KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
COLLEGE OF COMPUTER SCIENCES & ENGINEERING

COMPUTER ENGINEERING DEPARTMENT

COE 541 – Local and Metropolitan Area Networks

Assignment 1

Problem 1:

Show that if $S(f)$ (raised cosine filter function) is given by

$$S(f)=\begin{cases} A & |f|>\frac{1}{T}-\alpha \\ A\cos^2\left(\frac{\pi}{4\alpha}\left(|f|-\frac{1}{T}+\alpha\right)\right) & \frac{1}{T}-\alpha<|f|<\frac{1}{T}+\alpha \\ 0 & |f|>\frac{1}{T}+\alpha \end{cases}$$

then, the corresponding s(t) is give by $s(t)=\frac{(2A)}{T}\frac{\cos(2\pi\alpha t)}{1-(4\alpha t)^2}\frac{\sin(2\pi t/T)}{2\pi t/T}$

Problem 2:

If the received signal level for a particular digital system is -151 dBW and the receiver system effective noise temperature is 1500 K. What is the Eb/No for a link transmitting 2400 b/s?

Problem 3:

The waveform below belongs to a Manchester encoded binary data stream. Determine the beginning and end of bit periods (i.e. extract clock information) and give the data sequence.

Problem 4:

Consider a CRC error detection scheme with $P(x)=x^4+x+1$.

a) Encode the bits 10010011011.

b) Suppose the channel introduces the error pattern 100010000000000 (i.e. a flip from 1 to 0 or from 0 to 1 in the positions 1 and 5). What is the received frame? Can the error be detected?

c) Repeat part (b) with error pattern 100110000000000.

Problem 5:

In the shown figure, frames are generated at node A and send to node C through node B.

a) What is the minimum time on line AB for transmitting 3 frames and being able to transmit again?

b) Using the time window computed in part (a) determine the minimum rate required between nodes B and C so that the buffers of node B are not flooded.

Hint: In order not to flood the buffers, the average number of frames entering and leaving node B must be the same over a long interval.

c) What is the efficiency of the communication on EACH of the two links?

The following specifies the two communication links:

- The data rate between node A and node B is 100 kb/s
- The propagation delay is 5 μsec/km for both links
- Both links are full-duplex
- All data frames are 1000 bits long; ACK frames are separate frames of negligible length
- Between A and B sliding window protocol with a window size of 3 is used
- Between B and C, stop-and-wait is used.
- There are no errors (lost or damaged frames)