CPEG 572 Data and Computer Communications

ASSIGNMENT #4

CH 6

Q.1

We have 14 sources, each creating 500 8-bit characters per second. Since only some of these sources are active at any moment, we use statistical TDM to combine these sources using character interleaving. Each frame carries 6 slots at a time, but we need to add 4-bit addresses to each slot. Answer the following questions:

1. What is the size of an output frame in bits?
   Number of slots * (character size + slot address)
   6 * (8 + 4) = 72 bits
2. What is the output frame rate?
   Let's assume, we have 6 input lines and each line send a character. Hence the frame rate should be 500 frames per second.
3. What is the duration of an output frame?
   Frame duration = $\frac{1}{frame\ rate} = \frac{1}{500} = 0.002\ \text{sec} = 2ms$
4. What is the output data rate?
   Data rate = frame rate * bits per frame = 500 * 72 = 36,000 bps

Q.2

What is the minimum number of bits in a PN sequence if we use FHSS with a channel bandwidth of B = 4 KHz and Bss = 100 KHz?

$$\frac{Bss}{B} = \frac{100}{4} = 25$$

So, we require $\log_2 25 = 4.64$

Q.3

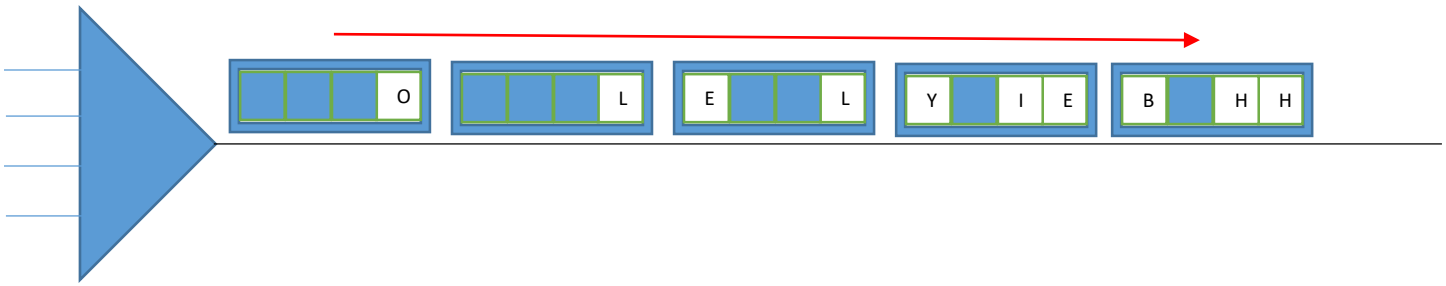
We have a digital medium with a data rate of 10 Mbps. How many 64-kbps voice channels can be carried by this medium if we use DSSS with the Barker sequence?
Barker sequence has 11 bits. It will increase the bit rate 11 times.
So a voice channel of 64 kb would require, 64 * 11 = 704 kbps. So the channels can carry $\frac{10{,}000}{704} = 14.02$

Q.4

Show the contents of the five output frames for a synchronous TDM multiplexer that combines four sources sending the following characters. Note that

the characters are sent in the same order that they are typed. The third source is silent.

1. Source 1 message: HELLO
2. Source 2 message: HI
3. Source 3 message:
4. Source 4 message: BYE



Q.5

Which of the three multiplexing techniques is (are) used to combine analog signals? Which of the three multiplexing techniques is (are) used to combine digital signals?

Analog signals

- frequency-division multiplexing
- wavelength-division multiplexing

Digital Signals

- time-division multiplexing

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ASSIGNMENT #4

CH7

Q.6

A light signal is travelling through a fiber. What is the delay in the signal if the length of the fiber-optic cable is 10 m, 100 m, and 1 Km (assume a propagation speed of 2 × 108 m)?

$Speed = 2 * 10^8$

$$Delay = \frac{Distance}{Speed} = \frac{10}{2 * 10^8} = 0.00{,}000{,}005$$

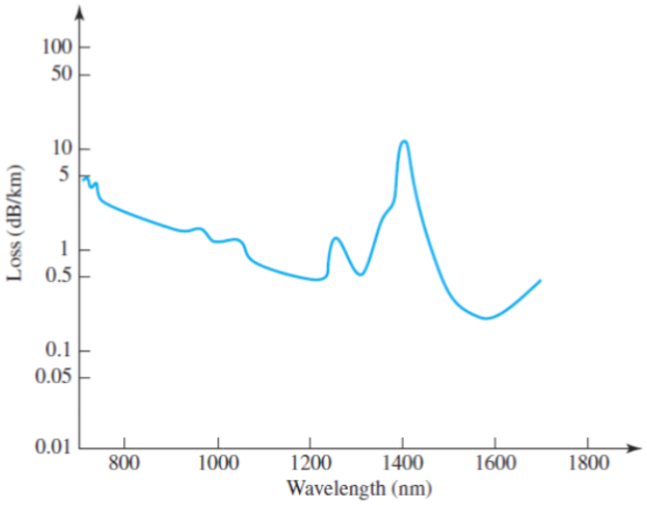
$$Delay = \frac{Distance}{Speed} = \frac{100}{2 * 10^8} = 0.0{,}000{,}005$$

$$Delay = \frac{Distance}{Speed} = \frac{1{,}000}{2 * 10^8} = 0.000{,}005$$

Q.7

Using Figure below, tabulate the attenuation (in dB) of an optical fiber for the indicated wavelength and distances

Figure 7.16 *Optical fiber performance*



Distance	***dB at 800 nm***	***dB at 1000 nm***	***dB at 1200 nm***	***dB at 1200 nm***
1Km	-1	-1.1	-0.5	-0.5
10Km	-30	-11	-5	-5
15Km	-45	-16.5	-7.5	-7.5
25Km	-60	-22	-10	-10

Q.8

Calculate the bandwidth of the light for the following wavelength ranges (assume a propagation speed of 2 × 108 m):

Propagation speed = $2 * 10^8$
Wavelength range = 1,000 to 1,200
= $1{,}000 * 10^{-9} m \; to \; 1{,}200 * 10^{-9} m$
Therefore, bandwidth

$$B = \left(\frac{2*10^8}{1{,}000*10^{-9}}\right) - \left(\frac{2*10^8}{1{,}200*10^{-9}}\right)$$

$$B = 3.3 * 10^{13} m$$

$$B = 33 \; THz$$

Wavelength range = 1,000 to 1,400
= $1{,}000 * 10^{-9} m \; to \; 1{,}200 * 10^{-9} m$
Therefore, bandwidth

$$B = \left(\frac{2*10^8}{1{,}000*10^{-9}}\right) - \left(\frac{2*10^8}{1{,}400*10^{-9}}\right)$$

$$B = 5.7 * 10^{13} m$$

$$B = 57 \; THz$$