CSE 473 – Introduction to Computer Networks *Roch Guérin*

Quiz 3 – (10 points)

Your Name: *10/09/2017*

1) **[5 points total]** Consider webserver `mywebserver.mycompany.com` located in a network that uses private addresses, *e.g.*, the webserver has address 10.1.1.10, where the network is connected to the Internet using a NAT/PAT router with public address 153.12.45.67.

   a. **[2 points]** What would you expect the content of the DNS A-record for `mywebserver.mycompany.com` to be?

   An A record maps a domain name to the IP address (IPv4) of the computer hosting the domain. The expected A-record would be 153.12.45.67, the IP address of the NAT/PAT router.

   b. **[2 points]** What static mapping entry would you expect to see in the NAT/PAT to support external web connectivity to `mywebserver.mycompany.com`?

   The NAT/PAT should map 153.12.45.67:80 to 10.1.1.10:80 to ensure that http request directed at `mywebserver.mycompany.com` *are properly forwarded to the local address of the web server.*

   c. **[1 point]** Assume that 10 external clients are connected to `mywebserver.mycompany.com`. How many mapping entries would there be in the NAT/PAT router? **Justify your answer**.

   Only one entry that maps 153.12.45.67:80, or simply port 80, to 10.1.1.10:80 will be sufficient to direct all external connections to the local address of the web server.

2) **[5 points]** A sender is using the go-back-N protocol with N=50 to communicate with a receiver over a direct link with a 5ms one-way propagation delay, *i.e.*, the RTT is 10ms. Packets are 10,000 bits long (including headers).

   a. **[2 points]** What is the fastest link the protocol can keep continuously busy assuming no errors (assume that ACKs have a negligible transmission time)?

   Let C denote the link speed. To keep the link busy, the first ACK needs to come back before the 50^{th} *packet has been transmitted. The last bit of the* 1^{st} *packet arrives at the receiver 5ms after leaving the sender and the ACK takes another 5ms to get back to the sender, for a total of 10ms. Assuming that the link remains busy, C*x*20ms bits will have been transmitted during that time. With a window of 50 packets, the sender had another 49 packets to send, i.e., 490,000 bits, after the first packet. So we need* $C \times 10^{-2} \leq 490{,}000$ *or* $C \leq 4.9 \times 10^{7}$ *bps or 49 Mbps.*

   b. **[3 points]** Assume a link speed of 10Mbps (10^7 bps) and that on average one out of every 50 packets is lost. The time-out is set to **twice** the RTT or 20ms. What fraction of the link capacity is the protocol able to realize?

   With a 10 Mbps link, t_{pkt} *= 1ms, so that* t_{out} *= 20 ms = 20* t_{pkt}*, i.e.,*α*-1=20. The packet loss probability is q=1/50=0.02. This gives* $T_{succ} = t_{pkt} \times (1+20 \times 0.02)/0.98 \sim 1.43$*ms. Hence, the fraction of the link capacity the protocol can realize is 1/1.43 = 0.7 or 7 Mbps.*