

Candidates are admitted to the examination room ten minutes before the start of the examination. On admission to the examination room, you are permitted to acquaint yourself with the instructions below and to read the question paper.

Do not write anything until the invigilator informs you that you may start the examination. You will be given five minutes at the end of the examination to complete the front of any answer books used.

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SE3CN11 2012/13 A 001

1 Answer Book

Figure 1

Any calculator (including programmable calculator) permitted

UNIVERSITY OF READING

COMPUTER NETWORKING (SE3CN11)

Two hours

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Answer any **THREE** out of **FOUR** questions.

**EACH** Question is worth 20 marks.

1. (a) State why both flow control and congestion control procedures are required with TCP. What mechanisms does TCP use to implement these procedures? (4 marks)
- (b) Explain why IP is more suited to transferring bursty data than streaming data, and why ATM is more suited to streaming data. (4 marks)
- (c) TCP is an extremely reliable protocol, but it isn't suitable in all cases. In particular, certain aspects of TCP can cause problems with the following technologies and protocols:
  - (i) Non-persistent HTTP (version 1.0)
  - (ii) WiFi
  - (iii) Delay Tolerant Networks (i.e. networks involving nodes such as satellites, where the time taken for a message to be transmitted can be substantial).

For each example listed, describe which aspect(s) of TCP can cause problems and how it can either cause data rates to slow dramatically, or even stop transmission entirely. (12 marks)

2. (a) TCP/IP uses end-end congestion control, which is very different from ATM's network-assisted congestion control approach. Describe how TCP/IP is able to infer network congestion and discuss why this is the approach chosen by the designers of TCP/IP, rather than the network-assisted approach chosen for ATM. (4 marks)
- (b) IPv6 uses the concept of flow to improve the processing of a series of related packets through a network. Describe how flow works, and compare it to the Virtual Circuit approach used by protocols such as ATM. (4 marks)
- (c) Multimedia Streaming over the Internet adopts a completely different philosophy to the telecoms-inspired approach adopted by ATM. Compare how YouTube streams its videos over the Internet with how a similar service could be provided over ATM, and discuss why YouTube took the design decisions it did. Why can't TCP/IP provide a similar level of Quality of Service for multimedia streams to that offered by ATM? (12 marks)

3. (a) HTTP is a stateless protocol. Explain what this means, and describe how cookies help give HTTP the stateful mechanism it needs to support e-commerce. (4 marks)
- (b) The requirements of the application layer and the properties of the underlying physical layer determine the functions of the transport layer. Discuss why this is the case and give examples of the functions needed in a transport layer that can support email over a WiFi connection. (4 marks)
- (c) Suppose you take your laptop to University with you and with it, connect to the University's WLAN. Once connected, you use your laptop's Web browser to visit a Web page hosted on a server on an external network.

Describe the steps needed to achieve this. In particular, describe how your laptop first obtains an IP address, how it is able to reach the wider Internet via the WLAN, and how the Web page request is able to find its way to the Web server.

You should include descriptions of how the protocols involved in this process work to enable your laptop to communicate with the Web server across networks.

(Note: you do not need to include descriptions of IP routing protocols). (12 marks)

4. (a) Why has IP's original Classfull addressing scheme led to the rapid depletion of IP addresses? How has Network Address Translation helped overcome this problem for the short-term? (4 marks)
- (b) Assume an Ethernet frame has become corrupted during transmission, and has been discarded by the Link Layer on the receiving host. Using your knowledge of the service Ethernet provides to the network layer above it, describe how the receiving host's network layer, transport layer and application layer would react, if the application is using UDP.

How would this affect an email application and a video streaming application? (4 marks)

- (c) Figure 1 shows three subnets (Subnet 1, Subnet 2 and Subnet 3), each comprising two hosts and a switch. Each subnet is connected via a router. Router R1 connects Subnet 1 to Subnet 2 and Router R2 connects subnet 2 to subnet 3.

Each host has its single IP address and Mac address shown beneath it. Each router has its two IP addresses and MAC addresses shown beneath it.

Using Figure 1, answer the following:

- (i) Suppose that Host E sends an IP datagram to Host F. Will Host E ask Router R2 to help forward the datagram? Explain your answer.
- (ii) Suppose Host C broadcasts an ARP request to discover the MAC address of Host D. Will the Routers R1 and Router 2 receive this ARP request? Will they forward it on to Subnets 1 and 3? Explain your answer.
- (iii) Suppose Host E wants to send an IP datagram to Host B, but E's ARP table does not contain B's MAC address. Will E perform an ARP query to find B's MAC address? Explain your answer.

(Question continues over page)

- (iv) Suppose Host A sends an IP datagram to Host F. Copy the table below into your answer book and complete it by entering the Source and Destination MAC addresses, and the Source and Destination IP addresses, in the frame encapsulating this IP datagram, as the frame is transmitted:

- A. from Host A to Router R1
- B. from Router R1 to Router R2
- C. from Router R2 to Host F

Point in Time	Source MAC	Destination MAC	Source IP	Destination IP
A. From Host A to Router R1				
B. From Router R1 to Router R2				
C. From Router R2 to Host F				

(12 marks)

(End of Question Paper)