2014

Minia University
Faculty of Engineering
Comp. & Sys. Engineering Dept., 3rd year

Data transmission
Final Exam
Time allowed: 3 hours

Assume any missing data

Question 1

a. Define the following terms:
Digital signal, modulation rate, transmission time, propagation delay, bit stuffing

b. Draw the block diagram of the QPSK system stating the expression of the output function of the system. Draw the waveform of the output of the system if the input bit stream is 1011000111.

Question 2

a. What is the difference between each of the following pairs:
i. Periodic signal and aperiodic signal.
ii. Fourier series and Fourier transform.
iii. Synchronous transmission and asynchronous transmission.

b. For the bit stream 01001110, sketch the waveforms for each of the following codes

NRZI, Bipolar-AMI, Pseudoternary, Manchester, and Differential Manchester

Assume that the signal level for the preceding bit for NRZI was high; the most recent preceding 1 bit (AMI) has a negative voltage; and the most recent preceding 0 bit (pseudoternary) has a negative voltage.

Question 3

a. The most common error control techniques are based on some scenarios which are referred to as automatic repeat request (ARQ).
i. What are these scenarios?
ii. With brief discussion, what are the versions of ARQ?

b. Consider an audio signal with spectral components in the range 300 to 3000 Hz. Assume that a sampling rate of 7000 samples per second will be used to generate a PCM signal.
i. For SNR = 30 dB, what is the number of uniform quantization levels needed?
ii. What is the capacity of the channel required to carry this signal?

Question 4

a. Write short notes showing the advantages and disadvantages of each of the following transmission media
i. Twisted pair.
ii. Coaxial cable.
iii. Optical fiber

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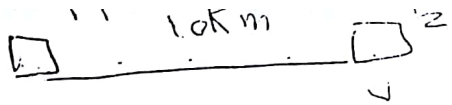

$$\text{attenuation} = \frac{\text{gain}}{\text{distance}} = 10\log_{10}\frac{P_1}{P_{1/3}} = 10\log 3 = 4.77 \text{ dB/Km}$$

(b) **A digital signal propagates on a high attenuation transmission line. The power of the signal is measured at an arbitrary point (P1) on the transmission line and after a distance of 10 Km it is measured again. At the second point, it is found that the power decreased to the third of its value at P1.**

i. **Calculate the attenuation in dB/Km.**
ii. **How could we compensate for the attenuation effect to improve the signal quality.**
iii. **If the signal is analog, how could we decrease the attenuation effect?**

Question 5

a. **Draw the frame structure of the high-level data link control (HDLC) with explanation of the function of each data field.**

(b.) **Consider a 200-m optical fiber link operating at 1 Gbps. The velocity of propagation of optical fiber is typically about 3×10^8 m/s. Assuming a frame of 8000 bits length is required to be transmitted over the link.**

i. **What is the value of propagation delay over this link?**
ii. **What is the transmission time of the frame?**
iii. **If the stop-and-wait flow control is used, what is the total time is required to transmit one frame and receive an acknowledgment?**
iv. **Repeat i, ii, and iii if the frame size become 500 bits. What is your comment on the results.**

With my best wishes

Propagation delay $a = \frac{B}{L}$ $\quad B = R\frac{d}{V} \Rightarrow 1\times10^9 * \frac{200}{3\times10^8} = \frac{2000}{3} = 666.$

$$a = \frac{666.66}{8000} = 0.083 \qquad \boxed{0.08 < 1}$$

iv $a \Rightarrow \frac{666.66}{500} = \boxed{1.3 > 1}$

HDLC

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