

UNIVERSITY OF ABERDEEN

SESSION 2002-03

Degree Examination in EG 3567 Communications Engineering 1A

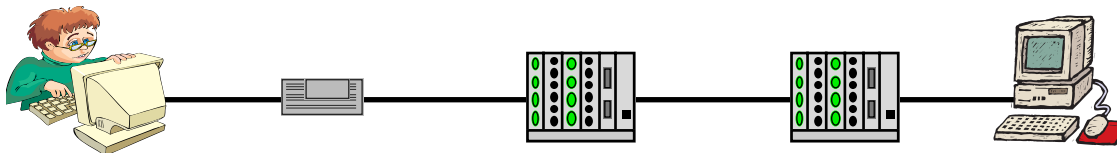
Tuesday 27th May 2003 (09:00 am - 12:00 noon)

**Notes:**

- (i) Candidates are permitted to use approved calculators
- (ii) Candidates are not permitted to use the Engineering Mathematics Handbook
- (iii) An information sheet providing details of protocol headers is provided

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

1. (a) Describe the operation of *Message Switching* and *Packet Switching*. [8 marks]
  - (b) Sketch a diagram showing each of the layers in the *Open Systems Interconnection (OSI) Reference Model*. Label each protocol layer in your diagram. [6 marks]
  - (c) What is the function of the *Transport Layer* in the *OSI Reference Model*? [3 marks]
  - (d) A session uses the *User Datagram Protocol (UDP)*. It sends a series of packets over an Ethernet LAN. The payload of each UDP packet has a size of 690 bytes. Determine the total size of the Ethernet frame using the information provided in the attached PDU Header Chart. [3 marks]
2. (a) Define the following terms relating to the use of an Ethernet *Local Area Network (LAN)*:
    - (i) *Carrier Sense* [4 marks]
    - (ii) *Collision Detection* [4 marks]
    - (iii) *Collision Domain* [4 marks]



(b) Client A                      Switch I                      Router J                      Router K                      Server B

*Figure 1: An Internet Path between two End Systems, A and B*

The *traceroute* program may be used to determine an end-to-end *Internet Path* through a network. Explain (using appropriate diagrams) the set of packets that are exchanged when Client A uses *traceroute* to find the path to Server B. [8 marks]

3. (a) In what cases may an IP Router not forward the packets that are received? [4 marks]
- (b) The *Trivial File Transfer Protocol (TFTP)* may be used to provide a *reliable* service. What guarantees must a reliable protocol offer? [5 marks]
- (c) An *End System* sends 5 packets per second using the *User Datagram Protocol (UDP)* over a full duplex 100 Mbps Ethernet LAN connection. Each frame consists of 1500 bytes of Ethernet payload data. What is the throughput, when measured at the UDP layer? [8 marks]
- (d) Given that the Ethernet CRC-32 protects the integrity of frames sent across a *Local Area Network*, why does a transport protocol also include a checksum? [3 marks]

4. Consider the network shown in Figure 3:

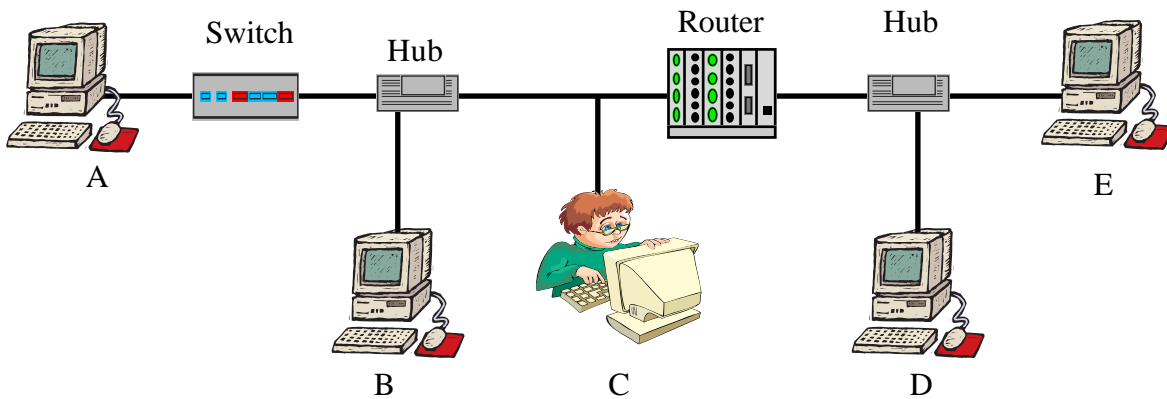


Figure 3: An Ethernet LAN

- The *End System C* uses the *Transmission Control Protocol (TCP)* with a payload of 100 bytes to send a packet to *End System E*. Sketch the Ethernet frame that is sent, ensuring that the sketch shows the addresses at **both the MAC and IP layers**. [6 marks]
- An *Internet Protocol* packet is broadcast by B. Which *End Systems* receive this? [2 marks]
- Outline the process of *Path Maximum Transfer Unit (MTU) Discovery* when *End System A* communicates with *End System E*. [4 marks]
- Explain in detail the operation of *Address Learning* by an Ethernet Switch. Your answer should refer to the network shown in Figure 3. [8 marks]

5.

```

0800 2086 354B 00E0 F726 3FE9 0800 4500
0028 AAFE 0000 FC06 3A55 8A84 E902 8B85
D96E 0017 9005 9431 1028 7214 F131 5010
2238 1C64 0000 0000 0010 0000
  
```

Figure 4: Hexadecimal dump of a TCP Packet received on an Ethernet interface

- What is the IP address of the *End System* that sent the packet shown in Figure 4? [4 marks]
- What is the value of the Ethernet Frame Type in the frame shown in Figure 4? Your answer must **also** describe the use of this value by the system that receives this frame. [4 marks]
- Explain what is meant by the term “*Preamble*” used by 10 Mbps Ethernet. [6 marks]

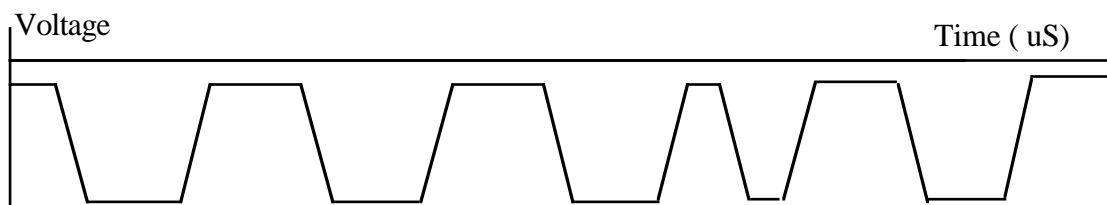


Figure 5: Waveform recorded on a coaxial Ethernet cable

- The waveform in Figure 5 shows was recorded on a coaxial Ethernet cable. Determine the number of bits before the *Start of Frame Delimiter (SFD)* shown in this Figure. [4 marks]
- Ethernet LANs traditionally used copper cable. Name two other media that may be used. [2 marks]