University of Bath

DEPARTMENT OF COMPUTER SCIENCE
EXAMINATION

CM30078: NETWORKING

Assessment Available from: Friday, 22 January, 9:30am
Latest Submission Time: Saturday, 23 January, 9:30am
All timings are given in Greenwich Mean Time (GMT)

Please read the Guidance for Students (`https://www.bath.ac.uk/topics/exams-and-assessments`) before attempting this exam. The Guidance contains information about submitting your exam attempt and choosing to defer.

This is an open book exam. You may refer to your own course and revision notes and look up information in offline or online resources, for example textbooks or online journals. Make sure you give proper citations to any sources you use.

This exam is designed to take approximately 2 hours to complete.

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 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.

This exam is an **individual** assessment.

Submitting your assessment: upload a *single* PDF before the hand in cutoff. PDF is the only format that will be accepted. You may use a word-processor or write by hand and scan to PDF. Diagrams may be hand-drawn and scanned. Please check all scans are legible.

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1. (a) What is data *presentation*, and why is it a problem when networking? [3]

   (b) Suppose you have a 32-bit integer you wish to send to a remote host; what, if anything, should you do to the integer before sending it? Explain. [2]

   Suppose you have just read 32-bit integer from the network; what, if anything, should you do to the integer before using it? Explain. [2]

   (c) What is the *Universal Coded Character Set* (UCS) and how many bits does it use to represent a character? [2]

   Why would using a 32-bit word to store a UCS value not be a good idea? [2]

   Outline how UTF-8 encodes UCS values and describe some of the benefits of using UTF-8. [5]

   (d) Some people argue that SSL/TLS should be regarded as a presentation layer, as it performs a manipulation of the data before passing it on to the transport layer. Do you agree of disagree with this argument? Explain. [4]

2. You have been tasked with the design of a secure networked banking application. For each of the seven layers in the OSI layering model, describe in your own words the kinds of issues that layer should tackle in an implementation of the design. [7×2]

   Next, outline the some of the approaches to security that your design could take and make a recommendation on one approach, giving reasons. [6]

3. (a) What does the TCP advertised window measure and how is it calculated? [3]

   (b) Explain *sliding windows* and how they are used to determine a limit on data transmission. [3]

   (c) Why might packets be duplicated? [2]

   (d) Why might packets be lost? [2]

   (e) Why is packet duplication and loss taken as sign of congestion? [2]

   (f) What is the TCP *congestion window*? [2]

   (g) Describe one of the standard ways a TCP implementation would estimate the congestion window. [6]

4. What is the IPv4 address exhaustion problem? [2]

Describe in detail each of the following ways of tackling address exhaustion and discuss their advantages and disadvantages:

(a) CIDR [5]

(b) Network Address Translation [5]

(c) IPv6 [4]

Some ISPs employ *carrier grade NAT*. Describe what this is, and explain why they might want to use it in preference to IPv6. [4]