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]