

2005 Paper 5 Question 3

Digital Communication I

It is proposed to send information across a fixed delay channel using a simple (window of 1) ARQ protocol with a transmitter timeout of T . That is, if the transmitter does not receive an acknowledgement for a packet within time T of sending the packet, it retransmits.

The delay of the underlying channel is τ , the data rate is B and the packet size is p bits. Bit errors in the channel are independent and packets of size p have a packet error rate of e . Errors in the small acknowledgement packets are rare enough to be discounted in this analysis.

- (a) What is the expected throughput of the ARQ protocol if e is zero? [4 marks]
- (b) What is the expected throughput if e is non-zero, but small enough that e^2 is negligibly small? [4 marks]
- (c) How could a forward error code help the throughput of the ARQ scheme? [2 marks]
- (d) What is meant by the term *code rate* of a forward error code? [2 marks]
- (e) What code rate must a code which squared the error rate have in order to improve throughput of the ARQ scheme? [4 marks]
- (f) If the forward error coder adds delay, how will this affect performance? [4 marks]