

On admission to the examination room, you should acquaint yourself with the instructions below. You must listen carefully to all instructions given by the invigilators. You may read the question paper, but must 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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May/June 2014

SE3CN11 2013/14 A 001 & SE3CN11 2012/13 A 201

1 Answer Book  
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.

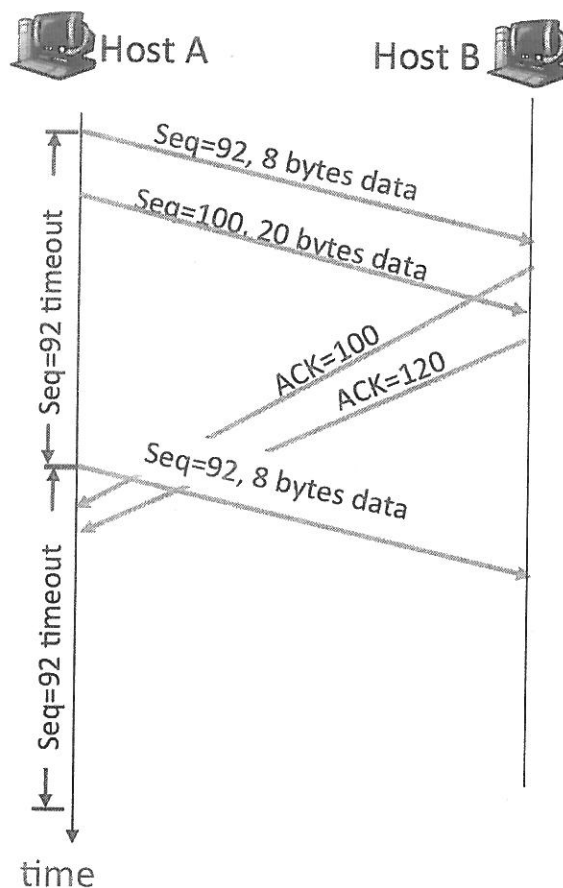
**EACH** Question is 20 marks.

1. (a) Suppose Host A is sending Host B a large file over a TCP connection. Can the number of unacknowledged bytes that A sends exceed the size of the receive buffer? Explain your answer.

(4 marks)

- (b) *Figure Q1-1* shows a sequence of TCP segments flowing between Host A (client) and Host B (server). What segment will Host B send after receiving the second 'seq=92' segment from Host A, and what value(s) will it contain? Explain why the server sends this particular segment.

(4 marks)



*FigureQ1-1*

- (c) Now suppose that Host A and Host B in *figure Q1-1* begin a new communication session. As part of this session, Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 65; the second has sequence number 92.
- (i) How much data is in the first segment?
  - (ii) Suppose the first segment is lost but the second segment arrives at B. In the acknowledgement that B sends to A, what will be the acknowledgement number?
  - (iii) Copy *figure Q1-2* in your answer book and complete the segments that are necessary for Host A to determine that the segment “*seq # x1*” was lost and to resend the missing segment before the timeout expires (i.e. to initiate fast retransmit). In your answer, list any segments from Host A as ‘*seq # xn*’ (where *n* is the *segment* number – e.g. *seq # x1*, *seq # x2*, etc), and any acknowledgement segments from Host B as ‘*ACK xn*’ (where *n* is the number of the *segment* being acknowledged – e.g. *ACK x1* to acknowledge *seq # x1*, *ACK x2* for *seq # x2*, etc).

For all questions, explain your answer in full.

(12 marks)

(*Figure Q1-2* is shown on the next page)

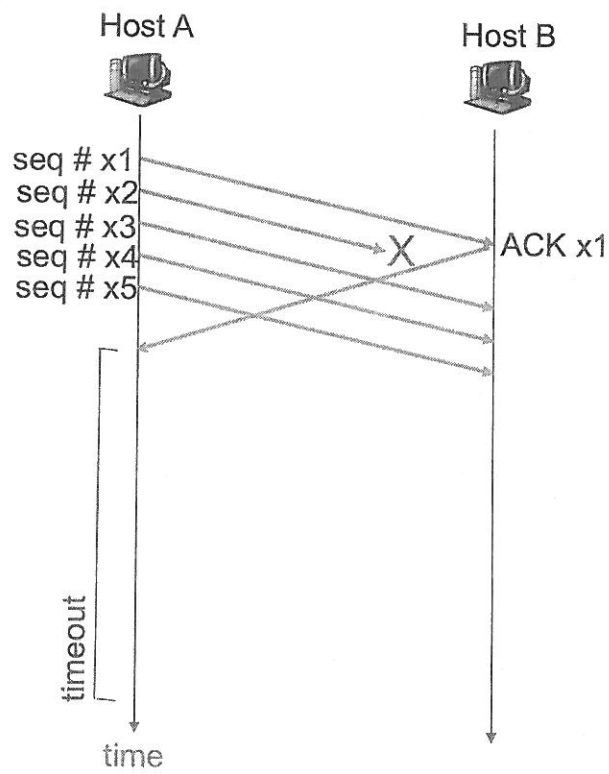


Figure Q1-2

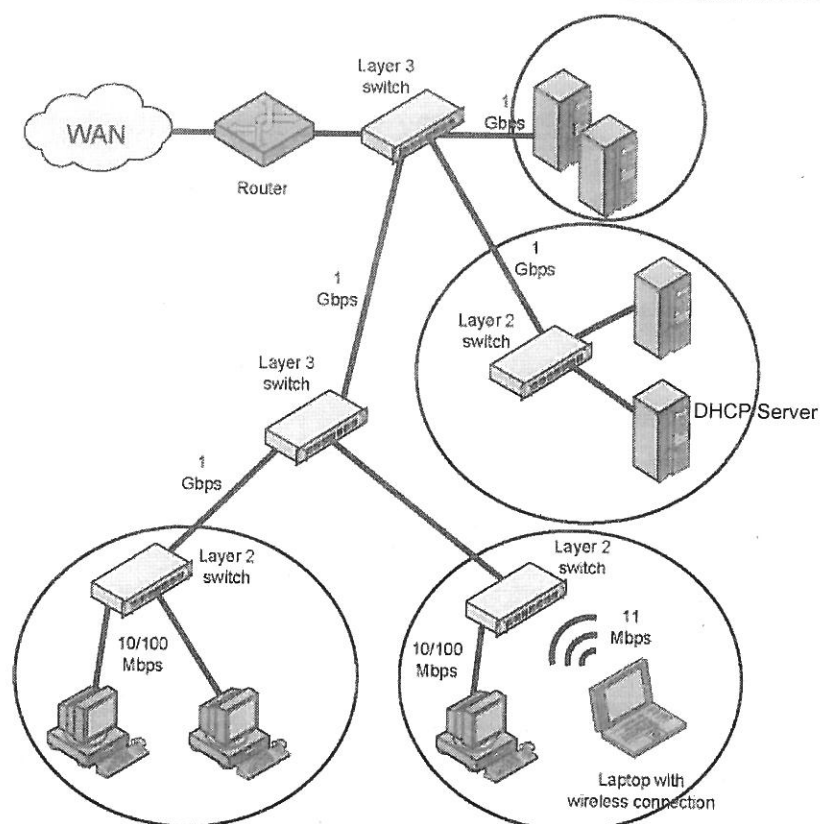
2. (a) Suppose that routers were subjected to conditions that might cause them to fail fairly often. Would this argue in favour of a Virtual Circuit (VC) or datagram architecture? Explain your answer.
- (4 marks)
- (b) Consider a class C subnet with prefix 192.168.56.128/26. What is the **last** IP address that can be assigned to this subnet? Show your calculations and reasoning. (*hint: 192.168.56.128 is the **first** IP address that can be assigned to this subnet*).
- (4 marks)
- (c) Suppose you purchase a wireless router and connect it to your cable modem. Also suppose that your ISP dynamically assigns your wireless router one IP address. Also suppose that you have 5 PCs at home that use 802.11 (WiFi) to wirelessly connect to your wireless router.
- (i) How are IP addresses assigned to the five PCs? What features will your wireless router need to have to automate this assignment?
- (ii) Describe what your wireless router does to any outgoing and ingoing packets to enable your PCs to communicate with a Web server outside of your network.
- (iii) How can your friend initiate a Skype session with one of your PCs?

(12 marks)

3. (a) Referring to *Figure Q3* (below), copy *Table Q3* below into your answer book and complete it by entering the number of IP addresses, MAC addresses and Network Interface Cards for the router and its immediately-connected layer 3 switch.
- (4 marks)

*Table Q3:*

Device	IP Addresses	MAC Addresses	Network Interface Cards
PC	1	1	1
Router			
Layer 3 Switch			



*Figure Q3*

(Question continues on next page)

- (b) Suppose you added NAT functionality to the router in figure 3. In the network as a whole, which device(s) would be given a public IP address and which a private IP address? Explain your answer.

(4 marks)

- (c) Suppose the laptop in figure 3 has just been introduced to the network and its WiFi functionality has been switched on. Once it connects to the network, the laptop's user opens up a 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 the 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) In video streaming applications, why is HTTP streaming more popular than UDP streaming? Provide three reasons why HTTP streaming is one of the least efficient streaming methods available.
- (4 marks)
- (b) ATM's Virtual Circuit approach is a much more efficient and effective protocol for transferring streaming media than TCP/IP's datagram approach. Why is this?
- (4 marks)
- (c) Describe TCP's slow start congestion control algorithm, and explain how it can introduce jitter to a media stream sent over HTTP.
- (i) What impact does it also have on a wireless network connection using 802.11?
- (ii) What impact does it have on a Delay Tolerant Network (i.e. a network in which there may be many minutes between acknowledgments being received)?
- (12 marks)

(End of Question Paper)