



UNIVERSITY of LIMERICK

O L L S C O I L L U I M N I G H

COLLEGE of INFORMATICS and ELECTRONICS

Department of Computer Science
and Information Systems

End-of-Semester Assessment Paper

Academic Year:	2006/07	Semester:	Spring
Module Title:	Computer Networks	Module Code:	CS4225
Duration of Exam:	2½ Hours	Percent of Total Marks:	80
Lecturer(s):	Dr Séamus O'Shea	Paper marked out of :	100

Instructions to Candidates:

Answer 3 Questions

Q1.

- (a) What are the primary issues that data link protocols are concerned with? (8 marks)
- (b) Describe the features of the 'Go back n' type of data link protocol. Suppose frames f_k , f_{k+2} , f_{k+3} , f_{k+4} are received by a node which is operating a 'go back n' type of data link protocol. ($k=1, 2, \dots$) Discuss how it behaves in response to the missing frame. (8 marks)
- (c) If the one-way propagation delay over the link is large, how does this affect the operation of the protocol? (9 marks)
- (d) If the link were of poor quality, discuss how well this type of protocol would perform, and suggest how performance may be enhanced via a different type of protocol. (8 marks)

Q2.

- (a) In the context of the TCP/IP protocol stack, give examples where address resolution is necessary. Describe how the ARP protocol resolves IP addresses. (9 marks)
- (b) What is the role of DHCP in the protocol stack? Draw a diagram to show a typical exchange of DHCP messages in respect of a booting client machine. (10 marks)
- (c) Suppose you have 12 PCs plus a router connected into the same Ethernet switch. Suppose that you wish to arrange the PCs into 4 separate interconnected networks at the IP level, using addresses from the block 192.168.11.192/26. Show how this could be done, assuming CIDR addressing policy. (14 marks)

Q3.

- (a) Give examples of the kind of information which is stored in IP routing tables. Compare the advantages of static versus dynamic routing strategies, and state how and when each may be suitable. Give examples of criteria that can be used to select the 'best' route to a given destination. (8 marks)
- (b) In the Internet, it is hardly possible for routers to contain entries for every possible reachable network. Suggest how the size of routing tables could be controlled. (8 marks)

- (c) Draw a diagram to show how ICMP relates to the rest of the TCP/IP stack. (7 marks)
- (d) Briefly describe the role of the ICMP protocol, and give examples of events that cause ICMP messages to be generated. (6 marks)
- (e) If an IP packet which has a 'protocol' value of 1 is received by a host machine, which process should receive the packet's payload? (4 marks)

Q4.

- (a) Draw a diagram to show the header fields of an IPv4 packet. Explain the purpose of the protocol field. (4 marks)
- (b) Discuss the advantages and disadvantages of 'small' versus 'large' packets. (7 marks)
- (c) Suppose you send an email message to the address 'john@abc.ie'. Draw a diagram to show the relation between your email software and the TCP/IP protocol stack. (4 marks)
- (d) In the process of being sent, describe the transformations which will be applied to the email message as it makes its way down the protocol stack on the source machine. (6 marks)
- (e) How does the IP protocol decide whether a given packet's destination is on a local or a remote network? (6 marks)
- (f) When IP discovers that a packet's destination is on a remote network, outline the steps taken in routing it to its destination. (6 marks)

Q5.

- (a) Compare the tasks performed at both the link layer and transport layers in a typical protocol stack. Suppose the path from source to destination involves a single router. If the router discards a packet because of congestion, how can the loss of the packet be discovered at the destination? Assume a TCP/IP stack. (8 marks)
- (b) Consider the HDLC link protocol and the TCP transport layer protocol. Compare the error and flow control mechanisms available to each protocol. (8 marks)
- (c) A timer is associated with each transmitted TCP segment. What are the consequences of a timer setting which is (1) too short, (2) too long? How can the 'best' timer setting be estimated? (8 marks)
- (d) Briefly describe how TCP may dynamically adjust to changing connection characteristics. (e.g packet loss) (10 marks)