UNIVERSITY OF ABERDEEN   SESSION 1998-99

Degree Examination in ES 3561 Communications Engineering 1B
Xday Xth August 1998   (9:00 am - 12:00 noon)

Notes:

(i) Candidates are permitted to use approved calculators

(ii) Candidates are not permitted to use the Engineering Mathematics Handbook

(iii) An information sheet of protocol headers is provided

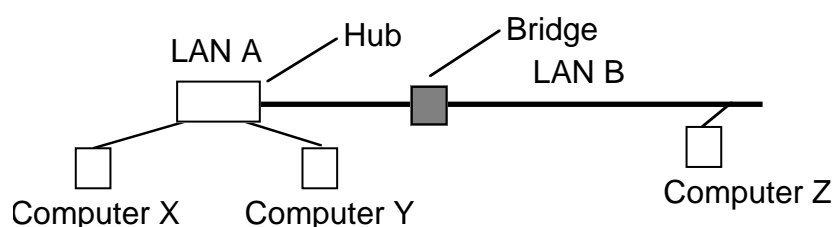*Candidates should attempt THREE questions.   All questions carry 20 marks.*

1.(a)

Figure 1: Two Ethernet LANs are connected via a bridge.

Figure 1 shows three computers X, Y, and computer Z connected to two Local Area Networks (LANs). Outline the operation of the address tables within a bridge. Illustrate your answer by showing how the bridge in the figure recognises whether packets from computer X are to be forwarded from LAN A to LAN B.   **[6 marks]**

(b) The IEEE 802.x family of LANs support many physical media, explain with the aid of diagrams the differences between 10BT (twisted pair) and 10B2 (coaxial cable) technologies.   **[6 marks]**

(c) With the help of a frame transition diagram describe in detail how the IP *Address Resolution Protocol* (arp) is used in a LAN.   **[8 marks]**

2.   (a) With the help of diagrams, explain the operation of the framing provided by the *High Level Data Link Control* (HDLC) protocol. Pay particular attention to define the following terms:
Hunt Mode, Bit Transparency, Abort, and Flag   **[8 Marks]**

(b) With reference to the IP network layer protocol describe the following terms:

   (i)   *Network layer address*   **[2 marks]**
   (ii) *Fragmentation,* also known as *segmentation*   **[2 marks]**
      (iii)   The *"more"*
flag in the IP header   **[2 marks]**
   (iv) *Maximum Transfer Unit* (MTU])   **[2 marks]**

(c) Calculate the number of fragments which are sent when an IP packet with a payload of 3000 bytes is sent from a computer using a network connection with an *Maximum Transfer Unit* of 512 bytes. Ensure that your answer specifies the number and size of each of the IP packets which are sent.   **[4 marks]**

3. (a) What is the *Open Systems Interconnection* (OSI) *Reference Model*? Provide a description of the services provided by each of the layers defined by the model.
[8 Marks]

(b) The *Universal Datagram Protocol* (UDP) is a simple transport protocol supported by the *Internet Protocol* (IP) suite. Explain the function of each of the component fields of the UDP packet header (see the Protocol Header Sheet).

(c) A UDP packet containing 150 bytes of payload data is transmitted using IP over an Ethernet LAN. Draw a diagram showing the transmitted frame, including all protocol headers. What is the *total size* of the frame, when sent using an Ethernet network?
[6 Marks]

4. (a) Describe the following three types of network:

   (i) *Wide Area Network*   **[2 Marks]**
   (ii) *Metropolitan Area Network*   **[2 Marks]**
   (iii) *Local Area Network*   **[2 Marks]**

(b) Discuss the use of fibre optic cabling in *Wide Area Networks*, suggesting reasons for the trend to increasingly replace copper conductors with optical fibre. **[4 Marks]**

(c) Various types of equipment may be used to connect parts of a large network. Summarise the differences between a *router, a repeater* and a *bridge*. **[8 Marks]**

(d) Every computer in a Local Area Network requires a unique *Medium Access and Control* (MAC) address. Explain how these unique addresses are allocated.
[2 Marks]

5. (a) Some communications protocols are said to provide a *reliable service*. Describe the features which are required in a protocol to provide a *reliable service*. **[4 marks]**

(b) A transport connection sends 5 packets, but the remote receiver only receives the following packets: D(0), D(1), D(3) and D(4). Draw a *transition diagram* to show how the receiver may recover the missing packet using *Go-Back-N ARQ*. Your diagram should show all packets (with sequence numbers) which form a part of the transmission
. **[6 marks]**

(c) Explain why *event timers* form an important part of a reliable protocol. **[5 marks]**

(d) Describe how the *Internet Control Message Protocol* (ICMP) may be used to verify that a network connection is operating correctly. **[5 marks]**