UNIVERSITY OF EDINBURGH

FACULTY OF SCIENCE AND ENGINEERING

COMPUTER SCIENCE THREE

COMPUTER COMMUNICATIONS

Monday 9 September 2002

14:00 to 15:30

Examiners:

Prof. K. Turner (External)

Prof. C. Stirling (Chairman)

INSTRUCTIONS TO CANDIDATES

Answer any TWO questions.

All questions carry equal weight.

1. (a) Consider the following three phenomena relating to absolute time:

   i. synchronous bit transmission;
   ii. timeouts on acknowledgements; and
   iii. message expiry times.

   For each, give examples of usage in computer communications, indicating how the absolute time periods are measured. [*12 marks*]

   (b) Explain how a sliding window flow control mechanism works, and how the choice of window size depends on absolute round-trip times. [*6 marks*]

   (c) A multi-national company has one computer that has direct access to a device that provides the current time of day to microsecond accuracy. Discuss how the company might implement a service that makes an accurate time of day available to all computers attached to its company-wide inter-network. [*7 marks*]

2. (a) Consider the problem of routing messages through a message switching network. Describe the features that routing strategies might have to exhibit, indicating how these features relate to operational requirements. [*7 marks*]

(b) Two possible approaches to sharing network status information are, respectively:

- *distance vector*: switches exchange their entire routing tables with their immediate neighbours in the network; and
- *link state*: switches broadcast (to all computers in the network) information about the current quality of their links to immediate neighbours.

Explain how these schemes can form the basis of adaptive routing strategies, and compare and contrast their usefulness in satisfying potential operational requirements. [*8 marks*]

(c) Suppose that two message switching networks are to be connected together to form a simple inter-network, the connection being made via a single computer that has a link to each network. One network offers a connection-oriented service that delivers short fixed-length messages with pre-determined guarantees on delivery time and message loss rate for any connection. The other network offers a connectionless service that delivers messages of any size up to 8192 bytes on a 'best effort' basis. Discuss two possible types of service that the inter-network might sensibly provide, describing the work that the intermediate computer will have to do in each case, and stating any assumptions that you make. [*10 marks*]

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

   (b) The Manufacturing Automation Protocol (MAP) stack of protocols relates closely to the layers of the RM/OSI model. Explain why this is so, and how MAP fits into the layers of the RM/OSI model. [*5 marks*]

   (c) Outline how the overall operation and use of a TCP/IP inter-network might be viewed in terms of the RM/OSI model. [*8 marks*]