MIDTERM I

EE/TE4367 Telecommunications Switching & Transmission

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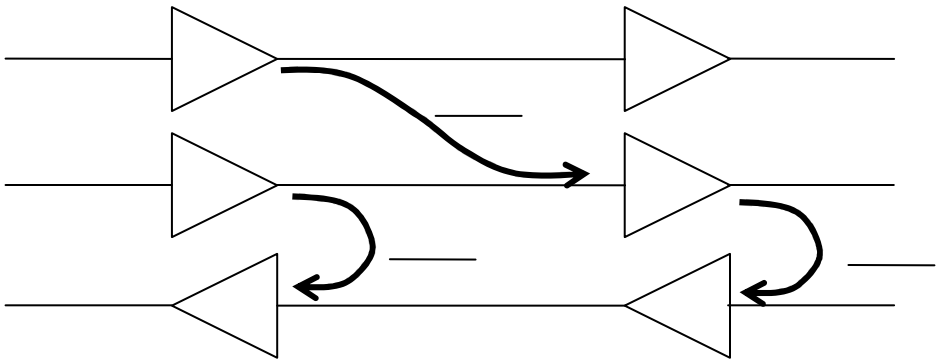
Problem 1. General, 30 points

(a) Describe FEXT and NEXT. Figure below illustrates NEXT and FEXT as they happen over transmission lines. Label the black arrows as appropriate (NEXT or FEXT) .

FEXT:

NEXT:



(b) The process of first compressing and then _____voice signal referred to as _____. One family of compression characteristics used in North American digital telephony network is _____characteristics. *(Fill up the blanks)*

(c) An idle-channel noise power measurement of 22 dBrnC occurs at -8 dB TLP. Express the noise power of this measurement in dBrnC0 and determine what power measurement this noise would produce at another point in the circuit that is designated as a -5 dB TLP.

Problem 2. Line Codes, 30 points

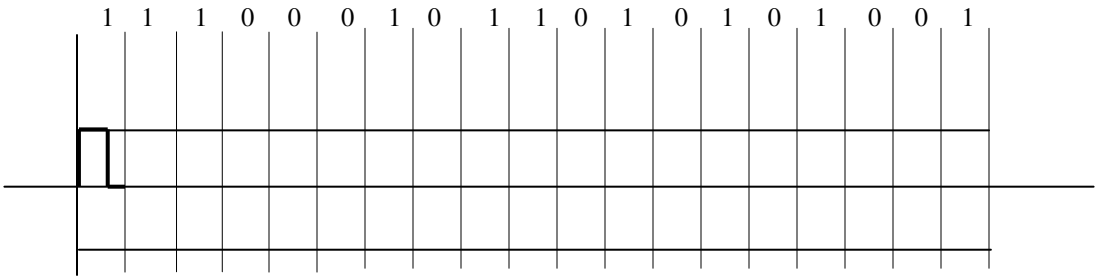
Suppose that a group of UTD students have invented the zzbinary line coding which works like bipolar. In this code, they did something very interesting:

- A “0” is transmitted by no pulse,

- A “1” is transmitted by a pulse f(t) or –f(t) using the following rule:

  - A “1” is encoded by the same pulse as that used for the previous “1”, if there is even number of “0”s between them.
  - It is encoded by a pulse of opposite polarity if there is an odd number of 0’s between them. The number 0 is considered an even number.

(a) Using the half-width pulse f(t) as shown below, complete the sketch of the zzbinary signal y(t) for an input sequence 11100010110101010001.



(b) Determine the time auto-correlation coefficient R_1 for this code if “0” and “1” are equally likely.

Problem 3. Quantization and TDM (40 points)

A new telephone system uses a 8-bit PCM uniform quantization and 8 KHz sampling rate to digitize voice channels. The SQR of the 8-bit PCM system is found to be 30 dB.

(a) Find the number of quantization levels that this PCM system uses.
(b) If 24 of these digitized voice channels are time division multiplexed to be transmitted over a carrier system, what is the date rate of the multiplexed system? Ignore any additional bit insertions such as framing or synchronization bits.
(c) If it is decided to increase SQR to 42 dB by increasing the number bits per sample. How many more bits are needed per sample? What is the number of quantization levels after this increase? (You can round the numbers to the closest integer).
(d) Find the new transmission rate of the carrier system in part (b) if a 8-bit PCM quantization is replaced with a 11-bit one.