6 Computer Networking (AWM)

(*a*) Consider packet switching and circuit switching. In simple terms, packet switching may allow more users to use the network.

We have N users sharing a 1 Mbit/s link. Each user consumes 100 kbit/s when transmitting but only transmits for 10% of the time, on average.

(*i*) How many users would a circuit-switching system support? State your assumptions. [1 mark]

(*ii*) For $N = 40$ users, the probability that more than 10 users are active at the same time is approximately 0.0015.

Show how to compute this probability. You are not required to calculate the actual figures. [6 marks]

(*iii*) State two assumptions that you made in Part (*a*)(*ii*) about the network users. In each case describe why the assumption may fail for current Internet traffic. [4 marks]

(*b*) The formulae below are used in TCP implementations to compute a value for the retransmission time-out T. R is an estimate of the round-trip time (RTT), D is an estimate of variance, M is the most recently measured round-trip measurement, $\alpha = 0.875$ and $h = 0.25$.

$$\begin{aligned} D &\leftarrow D + h(|M - R| - D) \\ R &\leftarrow \alpha R + (1 - \alpha)M \\ T &= R + 4D \end{aligned}$$

(*i*) Give an example of how the retransmission time-out T is used within TCP. [1 mark]

(*ii*) Describe why the computation of the retransmission time-out T incorporates a correction for deviation in the estimate of the RTT. [2 marks]

(*iii*) For each assumption you stated in Part (*a*)(*iii*), describe the impact on the estimate of the retransmission time-out T. [3 marks each]