資訊網路與多媒體研究所

96.10. 4

資格考試科目：高等計算機網路

1. (10%) Recall the idealized model for the steady-state dynamics of TCP. In the period of time from when the connection's window size from ***w/(2*RTT)*** to ***w/RTT***, only one packet is lost (at the very end of the period).
   a. Show that the loss rate is equal to L = loss rate $= \frac{1}{\frac{3}{8}w^2 + \frac{3}{4}w}$
   b. Use the result above to show that if a connection has loss rate L, then its average bandwidth is approximately given by: $\frac{1.22 * MSS}{RTT\sqrt{L}}$
2. (10%) Please (a) explain link state and distance vector routing algorithms, and (b) compare them on aspects of message complexity, speed of convergence, and robustness.

3. (15%) Suppose users share a 1Mbps link. Also suppose each user requires 100 Kbps when transmitting, but each user transmits only 10 percent of the time.
   a. When circuit switching is used, how many users can be supported?
   b. For the remainder of this problem, suppose packet switching is used. Find the probability that a given user is transmitting.
   c. Suppose there are 40 users. Find the probability that at any given time, exactly n users are transmitting simultaneously.

4. (15%) Consider a scenario in which a host, A, wants to simultaneously send messages to hosts B and C. A is connected to B and C via a broadcast channel – a packet sent by A is carried by the channel to both B and C. Suppose that the broadcast channel connecting A, B, and C can independently lose and corrupt messages (and so, for example, a message sent from A might be correctly received by B, but not by C). Design a stop-and-wait-like protocol for reliably transferring a packet from A to B and C, such that A will not get new data from the upper layer until it knows that both B and C have correctly received the current packet. Give FSM descriptions of A and C. (Hint: The FSM for B should be essentially the same as for C)

5. (10%) Why Ethernet chooses CSMA/CD as its protocol instead of others. Please compare CSMA/CD with slotted ALOHA, pure ALOHA and CSMA.

6. (15%)
   a. Please formally define "Independent Increment" and "Stationary

Increment".

b. Please give an example of stochastic process that both have "Independent Increment" and "Stationary Increment".

7. (15%) Suppose that shocks occur according to a Poisson process with rate λ, and suppose that each shock, independently, causes the system to fail with probability p. Let N denote the number of shocks that it takes for the system to fail and let T denote the time of failure. Find $P[N=n|T=t]$.

8. (10%) What is PASTA (Poisson Arrivals See Time Average)?