

**Q.** Television channels are 17 MHz wide. How many bits/sec can be sent if 64-level digital signals are used? Assume a noiseless channel.

**A.**

Mbps

Show Answer 204

**Q.** If a binary signal is sent over a 15-kHz channel whose signal-to-noise ratio is 22 dB, what is the maximum achievable data rate?

**A.**

kbps

Show Answer 30

**Q.** 8 signals, each requiring 5000 Hz, are multiplexed on to a single channel using FDM. How much minimum bandwidth is required for the multiplexed channel? Assume that the guard bands are 200 Hz wide.

**A:**

Hz

Show Answer 41400

**Q.** Suppose that A, B, and C are simultaneously transmitting 0 bits, using a CDMA system with the chip sequence of figure following:

|             |                              |
|-------------|------------------------------|
| A: 00011011 | A: (-1 -1 -1 +1 +1 -1 +1 +1) |
| B: 00101110 | B: (-1 -1 +1 -1 +1 +1 +1 -1) |
| C: 01011100 | C: (-1 +1 -1 +1 +1 +1 -1 -1) |
| D: 01000010 | D: (-1 +1 -1 -1 -1 -1 +1 -1) |
| (a)         | (b)                          |

What is the resulting chip sequence?

Show Answer (+3,+1,+1,-1,-3,-1,-1,+1)

**Q.** A CDMA receiver gets the following chips: (-1 +1 -3 +1 -1 -3 +1 +1). Assuming the chip sequences defined in figure following,

|             |                              |
|-------------|------------------------------|
| A: 00011011 | A: (-1 -1 -1 +1 +1 -1 +1 +1) |
| B: 00101110 | B: (-1 -1 +1 -1 +1 +1 +1 -1) |
| C: 01011100 | C: (-1 +1 -1 +1 +1 +1 -1 -1) |
| D: 01000010 | D: (-1 +1 -1 -1 -1 -1 +1 -1) |
| (a)         | (b)                          |

which stations transmitted, and which bits did each one send?

**A. Choose the best answer**

- Station A send ☐ sent bit 1 ☐ sent bit 0 ☐ silence
- Station B send ☐ sent bit 1 ☐ sent bit 0 ☐ silence
- Station C send ☐ sent bit 1 ☐ sent bit 0 ☐ silence
- Station D send ☐ sent bit 1 ☐ sent bit 0 ☐ silence

Show Answer sent bit 1

Show Answer sent bit 0

Show Answer silence

Show Answer sent bit 1

**Q.** A signal is transmitted digitally over a 4-kHz noiseless channel with one sample every 125  $\mu$ sec. How many bits per second are actually sent for each of these encoding methods?

**A.** 1) CCITT 2.048 Mbps standard:

kbps

**A.** 2) DPCM with a 4-bit relative signal value:

kbps

**A.** 3) Delta modulation:

kbps

Show Answer 64

Show Answer 32

Show Answer 8

**Q.** What is the percent overhead on a T1 carrier; that is, what percent of the 1.544 Mbps are not delivered to the end user? How about the E1 carrier ?

**A.** For the T1 carrier:

% (give your answer as an integer)

**A.** For the E1 carrier:

% (give your answer as an integer)

Show Answer 13

Show Answer 6

**Q.** A simple telephone system consists of two end offices and a single toll office to which each end office is connected by a 1-MHz full-duplex trunk. The average telephone is used to make four calls per 8-hour workday. The mean call duration is 6 min. Ten percent of the calls are long-distance (i.e., pass through the toll office). What is the maximum number of telephones an end office can support? (Assume 4 kHz per circuit.)

**A.**

Show Answer 50000

**Q.** What is the difference, if any, between the demodulator part of a modem and the coder part of a codec? (After all, both convert analog signals to digital ones.)

Show Answer A coder accepts an arbitrary analog signal and generates a digital signal from it. A demodulator accepts a modulated sine wave only and generates a digital signal.

**Q.** Why has the PCM sampling time been set at 125  $\mu$ sec?

Show Answer A sampling time of 125  $\mu$ sec corresponds to 8000 samples per second. According to the Nyquist theorem, this is the sampling frequency needed to capture all the information in a 4 kHz channel, such as a telephone channel. (Actually the nominal bandwidth is somewhat less, but the cutoff is not sharp.)