University of Bath

DEPARTMENT OF COMPUTER SCIENCE
EXAMINATION

CM30078: NETWORKING

Monday, 23 January 2023, 9:30–11:30

No calculators may be brought in or used.

Full marks will be given for correct answers to THREE questions. If you opt to answer more than the specified number of questions, you should clearly identify on the cover sheet which of your answers you wish to have marked. In cases you have failed to identify the correct number of answers the marker is only obliged to consider the answers in the order they appear up to the number of questions required.

DURING THIS EXAM YOU ARE NOT PERMITTED TO COMMUNICATE WITH ANY PERSON(S) EXCEPT AN INVIGILATOR OR AN ASSIGNED SUPPORT WORKER.

YOU MUST NOT HAVE ANY UNAUTHORISED DEVICES OR MATERIALS WITH YOU.

YOU MUST KEEP YOUR LIBRARY CARD ON YOUR DESK AT ALL TIMES.

PLEASE FILL IN THE DETAILS ON THE FRONT OF YOUR ANSWER BOOK/COVER AND SIGN IN THE SECTION ON THE RIGHT OF YOUR ANSWER BOOK/COVER, PEEL AWAY ADHESIVE STRIP AND SEAL.

TAKE CARE TO ENTER THE CORRECT CANDIDATE NUMBER AS DETAILED ON YOUR DESK LABEL.

DO NOT TURN OVER YOUR QUESTION PAPER UNTIL INSTRUCTED TO BY THE CHIEF INVIGILATOR.

1. What is the *last mile* problem? [1]

   And why is it a problem? [1]

   Write notes on each of the following technologies, describing what they are, and explaining their advantages and disadvantages.

   (a) The copper loop (with ADSL)

   (b) Fibre to the cabinet (with VDSL)

   (c) Fibre to the distribution point (with G.fast)

   (d) Fibre to the home [4 each]

   Why, do you think, there are so many different technologies used in the last mile problem? [2]

2. For each of the following, discuss whether it is true, false, or partially true, giving explanations.

   (a) There is no difference between an ephemeral port and a well-known port.

   (b) IPv6 dispensed with checksums as modern networks are so reliable.

   (c) Having both hardware and software addresses is redundant.

   (d) QUIC will replace TCP.

   (e) A missing TCP ACK is an indicator of congestion. [4 each]

3. (a) The TCP header contains an *advertised window* field. What does this field indicate? [2]

   Why is it needed? [2]

   Describe how, together with the latest ACK number, the advertised window describes a *sliding window*. [2]

   When does the sliding window *open*? [1]

   When does the sliding window *close*? [1]

   Why do we need the (optional) *window scale* in modern networks? [2]

   (b) Outline how *slow start* and *congestion avoidance* operate to converge on the fastest, non-congested rate. [6]

   TCP also has a *delayed ACK* strategy. How does this affect the slow start/congestion avoidance algorithm? [4]

4. The OSI Seven Layer Model make recommendations on how to structure a networking standard. Write an essay on how (or if) TCP/IP achieves the functionality that the OSI model recommends, highlighting how TCP/IP sometimes follows and sometimes doesn't follow its recommendations. In those places where TCP/IP diverges, explain why you think that TCP/IP does so. [20]