Principles of Communications

Supervision Questions Set 3:
Errors, Flow Control and Control Theory

Marks are given for guidance only. The exam questions are intended to be optional and it is left up to your supervisor whether they will require you to do them or not.

July 2012

1. Consider the following code:

Message Symbol	Code
a	00
b	001
c	1
d	11

   (a) What are the possible symbols that correspond to the code string 0011?[1] *(2 Marks)*

   (b) What are the possible symbols that correspond to the code string 1100? *(1 Mark)*

   (c) Is the code instantaneous? Explain how you can easily check this. *(2 Marks)*

2. Most communication systems employ some form of error control

   (a) Why is error control needed? *(2 Marks)*

   (b) What is the difference between error correction and error detection? Explain how the Hamming distance allows you to classify codes. *(3 Marks)*

   (c) Describe four types of packet errors. *(4 Marks)*

   (d) For each of the error types identified above describe a simple solution. *(4 Marks)*

3. TCP opens new sessions using a 3-way handshake.

   (a) Describe the 3-way handshake in detail. *(4 Marks)*

   (b) Explain how the 3-way handshake improves error control, flow control and reduces the chances of certain classes of attack. *(4 Marks)*

   (c) Why does TCP use a 4-way exchange to close the connection? *(4 Marks)*

4. An ISP (Comcast perhaps :) decides to limit the rate of P2P traffic to a maximum of $r\%$ in any given link. If this is exceeded the ISP sends TCP reset packets to the P2P connection endpoints.[2]

   (a) Explain how this reduces the rate of P2P traffic. *(4 Marks)*

   (b) Using control theory identify the plant, the command, the control input, the disturbance and the output. *(6 Marks)*

   (c) Give a state space representation of this system. Assume that the control rule is to reduce the number of P2P connections by u connections over a time period T whenever the P2P fractions exceeds $r\%$. *(5 Marks)*

   (d) Find the transfer function for the system when the congested link has more than $r\%$ P2P traffic. *(5 Marks)*

Exam Question

2011 Paper 9, Question 9

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[1]from Keshav Ch.9 Ex.3
[2]Taken from Keshav Chapter 8 Exercises 1, 3 & 4