuming routers use first in-first out (FIFO) servicing for all packets moved over the trunk, **compute the time** in will now take to move the 10 audio packets.

$\frac{400b}{49K\ b/sec} = 8.163 msec = t_1$

$\frac{400b}{190K\ b/sec} = 2.105 msec = t_2$



Time to transmit 1 packet
$= Prop + 2t_1 + t_2$
$= 9 + 16.33 + 2.105 = 27.43 msec$

Time to transmit 10 packets
$= Prop + t_1 + 10t_1 + t_2 = 9 + 89.79 + 2.105 = 100.9 msec$
ANS

Initials_____

1b) $t_1 \overset{\text{now}}{=} \frac{560b}{49K\ b/sec} = 11.43 msec$

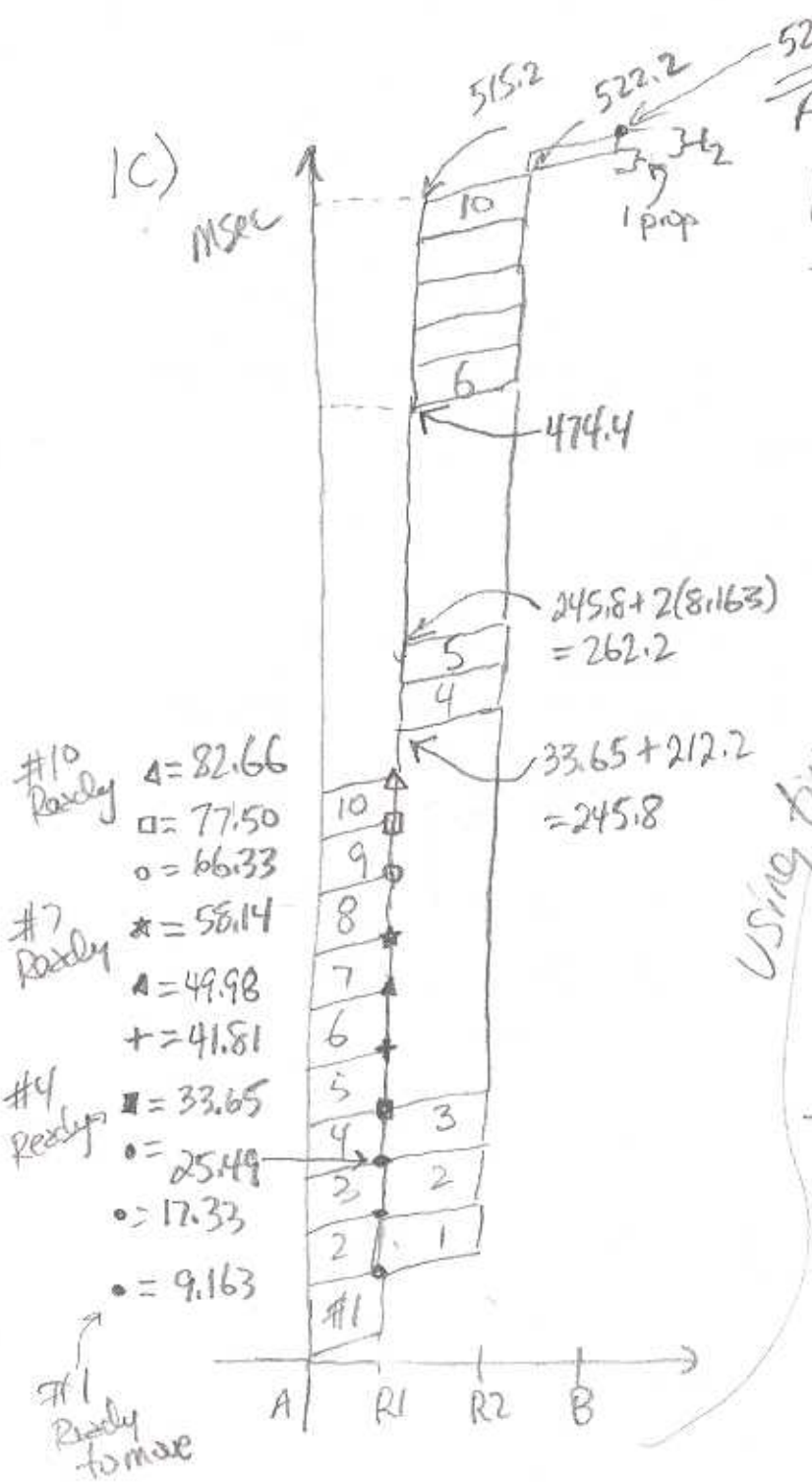
$t_2 \overset{\text{now}}{=} \frac{560b}{190K\ b/sec} = 2.947 msec$

$\Rightarrow$ Delivery = Prop + $1t_1 + t_2$

$= 9 + 125.7 + 2.947$

$= 137.7 msec$ ANS

1c)



$\frac{1300B(8b/B)}{49K\ b/sec} = .2122 sec = 212.2 msec \triangleq t_3$

Ready to move at 30 & 43 msec

Ready to move before #4 is ready.

Ready to move before #6 is ready.

Using time line

Check

Two of the large packets will be mixed in with the audio traffic. The 3rd large packet arrives after the audio traffic has exited the trunk.

$\Rightarrow$ TIME to Transmit 10 packets (msec)

$= Prop + t_1 + 10t_1 + 2t_3 + t_2$

$= 9 + 8.163 + 81.63 + 424.4 + 2.105$

$= 525.3 msec$ ANS