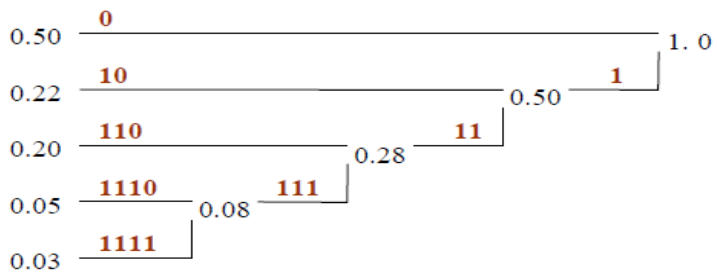
Q.2 a. An ensemble (A, z) is given where A={'000', '001', '010', '011', '100'} and z = [0.5 0.22 0.2 0.05 0.03]^T is given. Find the code-length per symbol before and after Huffman coding.

Answer:

Without using Huffman codes, $L_{avg} = 3$ (fixed) bits/symbol.



Using Huffman codes,

$$L_{avg} = \sum_{i=1}^{5} p_i L_i = 0.5\times1 + 0.22\times2 + 0.2\times3 + 0.05\times4 + 0.03\times4 = 1.86 \text{ bits/symbol.}$$

b.What are the advantages of Digital Communication?

Answer:

Ruggedness to channel noise and other interferences.

2. Flexible implementation of digital hardware system

3. Coding of digital signal to yield extremely low error rate and high fidelity.

4. Security of information.

c. Consider a discrete memory less source with source alphabets S = {s0, s1, s2} with probabilities p(s_0) = 1/4 , p(s_1) = 1/4, p(s_2) = ½. Calculate the entropy of the source

Answer:

Entropy of the source = ¼ $\log_2(4)$ + ¼ $\log_2(4)$ + ½ $\log_2(2)$

= 3/2 bits

Q.3a Draw Block diagram of PAM-TDM (pulse amplitude modulation-time division multiplexing) and explain the process in detail.

Answer: Page no 163 of text book

b. Explain flat top sampling process in detail. Why amplitude and delay distortion occurs in flat top sampling. How it can be corrected.

Answer: Page no 156 to 159 of text book

Q.4 a. Explain in detail Differential pulse code modulation (DPCM) with the help of neat block diagram.

Answer: Page no 200 to 203 of text book

b. What is the need of Robust Quantisation? Explain the model of Robust Quantisation.

Answer: Page no 194

Need of Robust Quantization

SNR decreases with decrease in input power level at the uniform quantizer but non-uniform quantization maintains a constant SNR for wide range of input power levels. This type of quantization is called as robust quantization

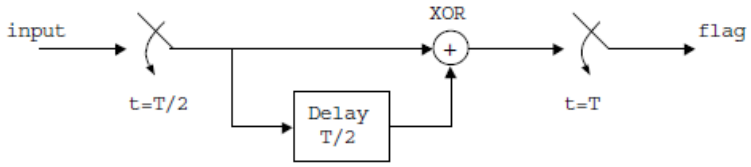
Q.5a. Write a short note on adaptive equalization for data transmission.

Answer: Page no 263 to 266 of text book

b. What is Inter symbol interference? Explain its effects and methods to reduce it.

Answer:

Manchester coding has the desirable feature that it is possible to detect the presence of errors in the received signal. This is done by checking that there is always a transition in the middle of a bit period. A simple block diagram on to achieve this is shown below:



The input is assumed to be sampled at a proper timing phase $t = kT/2+\tau$, so that the XOR gate outputs a "1" at least every other sample (spaced by $T/2$). The second sampler checks that there is a transition every bit. If this is the case, then the flag is always equal to "1"; otherwise, the flag is "0" and an error is detected. After a transition period, the system always outputs a "1" whenever the input is Manchester coded and a "0 whenever there is no transition in (at least) the following bit.

Q.6 a. Draw and explain the transmitter and receiver section of differential phase shift keying.

Answer: Page no 307 to 309 of text book

b. Compare Binary and Quaternary modulation techniques.

Answer: Page no 310 to 312 of text book

Q7 a. The received signal in a binary communication system that employs antipodal signals is $r(t) = s(t) + n(t)$, where $s(t)$ is shown in the figure below and $n(t)$ is AWGN with power spectral density $N_0/2$ W/Hz.

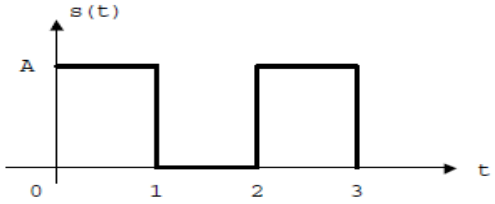


Fig.1

Obtain the impulse response and output of the matched filter matched to s (t)

Answer:

The impulse response of the filter matched to $s(t)$ is

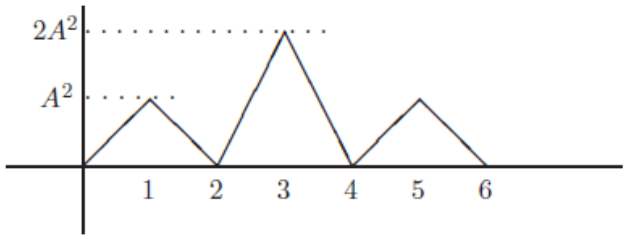
$$h(t) = s(T - t) = s(3 - t) = s(t)$$

Where we have used the fact that ss (t) is even with respect to the $t = T$

The output of the matched filter is

$$y(t) = s(t) \star s(t) = \int_0^t s(\tau)s(t-\tau)d\tau$$

$$= \begin{cases} 0 & t < 0 \\ A^2 t & 0 \le t < 1 \\ A^2(2-t) & 1 \le t < 2 \\ 2A^2(t-2) & 2 \le t < 3 \\ 2A^2(4-t) & 3 \le t < 4 \\ A^2(t-4) & 4 \le t < 5 \\ A^2(6-t) & 5 \le t < 6 \\ 0 & 6 \le t \end{cases}$$



b. What is matched filter receiver?

Answer:

A filter whose impulse response is a time reversed & delayed version of some signal ∅ j (t) then it is said to be matched to ∅j (t) correspondingly, the optimum receiver based on the detector is referred to as the matched filter receiver.

Q8. a. Explain Direct Sequence Spread Coherent Binary PSK.

Answer: Page no 452 to 454 of text book

b. Define spread spectrum and enlist the properties of maximum length sequences.

Answer: Page no 445,448 of text book

Q9 Write Short note on:

(i) Code division multiple Access (CDMA)

(ii) Digital Radio

Answer:

i) Page no 468 to 469 of text book

ii) Page no 350 to 354 of text book

Text Book

Digital communication, Wiley Student Edition, Simon Haykin