COMPUTER SCIENCE TRIPOS Part IB – 2015 – Paper 5

4   Computer Networking (AWM)

The following equation provides a simple way to estimate the throughput of a TCP connection, as a function of the loss probability p, the round-trip time RTT, and the maximum segment size MSS.

$$\text{TCP Throughput} = \sqrt{\frac{3}{2}} \frac{\text{MSS}}{\text{RTT}\sqrt{p}}$$

(a)   Alice wants to send a large amount of data to Bob over a network path with RTT $= 100$ ms, $p = 0.01$, and MSS $= 10,000$ bits. What is the expected throughput in Mbit/s?   [2 marks]

(b)   With the aid of a clearly labelled diagram showing window-size versus time, derive the above equation.   [10 marks]

(c)   Alice has two options to improve the throughput: halving either the RTT or the loss probability p. If both cost the same, which is more cost effective and why?
                                                                                                    [2 marks]

(d)   Consider your derivation of the equation in part (b). State three assumptions that are made and describe when these assumptions may not hold in reality.
                                                                                                    [6 marks]