UNIVERSITY *of* LIMERICK

OLLSCOIL LUIMNIGH

COLLEGE *of* INFORMATICS *and* ELECTRONICS

Department of Computer Science
and Information Systems

End-of-Semester Assessment Paper

Academic Year:	**2007/08**	Semester:	**Summer**
Module Title:	**Computer Networks**	Module Code:	**CS4225/CS5222**
Duration of Exam:	**2½ Hours**	Percent of Total Marks:	**100**
Lecturer(s):	**Dr Séamus O'Shea**	Paper marked out of :	**100**

Instructions to Candidates:

- **Answer 3 questions.**

1.
Suppose the transmission speed on a physical link is10Mbps and the propagation speed is 200m/μsec.

(a) How long does it take to transmit a single bit? (3 marks)
(b) How long will it take a bit to propagate over a 1km-long link? (3 marks)
(c) How many bits can be present on a 1km-long link at a given time? (4 marks)
(d) What are typical causes of the degradations suffered by a data signal as it traverses a physical link? (4 marks)
(e) If a signal suffers attenuation of 3dB in travelling from A to B and a further 3dB in travelling from B to C, what fraction of the original power is the final power? (4 marks)
(f) How does a receiver at one end of a link discover that the bits it has read from the link may not be identical to the bits that were transmitted at the other end? (3 marks)
(g) In relation to (f) above, what options are available to the receiver in terms of recovering the exact bits that were transmitted? (4 marks)
(h) If the propagation time on the link is large, how does this affect the receiver's available recovery options? (4 marks)
(i) How long will it take to download a 40kB MP3 file over a 64kbps channel? (4 marks)

2.

(a) Outline the essential differences between an Ethernet Hub and an Ethernet Switch.(4 marks)
(b) What is the purpose of the Ethernet CSMA/CD protocol? Describe the essence of the protocol. (5marks)
(c) Draw a diagram to show the header fields of an IPv4 packet. Explain the purpose of the Time-to-Live field. (5 marks)
(d) Trace the steps taken by an IP router in routing a received packet towards its destination. (5 marks)

(e) How are the forwarding tables of IP routers kept aware of network conditions and reachable destinations? (5 marks)

(f) Outline the typical entries in a forwarding table record for a given destination. (3 marks)

(g) A user's PC, with an IP address of 192.168.20.34, is configured with a default gateway address of 192.168.20.66. They have a common mask of 255.255.255.224. Is the PC able to access remote networks? Explain. (6 marks)

3.

(a) Outline typical reasons why it may be advantageous to arrange a large network as a collection of smaller subnets. (5 marks)

(b) Suppose you are the network administrator in an organization which has been allocated the address block 198.20.128.0 with an associated mask of 255.255.192.0. How many addresses are contained in this block? (5 marks)

(c) Show how the address block could be used to partition the organization's network into 10 equal-sized subnets, all of which are to be interconnected via a traditional classful router. (14 marks)

(d) What is the maximum number of addresses per subnet? (5 marks)

(e) What is the broadcast address on the 10^{th} subnet? (5 marks)

4.

(a) Compare the features of stop-and-wait data link protocols to those of pipelined protocols. What link characteristics would suggest the use of a given protocol type? (5 marks)

(b) Suppose the transmission speed on a link, which is operated under a stop-and-wait protocol, is 100Mbps. Suppose also that the frames exchanged over the link are 4000 bits in size while the one-way propagation time on the link is 2 msec. Calculate the link utilization. (6 marks)

(c) Outline the essential features of both 'go back n' and 'selective repeat' type link protocols. (5 marks)

(d) If a low bandwidth link has a substantial propagation delay and is of poor quality which protocol type would be most suitable under those circumstances? Explain your answer. (5 marks)

(e) In the case of the HDLC protocol, how is flow control between both ends of the link implemented? (6 marks)

(f) Are delivered frames acknowledged in an Ethernet network? Are delivered frames acknowledged in the HDLC protocol? Explain any differences. (6 marks)

5.

(a) Briefly describe the services which TCP provides in the protocol stack. (4 marks)

(b) On transmission, is the IP datagram encapsulated in the TCP segment, or is the TCP segment encapsulated in the IP datagram? (4 marks)

(c) How does TCP implement flow control? (4 marks)

(d) If an IP packet containing a TCP message is lost in the network, how does TCP at the destination discover this? (4 marks)

(e) What are the advantages and disadvantages attaching to a timer-based retransmission mechanism? (5 marks)

(f) Suggest how the timer setting can be estimated. (4 marks)

(g) A batch of 6 messages are sent across a TCP connection. Message #2 does not arrive, but all other messages are perfectly received. What acknowledgement is returned to the sender once the missing message is discovered and before any retransmission takes place? (4 marks)

(h) In relation to (g) above, what acknowledgement is returned after a successful retransmission takes place? (4 marks)