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## Digital Communication & Electronics Interview Questions

### Q1. What is Digital communication?

**Digital communication** is a means of communication in which the information is encoded digitally. Then the information is sent electrically as a signal to the recipient. Digital communication uses binary language that is 1s and 0s. Former represents the high value and the latter represents low values. It takes hardly a second to send the information to the recipient. Digital communication is extensively used nowadays.

### Q2. What is Dibit?

Dibits as the name suggests are composed of two bits. Dibits is used to obtain Quadrature phase-shift keying by defining four phase shifts separated by 90 degrees.

The four patterns of dibits are: -00, 01, 11, 10

### Q3. What is Pulse Code Modulation?

Pulse Code Modulation is a form of modulation that transforms a waveform into a binary signal so that it can be transmitted through the digital communication networks. Digital signal (binary signal) consists of two states i.e. 1 and 0.

### Q4. Define Nyquist rate?

The **Nyquist rate** or frequency is the minimum rate at which a signal can be sampled without errors. The Nyquist frequency is twice the bandwidth of span.

### Q5. What is difference in DPCM and DM?

Differences are:

#### **DM**

It is defined as Delta Modulation.

Feedback only exists in the transmitter.

#### **DPCM**

It is defined as Differential Pulse Code Modulation.

Feedback exists in both receiver and transmitter.

Step size is fixed in DM.

It is less efficient.

One bit is used per sample.

It is used in applications like images and speeches.

It usually has a low signal to noise ratio.

It needs the lowest bandwidth.

Number of levels fixed in DPCM.

It is more efficient than DM.

In this, more than one bit can be used but cannot use more than PCM.

It is used in applications like speeches and videos.

It has more signal to noise ratio as compared to DM.

It needs bandwidth more than DM but less than PCM.

## **Q6. What is Quantization in Digital communication?**

In mathematics and digital signal processing, Quantization is the process of sampling a few points on an analog signal and these points are then joined to round off the value to a stabilized value. Example of Quantization is truncation and rounding. Quantization is used in lossy compression algorithms and nearly all digital signal processing.

## **Q7. Enlist different types of Quantization?**

There are two types of Quantization:

- Uniform Quantization
- Non-uniform Quantization.

## **Q8. What is Delta Modulation?**

Delta modulation is a technique used to convert analog to digital and digital to an analog signal. It is used to convey the voice signal when the quality is not important. Delta modulation is a simple form of DPCM. Delta modulation or DM is also known as one bit two-level version of DPCM. The data is minimized to 1-bitstream in Delta modulation.

## **Q9. List different types of Data Encoding?**

## **Q10. What is Inter Symbol Interference?**

Inter Symbol Interference, in telecommunication, is a form of distortion of signal in which one symbol interferes with other signals. As a result, noise is created and delivers a bad output.

The main reason for the ISI is: -

- Multi-path Propagation
- Non-linear frequency in channels

It is unwanted and it needs to be removed to get a good output. It is also important to know the cause of the ISI so that the effect of ISI can be reduced.

### Q11. What is Amplitude Shift Keying and Frequency Shift Keying?

**Amplitude Shift keying** as the name suggests is a type of modulation where the amplitude of the carrier wave is the only parameter to be changed by the signal. It is a digital version of analog amplitude modulation. When a binary 1 appears, a burst of radiofrequency is conveyed whereas at 0 it stops.

**Frequency Shift keying** as the name suggests is a type of modulation where the frequency of the carrier wave is the only parameter to be changed by the signal. It is a digital version of analog amplitude modulation. The digital data which is encoded into binary language is conveyed with the help of one of two frequencies. In this, 1 is transmitted by one frequency whereas 0 is transmitted by another frequency.

### Q12. What is M-ary Equation?

Consider an example, with two bits,  $2^2 = 4$  conditions are possible.

Let's take an example of a digital signal under four conditions such as amplitude, frequency, phase and voltage levels. Then the value of M will be 4 .

$$N = \log_2 M$$

The mathematical equation of number of bits need to produce given no. of conditions is

In this, N represents the number of bits necessary

And M represents the number of levels, conditions, or combinations possible with N bits. So, the above equation can be rearranged as:  $2^N = M$

### Q13. What is Pseudo-Noise Sequence?

Pseudo-noise sequence is also referred to as **Pseudo-Random Binary Sequence (PRBS)** is used to create noise that is almost 'white'. This sequence is used in many applications like cryptography, scrambling and spread-spectrum communications. 'Pseudo' word states that the sequence is not random, it consists of a deterministic sequence of pulses that repeat after a specific period.

### Q14. What is matched filter?

The matched filter (MF) is an excellent tool for an electrical engineer to sense the availability of the wavelets from a signal that has been contaminated by **Additive White Gaussian Noise (AWGN)**. This feature is accomplished via cross-correlation of the wavelet with the signal.

**Q15. Define : mean, moment and variance of a random variable X.**

**Q16. When Granular noise occurs?**

Granular noise occurs when the step size is very large in comparison with the small difference in the input signal.

**Q17. What is correlative coding?**

**Correlative coding** is also known as partial response signalling schemes which are used to obtain a bit rate of  $2W$  bits per second in a channel of bandwidth  $W$  Hertz. ISI is usually an unwanted phenomenon and correlative coding helps in mitigating it.

**Q18. What are eye pattern?**

**Eye diagram** or **Eye pattern** takes its name because it looks like the human eye. The eye pattern is used to identify signal integrity before moving on to more refined analysis. Its insight into the digital signal to recognize the effect of distortion and what might be affecting signal integrity.

**Q19. What is baseband signal receiver?**

**Q20. What is hamming distance?**

In information theory, the distance between the two codewords is the number of positions at which the corresponding bits differ.

**Q21. What is convolution code?**

**Convolutional coding** is based on the output code bits which are determined by logic operations on the present bit and the previous bits.

In digital wireless communication, convolution code is extensively accepted for error correction.

## Q22. What is Golay codes?

**Golay code** name is taken after the **Marcel J.E. Golay** who introduced the Golay code in 1949 paper and it is considered as the best single published page in coding theory by E. R. Berlekamp. A binary Golay code is used in digital communication. In mathematics and electronics engineering, it is a linear error-correcting code. It has a very fine connection with the theory of finite sporadic groups.

There are two versions of Golay codes which are enlisted below:

1. Binary Golay code version.
2. Ternary Golay codes version.

## Q23. What is jamming margin?

Jamming margin is the level or range of interference which a system can handle without affecting the specified level of performance. For example, maintaining a specific bit-error ratio despite the ratio of signal-to-noise is reducing.

In other words, it is defined as how much protection it can give to the system from jamming.

## Q24. What is frequency hopping?

**Frequency hopping** is a technique used to change the conveying radio signals from one to another in a specific period. It is beneficial in avoiding communication at a specific frequency because of interference.

## Q25. What is line code? List some properties of Line Coding?

Line code, also known as digital baseband transmission method or digital baseband modulation, is the code used for converting a sequence of bits to a digital signal. It is used to convert the digital signal from digital data. At the sender side, digital data is converted into a digital signal and vice versa at the receiver side.

- **Error detection:** Codes like duobinary detect the errors in data. Moreover, it does not need to add new error detection bits into the data sequence. .
- **Bandwidth compression:** There are some codes which help in enhancing the bandwidth utilization like multilevel codes. It does this by permitting the decrease in needed bandwidth for a given data rate. As a result, more information can be conveyed per unit bandwidth .
- **Differential Encoding:** In communication inverted waveform is very useful and line code permits the polarity of a differentially encoded waveform to be inverted. In this process, it does not affect the data detection. .
- **Noise Immunity:** There are some codes which produce lesser bit detection errors in comparison with others (for same transmitted energy) in the presence of noise .
- **Transparency:** To maintain transparency, long strings of 0s and 1s are avoided.

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