UNIVERSITY OF EDINBURGH

FACULTY OF SCIENCE AND ENGINEERING

COMPUTER SCIENCE THREE

COMPUTER COMMUNICATIONS

Thursday 25 May 2000

09:30 to 11:00

Examiners:

Prof. K. Turner (External)

Prof. G. Brebner (Chairman)

INSTRUCTIONS TO CANDIDATES

Answer any TWO questions.

All questions carry equal weight.

1. (a) In most protocols for implementing connection-oriented services, each message carrying user information also carries a sequence number. Explain the main facilities that can be enabled by this feature. [*9 marks*]

   (b) *Source routing* is a technique that can be used in message switching networks: each message carries an ordered list of all the switching computers that it should pass through on the path between its source and destination. Discuss the merits and demerits of this approach, compared with one in which messages only carry the address of their destination. [*8 marks*]

   (c) In some protocols, each message carries a 'time to live' value, which is meant to indicate for how many more seconds the message is allowed to exist within a network or inter-network; if this number reaches zero, the message is destroyed. Discuss the problems involved in implementing, and using, such a facility. [*8 marks*]

2. (a) Consider a local area network (LAN) that provides a message broadcasting service, based on a physical bus that interconnects the computers of the network. Explain what is meant by *medium access control* (MAC), and outline three possible MAC schemes, based on the following three arrangements:

   i. one computer being designated as a master for the network;

   ii. the computers directly collaborating with one another; and

   iii. the computers obeying certain rules, but in isolation. [*11 marks*]

   (b) Explain why most modern bus-based LANs have a hub-style (star topology) physical arrangement, rather than having a physical bus that passes nearby each of the computers on the network. [*5 marks*]

   (c) Suppose that two next-door student flats each contain a LAN, of unknown type, connecting the students' personal computers together. Discuss the problems that might be involved in connecting the two LANs together to form a small inter-network, and suggest practical solutions. [*9 marks*]

3. (a) Describe the structure of the ISO Reference Model for Open Systems Interconnection (RM/OSI), including a brief outline of the role and the present-day relevance of each layer in the model. [*12 marks*]

   (b) Consider the problem of reliably and securely transmitting an e-mail message from a large computer in Manchester to a palmtop computer being carried by an adventurer walking unaided across the Antarctic towards the South Pole. Discuss how the communication protocol functions required might fit into the layers of the OSI model. [*8 marks*]

   (c) Explain the role of data compression in computer communications, and comment on which layers of the OSI model might include data compression as a function. [*5 marks*]