



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

## 2007 A SEMESTER EXAMINATIONS

|                                       |                                     |
|---------------------------------------|-------------------------------------|
| DEPARTMENT                            | Computer Science                    |
| PAPER TITLE                           | Communications and Systems Software |
| TIME ALLOWED                          | Three Hours                         |
| NUMBER OF QUESTIONS<br>IN PAPER       | Five                                |
| NUMBER OF QUESTIONS<br>TO BE ANSWERED | Five                                |
| VALUE OF EACH QUESTION                | All questions are of equal value.   |
| GENERAL INSTRUCTIONS                  | Answer ALL FIVE questions.          |
| SPECIAL INSTRUCTIONS                  | Nil                                 |
| CALCULATORS PERMITTED                 | Yes                                 |

TURN OVER

## 1. Link Layer Protocols

- (a) Show, using examples, how a two dimensional parity check can detect and correct a single bit error. (3 marks)
- (b) Why are CRCs regarded as being a better form of error correction than checksums? (2 marks)
- (c) *Pure aloha* and *slotted aloha* are two multiple access protocols. Explain the difference between these two protocols. Which one of them will perform better under load with multiple transmitters? Explain your answer. (5 marks)
- (d) What is CSMA/CD? Why do CSMA/CD protocols, such as Ethernet, employ exponential back-off? (5 marks)

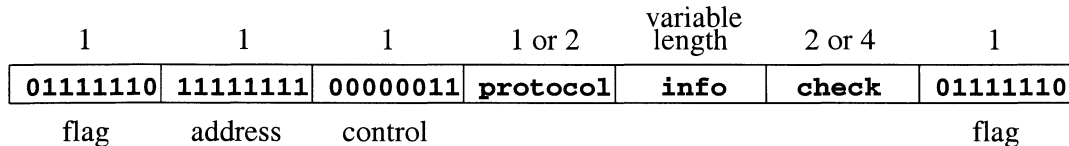


Figure 1: PPP Frame Format.

- (e) Figure 1 shows the PPP frame format.
- (i) What is byte stuffing and why is it used in the PPP protocol?
- (ii) Show how the following data will be inserted into the info section of a PPP frame. The control escape character is 01111101 – 0x7D.
- 01001000 – 0x48
- 01111110 – 0x7E
- 01000101 – 0x45
- 01101100 – 0x6C
- 01111101 – 0x7D
- 01111110 – 0x7E
- 01101111 – 0x6F

(5 marks)

## 2. Local Area Networks

- (a) What is the difference between a switch, a hub and a router? Your answer should include discussion on the contention and broadcast domains associated with each of these. (5 marks)

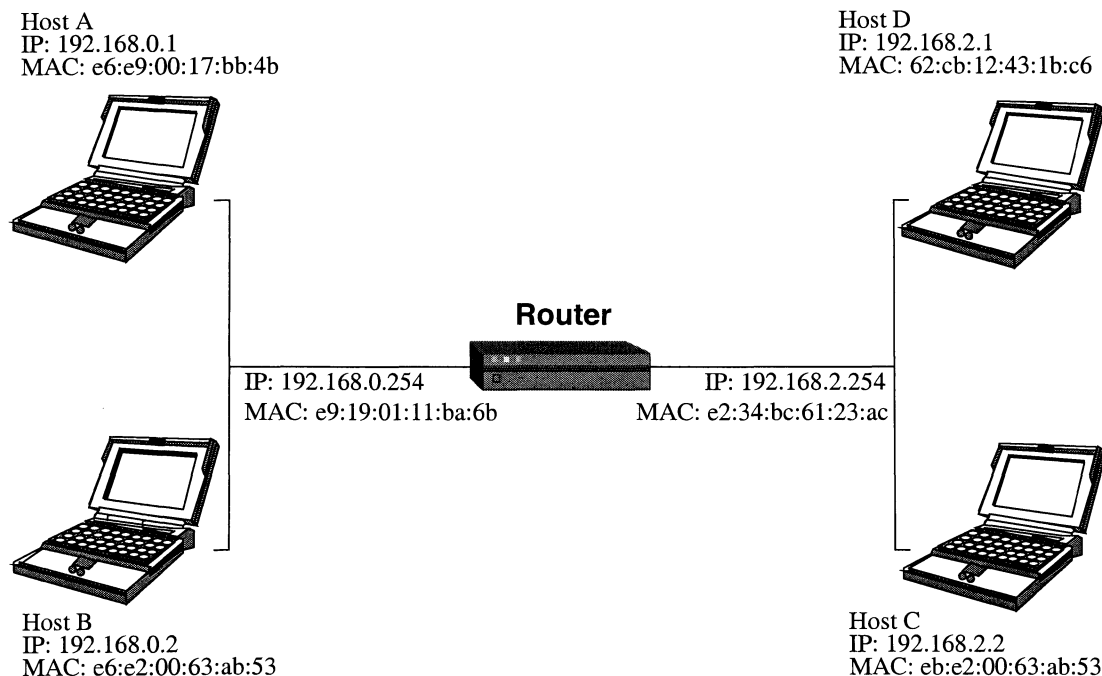


Figure 2: Network Diagram for Question 2b.

- (b) Consider two LANs interconnected by a router as shown in Figure 2.
- Enumerate all of the steps required to send an IP datagram from host A to host C assuming that the ARP tables in the host A and the router are up to date.
  - Enumerate all of the steps required to send an IP datagram from host B to host C assuming that the ARP table in host B is empty and the ARP table in the router is up to date.
- (6 marks)
- (c) What is a VLAN? Why are VLANs commonly used in large campus networks? (5 marks)
- (d) What is Multi Protocol Label Switching (MPLS)? Why is MPLS frequently used by large network carriers in the core of their networks? (4 marks)

### 3. Wireless and Mobile Networks

- (a) What are the advantages of CDMA over other medium access protocols such as channel portioning in wireless networking?  
(4 marks)
- (b) Describe the role of beacon frames in 802.11.  
(3 marks)
- (c) Why are acknowledgement frames used in 802.11 but not in 802.3 wired Ethernet?  
(3 marks)
- (d) In wireless networking what is the hidden node problem and why can hidden nodes in a wireless network have a major impact on the network's performance?  
(4 marks)
- (e) What is meant by the term antenna gain?  
(3 marks)
- (f) Define the following terms associated with mobile IP:
  - (i) Home network
  - (ii) Home agent
  - (iii) Foreign agent  
(3 marks)

#### 4. Internet Protocol and Packet Forwarding

- (a) IP is *best effort* and *connectionless*. Briefly describe what is meant by the terms “best effort” and “connectionless”.

(4 marks)

- (b) The host 203.173.129.56 is on a subnet with a 11 bit Host ID portion of the address.

- (i) Write down the subnet mask.
- (ii) Write down the reserved addresses on this subnet.
- (iii) What are they reserved for?
- (iv) How many host addresses are available on this subnet?

(4 marks)

- (c) Packet handling at routers and end nodes follows a set of well-defined procedures. Describe the process an Internet host uses when forwarding packets, with particular reference to:

- how the correct routing table entry is chosen,
- how the table is organised to assist this,
- and how the correct Ethernet addresses for a packet are chosen.

Use of a flow chart or other diagram would be appropriate.

(8 marks)

- (d) What two conditions differentiate a router from an end node?

(2 marks)

- (e) What conditions must be met for two entries in a routing table to be aggregated?

(2 marks)

TURN OVER

## 5. Internet Applications and the Transport Layer

- (a) The retransmit timer (RTO) expires for a TCP sender. Describe what happens next.  
(2 marks)
- (b) A TCP sender receives three duplicate acknowledgements and enters congestion avoidance.
- (i) What is a duplicate acknowledgement?
  - (ii) Why are three duplicate acknowledgements required before a TCP sender may enter congestion avoidance?
  - (iii) Describe what happens next.
- (8 marks)
- (c) A TCP connection is established between hosts **A** and **B**, both with 100Mbps Ethernet interfaces and 1024 byte transmit and receive buffers. The RTT between them is 25ms. What is the maximum data rate that TCP can sustain between **A** and **B**?  
(4 marks)
- (d) SNMP and HTTP 1.0 are both application protocols designed to support individual transactions. Explain why SNMP uses UDP whereas HTTP 1.0 uses TCP.  
(4 marks)
- (e) Describe briefly how the TCP Retransmit Timer is calculated.  
(2 marks)