B0629021

IT3031: Communication Systems Quiz#1 Date: April 1st, 2020

The following formulae may be needed in these examination questions.
(1) $C = B\log_2(1+\text{SNR})$, (2) $R = 2B\log_2 L$, (3) $S = cN\frac{1}{r}$, and (4) $\text{dB} = 10\log_{10}\frac{P_2}{P_1}$

1. As we know, in telecom company, the term 'telecommunication' stands for the technology of conveying waves from one to another; however, the term 'data communication' stands for the data conveying among computers. Now we need you to explain the main difference between the term telecommunication and the term data communication in terms of technology and the content they transfer. (10 pts)
2. Compare the difference between terms 'analog' and 'digit.' (10 pts)
3. Assume, in vacuum, light is propagated with a speed 3×10^8 m/s. Let the light be carried into a frequency of 4 MHz. Please calculate the wavelength of the light in air. (10 pts)
4. Draw the time and frequency domains of a nonperiodic signal and a periodic signal. (10 pts)
5. Explain what low-pass channels (baseband transmission) and the bandpass channels (broadband transmission) are. (10 pts)
6. What does the term 'fundamental frequency' or 'first harmonic' mean? (10 pts)
7. Can an analog signal be a periodic signal? Why? (5 pts)
8. ~~Can an analog signal be a nonperiodic signal? Why? (5 pts)~~
9. Can a digital signal be a periodic signal? Why? (5 pts)
10. Can a digital signal be a nonperiodic signal? Why? (5 pts)
11. The power of a signal is 10 mW and the power of the noise is 1 μW; what are the values of SNR and SNR_{dB}? (10 pts)
12. We have a channel with a 1-MHz bandwidth. The SNR for this channel is 63. What are the appropriate bit rate? (10 pts)

$C = B \cdot \log_2(1+\text{SNR})$ $\quad R = 2 \cdot B \cdot \log_2 L$

$= 10^6 \cdot \log_2(1+63)$

$= 10^6 \cdot \log_2 2^6$

$= 6 \cdot 10^6$

$4M = 2 \cdot 10^6 \cdot \log_2 L$

$\log_2 L = \frac{4}{2} = 2$

$L = 4$

IT3031: Communication Systems Final Exam Date: June 17, 2020

The following formulae may be needed in these examination questions.

(1) $C = B\log_2(1+\text{SNR})$, (2) $R = 2B\log_2 L$, (3) $S = cN\frac{1}{r}$, and (4) $\text{dB} = 10\log_{10}\frac{P_2}{P_1}$ (5) $2kN+k\left(\frac{N}{n}\right)^2$

1. Multiplexing is a set of techniques that allows the simultaneous transmission of multiple signals across a single data link. As we discussed in the class, there are 3 categories of multiplexing. Please give these 3 kinds of categories of multiplexing techniques. (10 pts)

2. For the guided media, the twisted-pair cable has 2 different types of cables, one is UTP and the other one is STP. Explain what UTP is and what STP is? (10 pts)

3. What is the spread spectrum technology used for? Please illustrate the difference between the DSSS and FHSS and give an example of technology we use today to each one of them? (10 pts)

4. Use two-dimensional parity-check encoding to encode 0111011, 1010111, 0101000, 0111000. (10 pts)

5. Find the minimum Hamming distance of the codewords 11110, 00000, 01011, and 10101? (10 pts)

6. Support we have minimum Hamming distance value of 4 codewords. For how many bits error a codeword can a receiver detect? And up to how many bits error a codeword can a receiver correct? (10 pts)

7. If you want to design a 80×80 switch ($N = 80$), you have to use 6,400 crosspoints inside the switch. However, the use of 6,400 crosspoints inside a switch will greatly increase the cost of the switch. One way to decrease the amount of crosspoints is to use a three-stage design to implement the switch. If we expect to design a reduce the number of crosspoints to be 1,020 crosspoints, illustrate how you design it. Hint: $2kN + k(\frac{N}{n})^2$, where k represents the number of crossbars and n is the number of lines of a crossbar. To fulfill this question you have to draw your design as well as show your calculation process. (20 pts)

8. Use the cyclic redundancy check (CRC) to encode a dataword 1001101011. The divisor 1011 is chosen. Please show the division in CRC encoder if you want to encode the dataword. What is your codeword finally? Your calculation process is needed. (10 pts)

9. The most important responsibilities of the data link layer are flow control and error control. There are five common used flow control and error control protocols: Stop-and-Wait, Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, and Simplest. Which of them are used for noiseless channel and which of them are used for noisy channel? (10 pts)

B5679021

IT3031: Communication Systems Midterm Date: April 29th, 2020

The following formulae may be needed in these examination questions.
(1) $C = B\log_2(1+\text{SNR})$, (2) $R = 2B\log_2 L$, (3) $S = cN\frac{1}{r}$, and (4) $\text{dB} = 10\log_{10}\frac{P_2}{P_1}$

1. Explain the following terms. (20 pts)
   (a) Baseband transmission
   (b) Line coding
   (c) Baud rate
   (d) Attenuation
   (e) Distortion
   (f) Baseline wandering
   (g) DC components
   (h) Self-synchronization
   (i) Multiplexing
   (j) Direct Sequence Spread Spectrum

2. What are the propagation time and the transmission time for a 2.5-kbyte message (a text file) if the bandwidth of the network is 1 Gbps? Assume that the distance between the sender and the receiver is 12,000 km and that light travels at 2.4×10^8 m/s. (5 pts)

3. We need to send 640 kbps over a noiseless channel with a bandwidth 40 kHz. How many signal levels do we need? (5 pts)

4. A telephone normally has a bandwidth of 3000 Hz (300 to 3300 Hz) assigned for data communications. The signal-to-noise is usually 4095. What is the theoretical highest bit rate of the regular telephone line? (5 pts)

5. A signal is carrying data in which one data element is encoded as one signal element ($r = 1$). If the bit rate is 100 kbps, what is the average value of the baud rate if c is assumed as 1/2? (5 pts)

6. The attenuation of a signal is -10dB. What is the final signal power if it was originally 5W? (5 pts)

7. What is the total delay (latency) for a frame of size 5 million bits that is being sent on a link with 10 routers each having a queuing time of $2\mu s$ and a processing time of $1\ \mu s$. The length of the link is 2000 Km. The speed of light inside the link is 2×10^8 m/s. The link has a bandwidth of 5 Mbps. Which component of the total delay is dominant? Which one does dominant the transmission time? (10 pts)

8. What are causes of transmission impairment? Explain each one of them. (5 pts)

9. For the analog-to-digital conversion, one can adopt the PCM encoder to convert the analog signal to digital data by 3 steps. Explain these 3 steps in details. (6 pts)

10. Assume the line coding scheme eight binary, six ternary (8B6T) is taken for 100BASE-4T communication usage. How many signal patterns (combinations) are available for use of the 8B6T? How many data patterns will be used if we want to present a 8-bit long data? (10 pts)

11. Draw the data stream 11010100 00001110 with graph of following schemes. (24 pts)

(a) NRZ

(b) NRZ-I (the previous state is positive)

(c) RZ

(d) Manchester

(e) Differential Manchester (the previous state is positive)

(f) AMI

(g) Pseudoternary (the initial zero is positive)

(h) Multilevel: 2B1Q scheme (its previous level is positive)

	Previous level: positive	Previous level: negative
Next bits	Next level	Next level
00	+1	−1
01	+3	−3
10	−1	+1
11	−3	+3