

# 1999 Paper 13 Question 3

## Digital Communication I

What is a *hierarchical address space*? Give an example of an address space which is hierarchical and one which is not. [3 marks]

What is the Address Resolution Protocol? Describe its operation when used to resolve IP addresses to Ethernet addresses. Pay particular attention to the freshness of information. [7 marks]

Information is transferred via a long, error-prone communication link. The link has a data rate of 10 Mbps and a constant delay. The bit error rate on the link is 1 bit in  $10^4$ . A forward error correcting coder is available which can act in the following settings:

Data rate	Error rate	Code rate
10 Mbps	$10^{-4}$	unity (no coding)
5 Mbps	$10^{-5}$	half

A simple ARQ protocol is used over the link. Packets have 32-bit CRCs. You may assume that the undetected error rate is less than 1 in  $10^{20}$ , that is, effectively zero.

Information is sent in 1000-bit packets, with a window of one packet. At what link delay would it be beneficial to use the FEC coder? [10 marks]