

## COMPUTER SCIENCE TRIPOS Part IB – 2023 – Paper 5

### 1 Computer Networking (awm22)

Recall the simplified TCP throughput equation

$$\text{TCP throughput} = \frac{1.22 \cdot \text{MSS}}{\text{RTT} \cdot \sqrt{L}}$$

- (a) Provide a derivation of this equation utilising a figure. Include a description of each term of this equation and example values (including units). [6 marks]
- (b) What does this equation imply for networks of 10 Gbit/s throughput. [3 marks]
- (c) What important TCP congestion behaviour does this equation not capture? [3 marks]
- (d) CUBIC is commonly used as an alternative to classic AIMD TCP congestion control.
  - (i) With the aid of a diagram showing window size over time, compare how CUBIC differs from classic AIMD TCP congestion control. [6 marks]
  - (ii) With reference to the diagram used in part (d)(i) discuss how the CUBIC approach improves performance for a flow on a link with very large bandwidth delay products. [2 marks]