

Degree Examination in ES 3567 Communications Engineering 1B

XXXday XXth XXX 2008 (2:00 pm - 5:00 pm)

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 FOUR questions. All questions carry 25 marks.

1. (a) Provide a diagram that shows the *Open Systems Interconnection (OSI)* layers and describes the role of the network layer in communicating between systems. [6 marks]
- (b) Explain the function of the 16-bit *Port* field in the *User Datagram Protocol (UDP) transport protocol*. [3 marks]
- (c) An Ethernet frame (represented below in hexadecimal) is recorded by a network monitor.


```
08 00 20 00 70 df 08 00 20 01 62 f0 08 00 45 00
00 1e 4a 02 00 00 3c 17 84 53 8b 85 cc 16 8b 85
cc 13 06 1b 04 25 00 0A 00 00 42 42
```

Explain how this frame may be decoded to find the *Service Access Point* added by each protocol layer, and hence determine the set of protocols that were used. [5 marks]
- (d) What is the purpose of the *Link Layer Cyclic Redundancy Check, CRC*? [3 marks]
- (e) What constraints were faced when *Fast Ethernet* was introduced using the twisted pair cable technology and how were these overcome using new encoding methods? [8 marks]
2. (a) Explain how the *Trivial File Transfer Protocol* may be used to copy data between systems in a *Local Area Network*. Your answer must include appropriate diagrams. [6 marks]
- (b) Explain how a *router* can use the information in its *routing table* to redirect traffic around a failed *Link*. [5 marks]
- (c) Explain the term “*circuit-switched*” in the context of a *network*. [4 marks]
- (d) Explain the term “*packet-switched*” in the context of a *network*. [4 marks]
- (e) What features are introduced by TCP that extend the basic service offered by UDP? [6 marks]

continued over

3. (a) Describe the multiple access algorithm that is used to send a frame using an *Ethernet Network Interface Card (NIC)* connected to a shared Ethernet segment [10 marks]
- (b) Some modern Ethernet links support a larger Maximum Transmission Unit (MTU), how do end systems know whether they should use the larger MTU? [10 marks]
- (c) A system sends two *Internet Control Message Protocol (ICMP)* messages with 1000 bytes of data each second over a 10 Mbps cable segment. What is the resulting utilisation? [5 marks]

4. Figure 1 shows two computers A and B that are connected to a *switch* (Node I) and one computer C connected to a *hub* (Node II). Node III is a *router*.

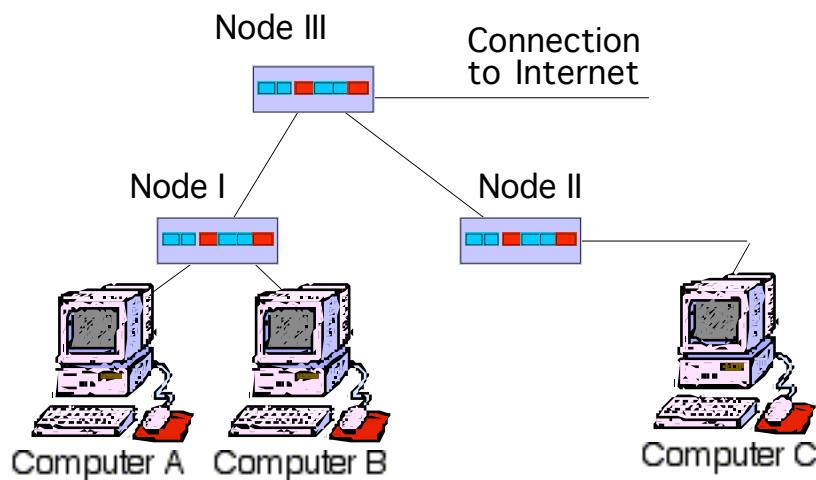


Figure 1: Three computers connected using 3 Intermediate Systems

- (a) Computer A sends an *IP broadcast packet*. Which computers receive this packet?[4 marks]
- (b) Explain how Computer B uses the *Address Resolution Protocol* to determine the *Medium Access Control (MAC)* address to be used when sending a packet towards system C. [6 marks]
- (c) Explain the information used by a *bridge I* to forward the Ethernet frames that it receives. [6 marks]
- (d) Explain the function of:
 (i) The Ethernet *Source Address* field [2 marks]
 (ii) The Internet Protocol *Time To Live (TTL)* field [2 marks]
 (iii) The Ethernet *Start of Frame Delimiter* [2 marks]
- (e) Explain how the source address is allocated to computers within a Local Area Network. [3 marks]

continued over

5. (a) What is meant by the term *Throughput* and how does this relate to the performance of a protocol layer? [2 marks]
- (b) A computer sends 50 packets per second to computer B with a total frame size of 1300 Bytes. This size includes all headers added during transmission. The packet was sent using the User Datagram Protocol (UDP). What is the *throughput* when measured at the *transport layer*? [5 marks]

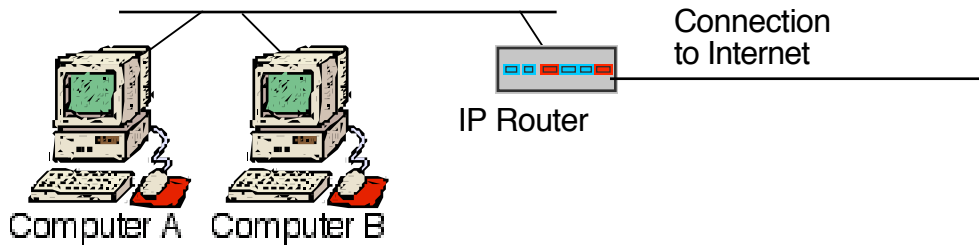


Figure 2: Two computers connected to an IP Router

- (c) Explain (with diagrams) the operation of the *traceroute* tool, which may be used to determine which other routers are along the *path* to a specific destination. [8 marks]
- (d) What is the *Domain Name Service (DNS)*, and how may it be used by computer A to identify the IP address associated with a particular *name*. [10 marks]