

UNIVERSITY OF ABERDEEN

SESSION 1997-98

Degree Examination in EG 3561 Communications Engineering

Xday X 1998 (??? - ???)

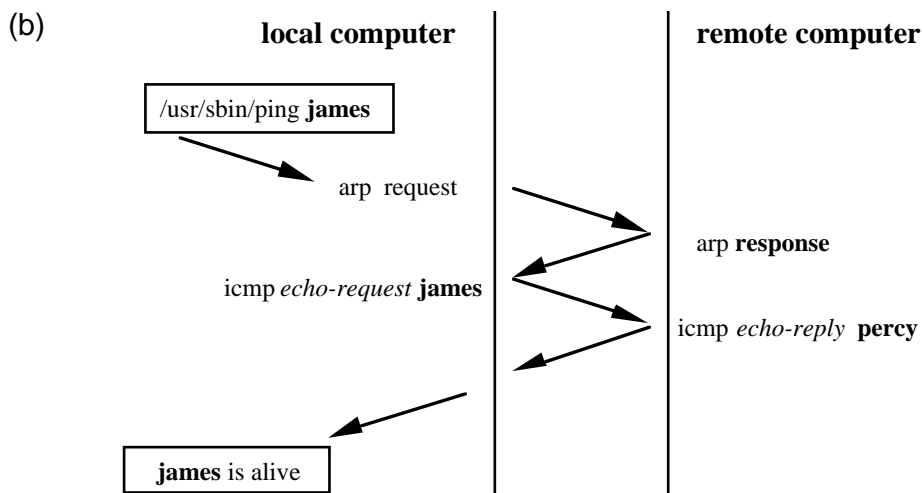
*Notes: Candidates are permitted to use approved calculators
An information sheet of protocol headers is provided*

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

1. (a) The Open Systems Interconnection (OSI) reference model describes some protocols as *End-to-End* and some as *Link-by-Link* (also known as *Hop-by-Hop*). Explain these two terms, and provide an appropriate diagram to illustrate End-to-End and Link-by-Link communication. [8 marks]
- (b) A Universal Datagram Protocol (UDP) packet is sent via an Ethernet network. Draw a diagram to show the frame of data. Your diagram should include all the protocol headers. [4 marks]
- (c) What is the purpose of a pre-amble and why is it sometimes needed for synchronous communications? [2 marks]
- (d) A client program sends one UDP packet with 60 B of data each second to a server and receives a corresponding reply also with 60 B of data. The client and server are connected by a 10B2 Ethernet Local Area Network (LAN). Calculate the total number of bits sent via the Ethernet network by this program in each second, and therefore the *Utilisation* of the LAN. [6 marks]
2. (a) Explain the properties of the *Physical Layer as defined by Open Systems Interconnection (OSI) Reference Model*. [4 marks]
- (b) Provide a description of the following terms:
 - (i) *Asynchronous Transmission*
 - (ii) *Synchronous Transmission*
 - (iii) *Non Return to Zero (NRZ)*
 - (iv) *Encoded Clock*
 [8 marks]
- (c) Compare the properties of *Alternate Mark Inversion (AMI)* and *Manchester* encoding. [4 marks]
- (d) Plot the waveform which you would observe on an oscilloscope when a byte with the hexadecimal value of 0x57 is transmitted along an Ethernet coaxial cable. [4 marks]

Continued overleaf

3. (a) A link using the *High Level Data Link Control* (HDLC) protocol may provide either a best effort or a reliable transmission service. In this context, define what is meant by *Best Effort* and *Reliable*. [6 marks]
- (b) What type of service is provided by the *Internet Protocol* (IP)? [1 mark]
- (c) Provide a detailed description of *Stop and Wait Error Recovery*. Your answer should include a frame transition diagram showing two cases: normal operation, and recovery following a transmission error. [8 marks]
- (d) HDLC uses a continuous transmission mode. Explain how this improves the throughput performance compared to Stop and Wait error recovery over links with a high bandwidth delay product. [5 marks]
4. (a) Explain in detail the operation of an *Ethernet bridge* when used to connect two Ethernet LAN segments. [6 marks]
- (b) Provide a description of the key differences between a *10BaseT hub*, an *Ethernet Bridge*, and an *IP Router*. Your answer should include appropriate diagrams and may include a table comparing the features provided by each equipment. [8 marks]
- (c) Ethernet supports *Broadcast*, *Unicast* and *Multicast* transmission modes, explain in detail what is meant by each term. [6 marks]
5. (a) The following terms are used when describing the Internet Protocol. Define the following terms:
- (i) *Internet Protocol* (IP) Network Address
 - (ii) Fragmentation (or Segmentation)
 - (iii) *Maximum Transmission Unit* (MTU)
 - (iv) IP Router
- [8 marks]



The *Address Resolution Protocol* (ARP) is used when a local computer (with *Medium Access Control* (MAC) address x) wishes to communicate with a remote computer (with mac address y). Redraw the diagram above and provide notes to give a detailed explanation of the operation of ARP. Ensure you specify each of the MAC addresses in each frame. [6 marks]

(c) Outline the protocol headers which are present in each of the four Ethernet frames and calculate the total size of each frame, given the ICMP payload data is 100 B. [6 marks]