2002 Paper 9 Question 3

Digital Communication II

(a) Current TCP incurs loss to discover the available capacity. Describe the AIMD (Additive Increase, Multiplicative Decrease) mechanism, and fast recovery, and show how this leads to the characteristic "saw tooth" throughput behaviour of TCP over time. [5 marks]

(b) Consider a TCP connection operating in steady-state whereby each time the congestion window increases to W segments a single packet loss occurs. In terms of W and the round trip time (R), derive a simple formula for the time between the minimum and maximum data rates achieved. In this optimal scenario, how many packets are sent between each loss event? [4 marks]

(c) Derive the connection's average throughput in terms of the fraction of packets lost (p), the connection's round trip time (R), and the segment size (B). [4 marks]

(d) Under what conditions is this very simplistic model likely to be accurate? [3 marks]

(e) How can router support for Explicit Congestion Notification (ECN) be used to smooth the TCP throughput? [4 marks]