Explain the properties of ML Sequence for a Sequence generated from 3-Stage Shift register with linear feedback. verify these properties & determine the period of the given PN Sequence

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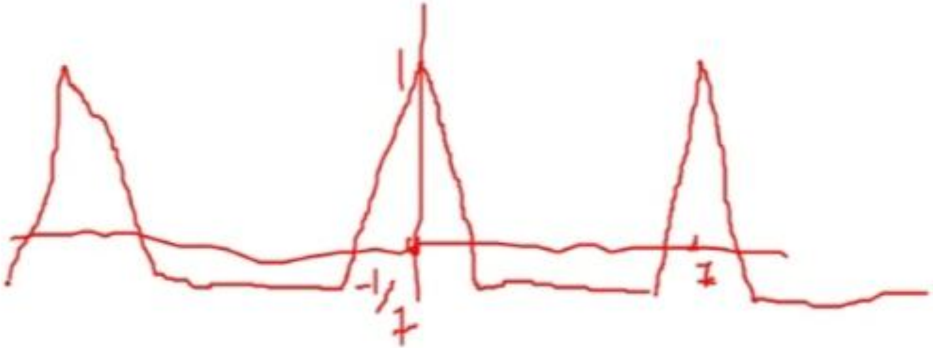

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$\underbrace{0}_{1}\ \underbrace{1}_{2}\ \underbrace{0}_{3}\ \underbrace{1\,1\,1}_{4}\ \underbrace{0}_{5}$

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$\underbrace{0\,0}_{1}\ \underbrace{1}_{2}\ \underbrace{0}_{3}\ \underbrace{1\,1\,1}_{4}$

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Example1

A pseudo random sequence is generated using a feed back shift register of length m=4. The chip rate is 107 chips per second. Find the following

a) PN sequence length

b) Chip duration of PN sequence

c) PN sequence period

Solution

a) Length of PN sequence $N = 2^m - 1$

$= 2^4 - 1 = 15$

b) Chip duration $T_c = 1/\text{chip rate} = 1/107 = 0.1\mu\text{sec}$

c) PN sequence period $T = NT_c$

$= 15 \times 0.1\mu\text{sec} = 1.5\mu\text{sec}$

Example2

A direct sequence spread binary phase shift keying system uses a feedback shift register of length 19 for the generation of PN sequence. Calculate the processing gain of the system.

Solution

Given length of shift register = m = 19

Therefore length of PN sequence $N = 2^m - 1$

$= 2^{19} - 1$

Processing gain $PG = T_b/T_c = N$

in db $= 10\log_{10}N = 10\log_{10}(2^{19})$

$= 57\text{db}$

Example3

A Spread spectrum communication system has the following parameters.

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Solution

Processing gain PG =N= Tb/Tc =1024 corresponding length of shift register m = 10

In case of coherent BPSK For Probability of error 10^{-5}.

[Referring to error function table]

E_b/N_0 =10.8

Therefore jamming margin

$$(\text{jamming margin})_{dB} = (\text{Processing gain})_{dB} - 10\log_{10}\left(\frac{E_b}{N_0}\right)_{min}$$

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$$= 10\log_{10} 1024 - 10\log_{10} 10.8$$

$$= 30.10 - 10.33$$

$$= 19.8 \text{ db}$$

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Frequency-Hop Spread Spectrum

- The type of spread spectrum in which the carrier hops randomly from one frequency to another is called frequency- hop(FH) spread spectrum.
- A common modulation format for FH systems is that of M-ary frequency shift keying(MFSK). The combination is referred as FH/MFSK

Since frequency hopping does not cover the entire spread spectrum instantaneously, we are led to consider the rate at which the hops occur. In this context, we may identify two basic (technology-independent) characterizations of frequency hopping:

1. *Slow-frequency hopping*, in which the *symbol rate* R_s of the MFSK signal is an integer multiple of the *hop rate* R_h. That is, several symbols are transmitted on each frequency hop.
2. *Fast-frequency hopping*, in which the hop rate R_h is an integer multi[illegible] the MFSK symbol rate R_s. That is, the carrier frequency will change or hop several times during the transmission of one symbol.

Frequency hop spread M-ary frequency shift keying Transmitter and Receiver