THE UNIVERSITY OF ADELAIDE
AUSTRALIA

Primary Examination, Semester 1, 2011

2328 Computer Networks and Applications COMPSCI 3001,

Official Reading Time:	10 mins
Writing Time:	120 mins
Total Duration:	130 mins

Questions	Time	Marks
Answer all 5 questions	120 mins	120 marks 120 Total

Instructions

- Begin each answer on a new page in the answer book.
- Examination material must not be removed from the examination room.

Materials

- Calculator without alphanumeric memory or remote communications capability permitted.
- Foreign language paper dictionaries permitted.

DO NOT COMMENCE WRITING UNTIL INSTRUCTED TO DO SO

Application Layer

Question 1

(a) Explain why SMTP servers do not avoid, or at least trace, spam by fully authenticating the From: field in incoming e-mail.

[3 marks]

(b) An HTTP client is requesting a web page containing two images. Both the web page and the images are located on the same HTTP server. *The IP address of the HTTP server is not initially known by the client.* Using 200 ms as an approximation of the total delay in sending any request and receiving a response, what would be the total delay to receiver all of the page contents if:

i. neither persistence nor pipelining is used

[3 marks]

ii. persistence is used but not pipelining

[3 marks]

iii. persistence and pipelining are both used

[3 marks]

iv. How would your answer change if the images were on the same server but the web page (HTML) was on a different server than the images?

[3 marks]

Specify any assumptions you are making.

(c) Calculate the time needed to distribute a 5 Gigabit file to 10 hosts under the following conditions (you can assume negligible delays due to processing, queuing at routers and propagation for this question)

i. A client server system with a server upload speed of 100 Mb/s and a client download speed of 15 Mb/s.

[5 marks]

ii. A peer to peer system with a seeder. The seeder will initially distribute 1/10th of the file to each peer and will not take further part in the distribution. The seeder has an upload bandwidth equivalent to the server above (100 Mb/sec) and each peer has a download bandwidth of 15 Mb/s and an upload bandwidth of 1 Mb/sec.

[5 marks]

[Total for Question 1: 25 marks]

Transport Layer

Question 2

(a) Reliable transport protocols

i. Consider a 10 Gb/sec network connection between Adelaide and Sydney. The one way propagation delay to travel the approximately 1000 kms between the two cities is approximately 5 msec. Assuming delays other than propagation are negligible, what window size would be needed to reach 90% link utilization?

[4 marks]

ii. Why do pipelined reliable protocols require a sequence numbers space larger than their window size?

[3 marks]

iii. When determining the timeout value what would be the consequence or overestimating or underestimating the time for an ACK to arrive. Would it be better to overestimate or underestimate? Explain.

[5 marks]

(b) A large file is be transmitted over TCP. The TCP handshake has just been completed and data is ready to be sent. Assume that no loss occurs and that round trip times are approximately constant and represented by the value $RTTmsecs$. How long will it take for the congestion window to reach

i. 4 maximum segment sizes (MSS)

[2 marks]

ii. 6 maximum segment sizes

[2 marks]

iii. When the congestion window reaches 6 maximum segment sizes, can the sender always send this many bytes, assuming it has bytes to send? Why or why not?

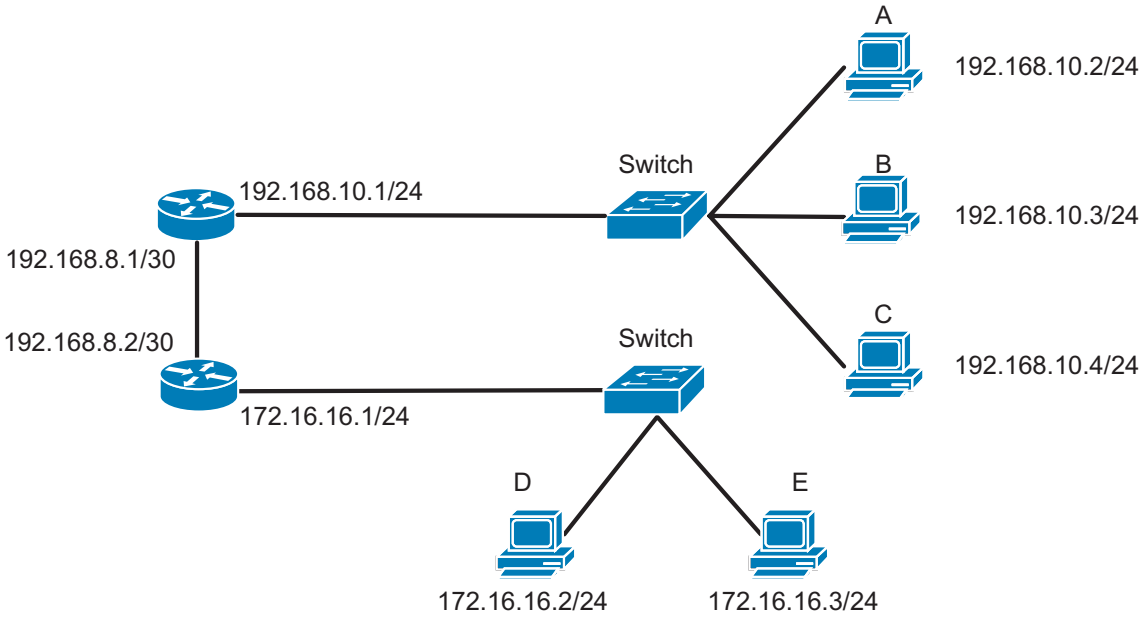
[2 marks]

(c) Since the connection establishment used in TCP means that communication through the socket will always be between the same ports, why does the information need to be carried in the header?

[2 marks]

[Total for Question 2: 20 marks]

Question 3



(a) In the network diagram above, the circular symbols represent routers and the rectangular shapes with arrows on the top represent switches. The remaining symbols are all host PCs of some sort. Where an IP address is drawn near a line or host, it represents the IP address for that interface. Based on the diagram:

i. How many subnets can you identify in the network diagram?

[2 marks]

ii. What is the destination IP address for a packet from Host C addressed to Host E?

[2 marks]

iii. In order to send the packet out, host C will need to use the *address resolution protocol* (ARP) to determine the correct *media access control* (MAC) address to pass the packet down to the data link layer for transmission. Which IP address will it look up in the ARP table? Briefly explain your answer.

[2 marks]

iv. Do switches have IP addresses associated with them? Give a reson for your answer.

[2 marks]

(b) An ISP organization has the CIDR IP address of 223.1.4.0/22. They wish to be able to use route aggregation to provide routing for organizations. Assuming they want to allow all organizations to have up to

126 hosts/addresses. How many organizations could they support in their address block?

[3 marks]

(c) Is the Internet Protocol a datagram or virtual circuit protocol? Give 2 application and/or network characteristics make that a good choice? What is the main limitation of the choice?

[5 marks]

(d) Compare link state and distance vector routing algorithms in terms of the number of messages sent to a node in an update period, the speed at which changes reach a node, and the robustness to router malfunctions. Include both the comparison and why each algorithm performs as it does. For example an answer of this algorithm converges slowly, is not sufficient to receive full marks. You must explain why it converges slowly.

[10 marks]

(e) What is *poisoned reverse* in the context of Distance Vector (DV) routing algorithms? Provide a simple example.

[4 marks]

[Total for Question 3: 30 marks]

Switching and Link Layer Protocols

Question 4

(a) i. Explain what *even parity* means in terms of single bit parity, as part of error detection.

[2 marks]

ii. Using a diagram, explain how two-dimensional bit parity can detect and correct single bit errors.

[5 marks]

(b) There are three broad classes of multiple access protocols. Identify and briefly explain each class.

[6 marks]

(c) Discuss the difference between *persistent* and *non-persistent* CSMA. In your answer, you should discuss potential instability issues and why they occur.

[6 marks]

(d) *Asynchronous Transfer Mode* (ATM) is a network protocol that can be used as a switched link layer protocol.

i. What is the purpose of the ATM adaptation layer (AAL) and where would you find it?

[2 marks]

ii. What are the disadvantages of the ATM *Virtual Circuit* (VC) approach?

[3 marks]

(e) Explain how a packet enters a *Multi-Protocol Label Switching* (MPLS) network, how it is routed through the network and how it is ultimately delivered.

[6 marks]

[Total for Question 4: 30 marks]

Other Topics

Question 5

(a) What are the purposes of the SNMP and ICMP protocols?

[4 marks]

(b) What is a "man in the middle attack"? You may wish to use a diagram to show what occurs in such an attack. Explain how certification of public keys can help prevent this attack.

[6 marks]

(c) What are the differences between symmetric key cryptography and public-key cryptography?

[5 marks]

[Total for Question 5: 15 marks]

End of exam