Comp 7005 – Data Communication Principles

Assignment Three – November, 2009

Due Date: 1730 hrs - Tuesday, November 17, 2009

Criteria: You may work in groups of two. Assignments must be word-processed and submitted by the date and time specified above.

Note: Clearly state any assumptions that you make in the solution of any of the questions. Substantiate your answers and show all your work for each problem – the answer alone is insufficient to receive credit for the question.

Section A

Work out the following problems in your textbook:
Chapter 4: P22.

Step	*N'*	*D(s),p(s)*	*D(t),p(t)*	*D(u),p(u)*	*D(v),p(v)*	*D(w),p(w)*	*D(y),p(y)*	*D(z),p(z)*
0	X	∞	∞	∞	3,x	6,x	6,x	∞
1	xv	∞	7,v	6,v	3,x	6,x	4,v	∞
2	xvy	∞	7,v	6,v	3,x	6,x	4,v	18,y
3	xvyu	10,u	7,v	6,v	3,x	6,x	4,y	18,y
4	xvyuw	10,u	7,v	6,v	3,x	6,x	4,y	18,y
5	xvyuwt	8,t	7,v	6,v	3,x	6,x	4,y	12,t
6	xvyuwts		8,t	7,v	6,v	3,x	6,x	4,y 12,t
7	xvyuwtsz		8,t	7,v	6,v	3,x	6,x	4,y 12,t

Chapter 5: P14

Wait for 51,200 bit times. For 10 Mbps, this wait time is:

$$\frac{51.2\times10^{3}\,bits}{10\times10^{6}\,bps}=5.12\text{msec}$$

For 100 Mbps, the wait is 512 µsec.

Chapter 5: P15.

At $t = 0$ A transmits. At $t = 576$, A would finish transmitting. In the worst case, B
begins transmitting at time $t = 224$. At time $t = 224 + 225 = 449$ B 's first bit arrives at
A . Because $449 < 576$, A aborts before completing the transmission of the packet, as it
is supposed to do.

Thus A cannot finish transmitting before it detects that B transmitted. This implies that if
A does not detect the presence of a host, then no other host begins transmitting while A
is transmitting.

Section B

1. Assume that you have been given the following information for a system link:

   Frequency of operation = 2.45 GHz
   Transmit power = 15 dBm (Output power of the transmitting access point)
   Connector + Cable loss = 3 dB (applied at both the transmit and receive ends)
   Transmit/Receive antennae gain = 9 dBi
   Receive power = Assume that the receiver gets the minimum required signal to meet its sensitivity specification (-50 dBm for a typical access point at 54 Mbit/s)
   Distance = 1 Km.

   Determine the link budget for this system. Comment on whether or not this is enough of a margin for the system to function reliably.

   Use the Link budget equation: **-23 dB – This is clearly not enough. We require at least a 5 dB margin for system to work properly.**

2. A LinksysWRT-54G 802.11g wireless base station/router transmits 20 mW into a monopole antenna (assume antenna gain = 1.5 dBi). The signal is received by a laptop with antenna gain -1.5 dBi. Express your answers to the following questions in both mW and dBm.

   (a) Estimate the received power at 200 m for free-space propagation.

   P_R = -103.2 dB => -73.2 dBm

   (b) Estimate the received power at 2 km for free-space propagation.

   P_R = -123.2 dB => -93.2 dBm

   (c) Suppose that we need a minimum received power of -80 dBm for the receiver at the laptop to properly work. Determine whether the receiver will work at the distances in (a) and (b).

   - **for a sensitivity of -80 dBm,**

   (a). P_R = -73.2 dBm > -80 dBm; will work
   (b). P_R = -93.2 dBm < -80 dBm; will not work

   (d) Now suppose that you replace the monopole antenna in the Linksys router by a parabolic dish antenna with gain 15 dBi. Repeat (a), (b), and (c).

   GT = 15 dBi

   (a). P_R = -59.7 dBm > -80 dBm; will work
   (b). P_R = -79.7 dBm > -80 dBm; will not work but barely! Not much of a margin here.