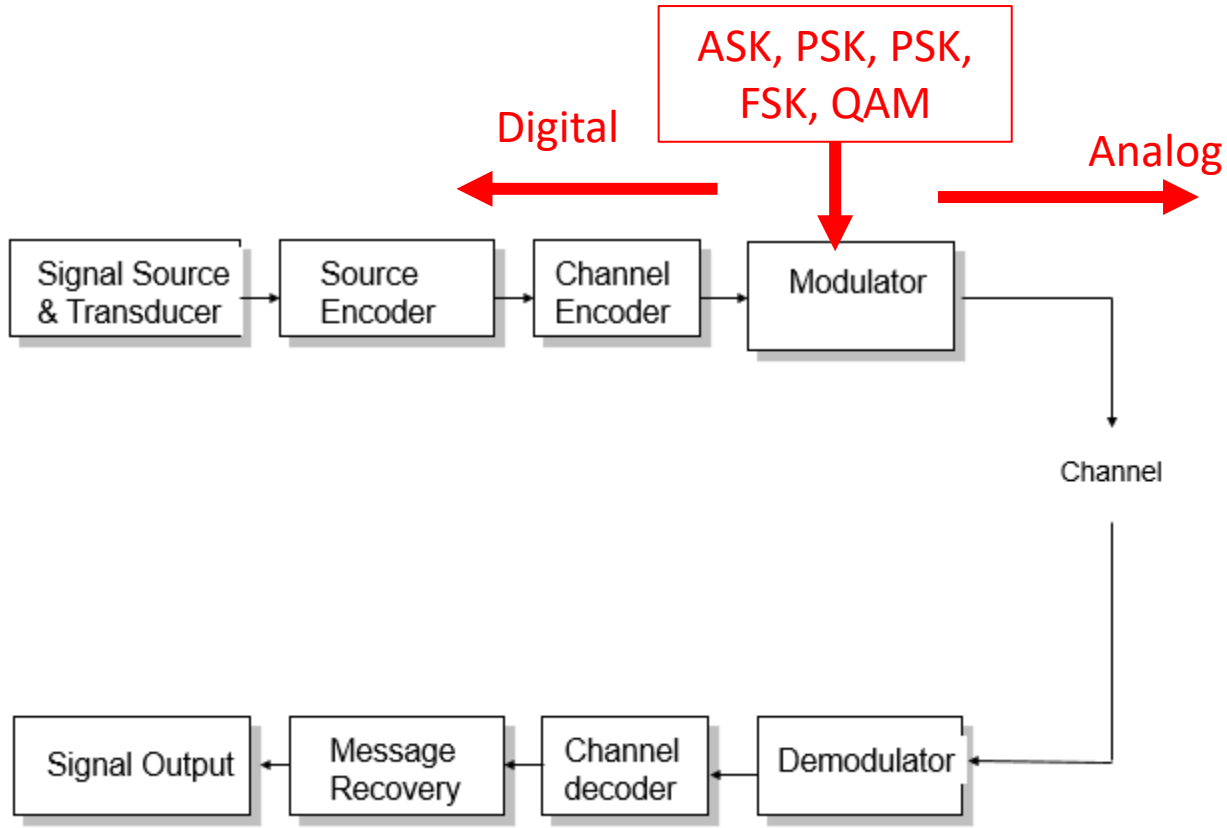
EEEN 464 - DIGITAL COMMUNICATION

CONTINUOUS ASSESSMENT TEST I

MODEL ANSWERS

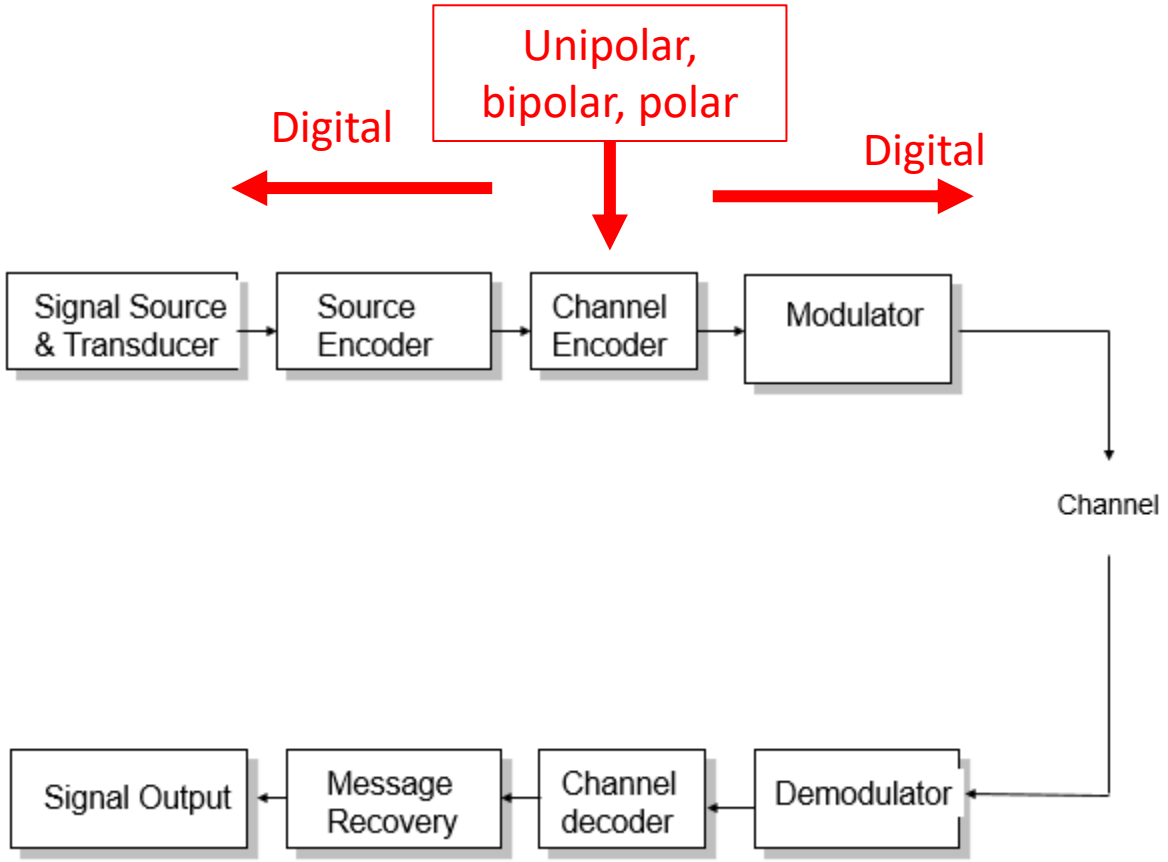
Q1: 4.1. ASK, PSK, FSK, and QAM are examples of _____ encoding.

- ○ Digital-to-digital
- ○ Digital-to-analogue
- ○ Analog-to –analogue
- ○ Analog-to-digital



2. Unipolar, bipolar, and polar encoding are types of _____ encoding.

- Digital-to-digital
- Digital-to-analogue
- Analog-to-analogue
- Analog-to-digital



3. If the frequency spectrum of a signal has a bandwidth of 500 Hz with the highest frequency at 600 Hz, what should be the sampling rate according to the Nyquist theorem?

- ○ 200 samples/sec
- ○ 500 samples/sec
- ○ 1000 samples/sec
- ○ 1200 samples/sec

Given : $f_{max} = 600\ Hz$

Nyquist sampling rate = $2 \times f_{max}$

$= 2 \times 600$

= 1200 Samples/sec

4. If the maximum value of a PCM signal is 31 and the minimum value is -31, how many bits were used for coding?

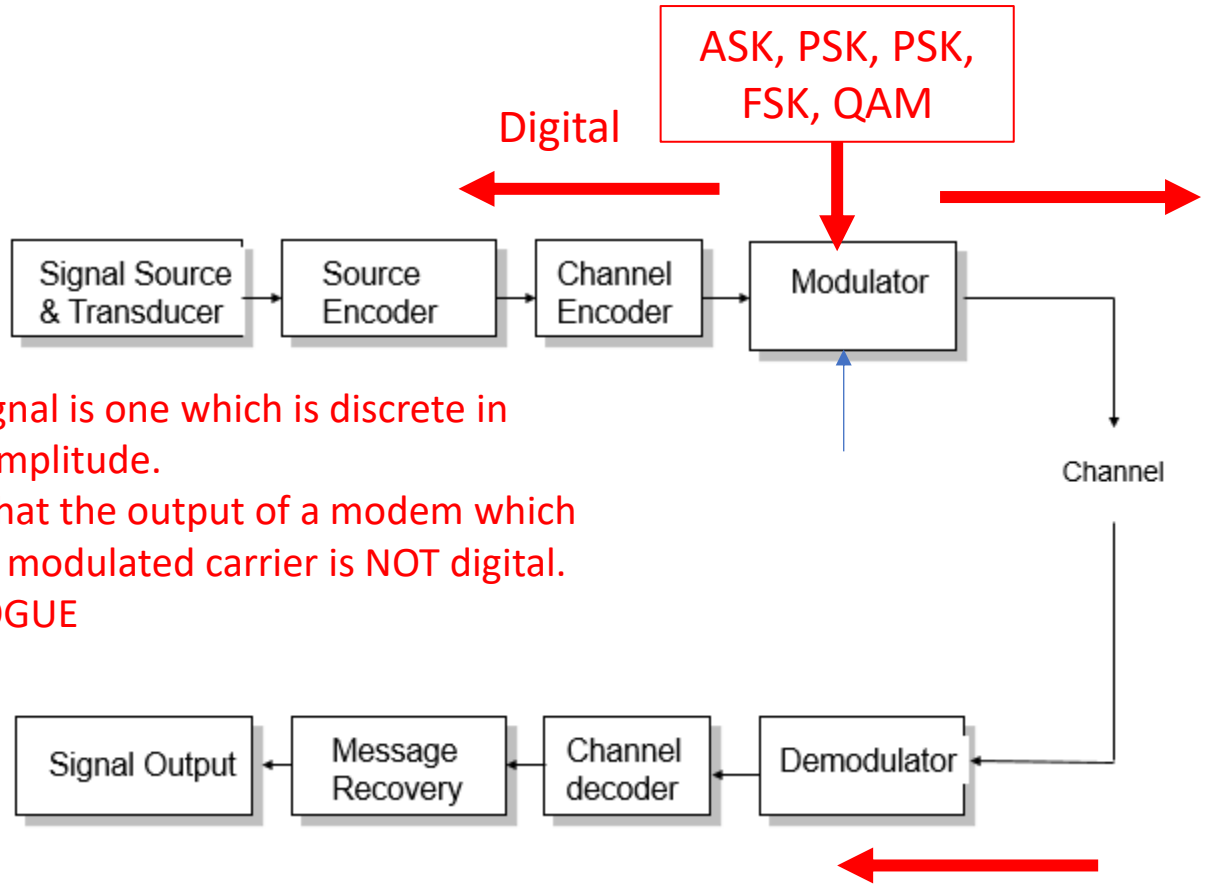
- ○ 4
- ○ 5
- ○ 6
- ○ 7

PCM input range = 2×31 = 62

Number of bits $v \geq log_2(62) \approx 6$

5. The signal between two modems is always

- ○ Digital
- ○ Analog
- ○ PSK
- ○ QAM



- A digital signal is one which is discrete in time and amplitude.
- It follows that the output of a modem which is usually a modulated carrier is NOT digital.
- It is ANALOGUE

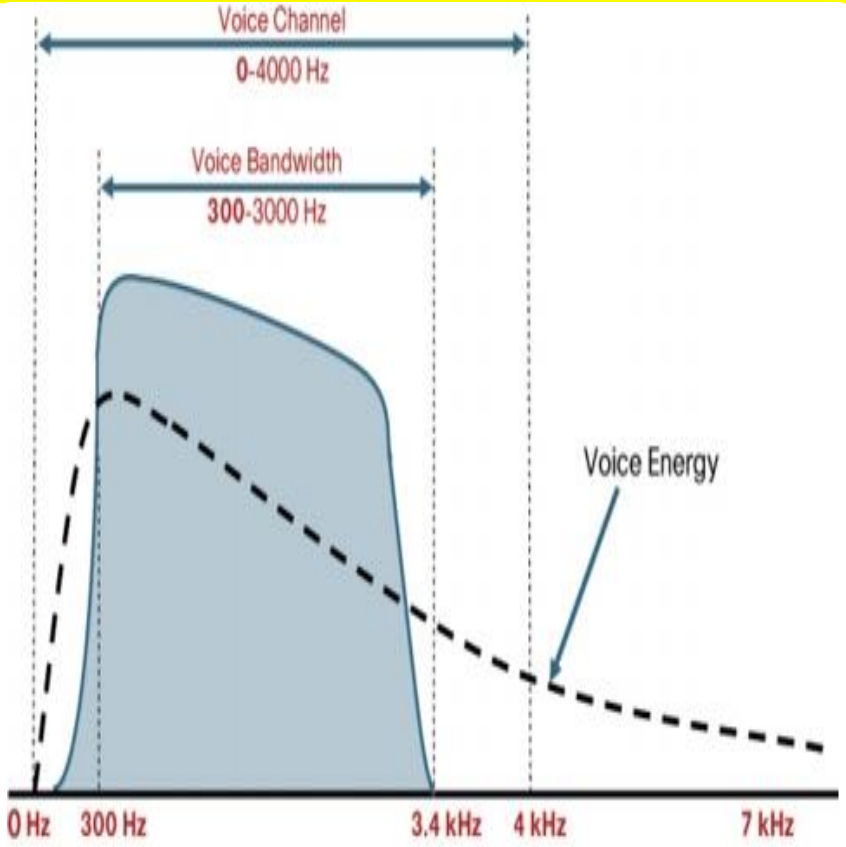
Analog because signal is a modulated carrier which is not discrete in time and amplitude

6. In discrete memoryless source, the current letter produced by a source is statistically independent of _____

- Past output
- Future output
- Both a and b
- None of the above

7. The maximum intelligibility for voice frequency is located between _____

- ○ 250 and 500 Hz
- ○ 1000 and 3000 Hz
- ○ 500 and 1000 Hz
- ○ 3000 and 5000 Hz



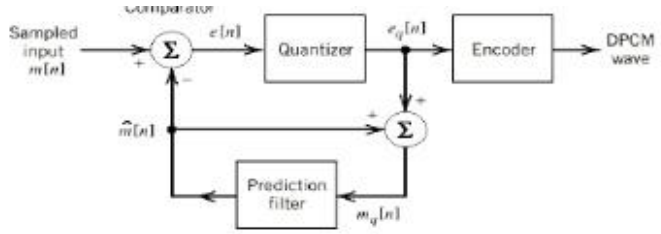
Why is the telephone voice channel standardized between 0.3 – 3.4 KHz?

(1) It covers the maximum intelligibility of voice

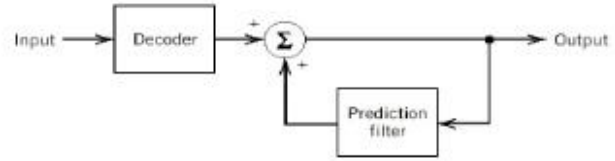
(2) It carries the maximum voice signal energy

8. A type of digital communication which is designed to take advantage of the sample-to-sample redundancies in the typical speech waveform

- ○ Single – bit PCM code
- ○ Pulse Code Modulation
- ○ Differential PCM
- ○ Delta modulation



(a) Transmitter



(b) Receiver

Differential pulse-code modulation (DPCM) is a signal encoder that uses the baseline of pulse-code modulation (PCM) but adds some functionalities based on the prediction of the samples of the signal.

If the input is a continuous-time analog signal, it needs to be sampled first so that a discrete-time signal is the input to the DPCM encoder.

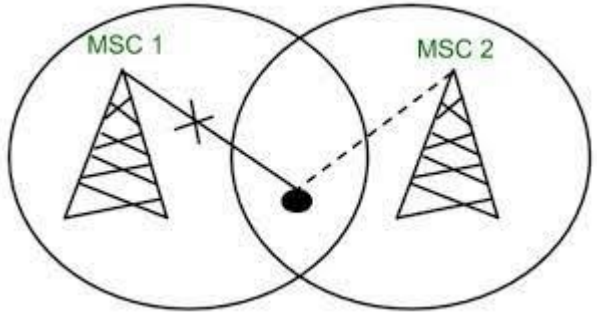
DPCM takes the values of two consecutive samples; if they are analog samples, quantize them; calculate the difference between the first one and the next; the output is the difference.

DPCM was invented by C. Chapin Cutler at Bell Labs in 1950.

9. The signal quality of the calls is constantly monitored by the base station, when the quality of the calls drops below a certain specified level. The base request the MTSO to try and find a better cell site through a process known as .....

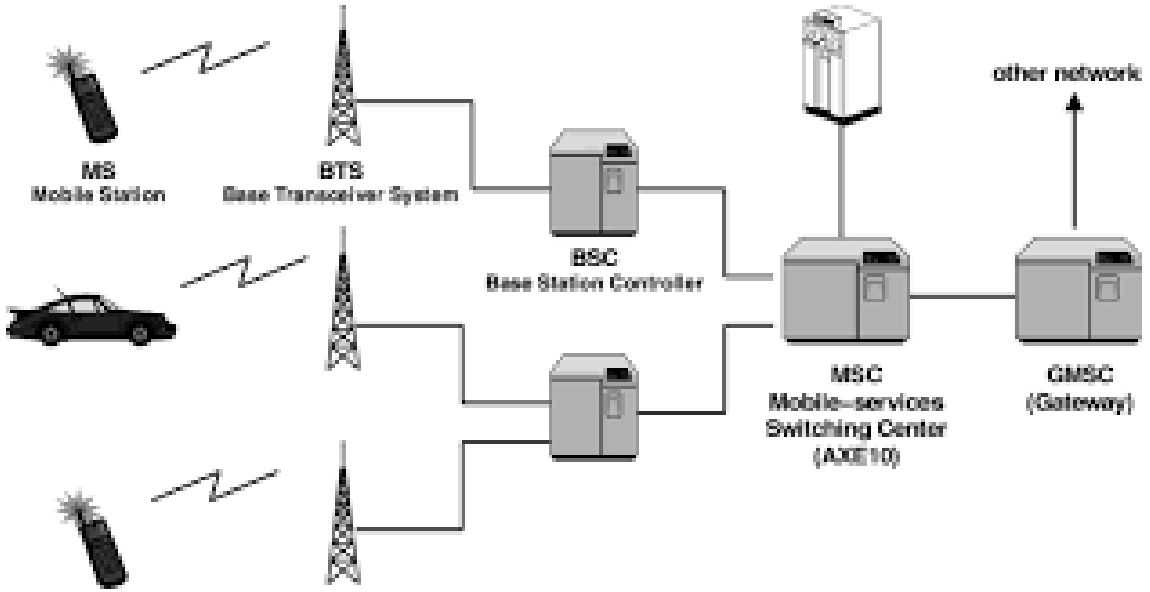
- ○ Hand-off
- ○ Cell splitting
- ○ Roaming
- ○ Frequency reuse

Handoff occurs when a mobile moves into a different cell while a conversation is in progress. The MTSO (MSC) automatically transfers the call to a new channel belonging to the new base station.



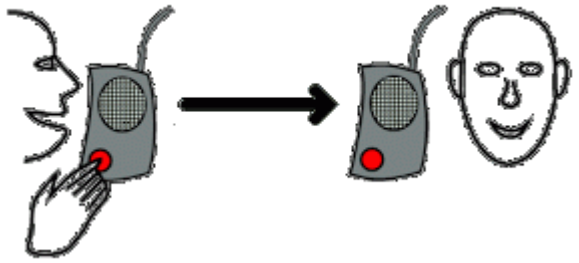
10. What is the linking point between cell phone network and other networks?

- ( ) Base station
- ( ) Base Station Controller
- ( ) Transit Exchange
- ( ) Mobile Switching Centre



11. A walkie talkie operates on _____

- Half duplex mode
- Full duplex mode
- Echoplex mode
- Simplex mode



A walkie-talkie which uses `push to talk' and `release to listen' type of switches on a half duplex mode.

12. What is the frequency separation between a transmit and the corresponding receive channel in the Global System for Mobile Communication (GSM)?

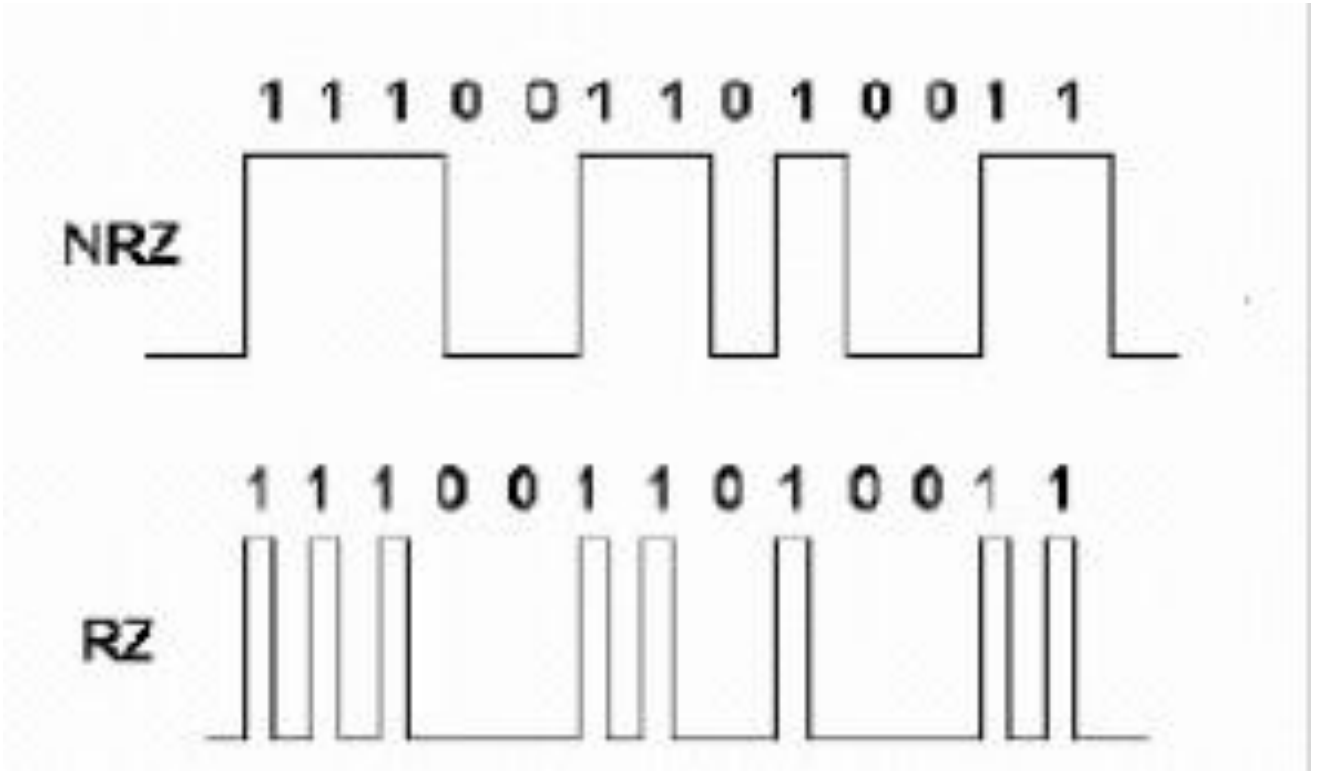
- ○ 30 MHz
- ○ 95 MHz
- ○ 55 MHz
- ○ 40 MHz

13. Knowledge or intelligence that is communicated between two or more points is called .....

- ( ) Carrier
- ( ) Entropy
- ( ) Information
- ( ) Broadband

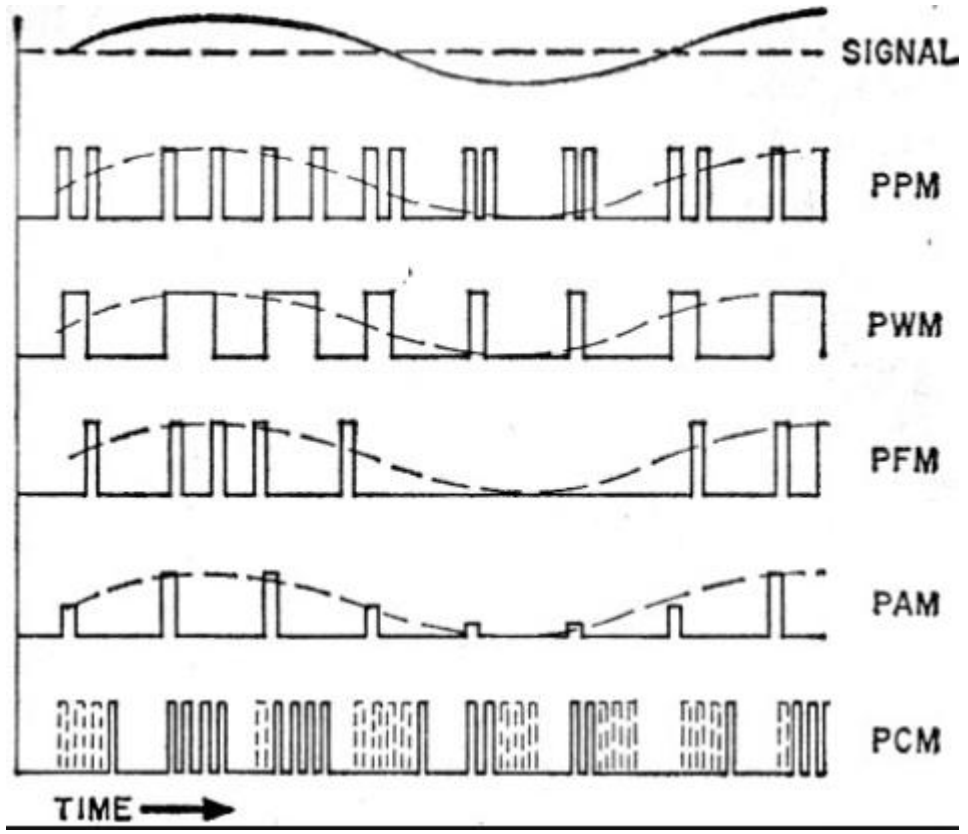
14. What is the category of data transmission if the binary pulse is maintained for the entire bit time?

- ○ RZ
- ○ Bipolar
- ○ Unipolar
- ○ NRZ



15. Indicate which of the following systems is digital

- ○ Pulse-position modulation
- ○ Pulse-code modulation
- ○ Pulse–width modulation
- ○ All of the above

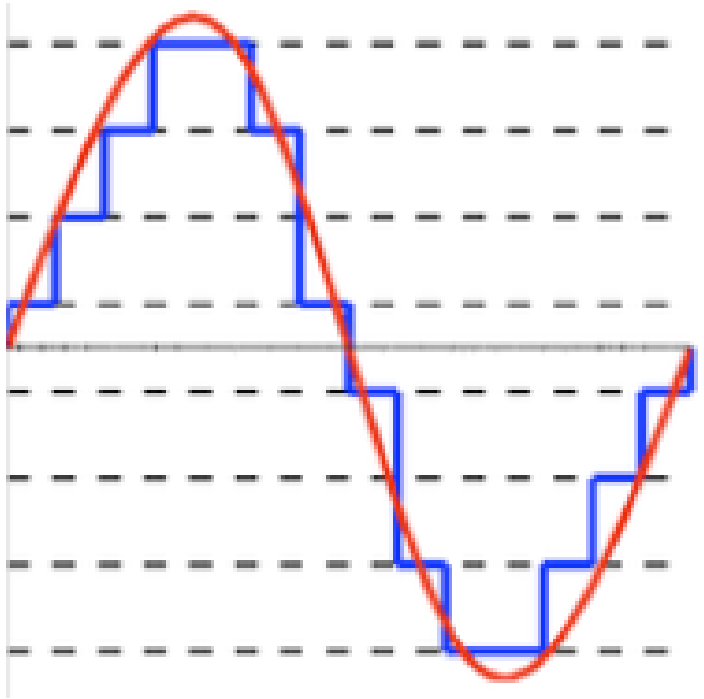


A digital signal is discrete in time and amplitude

16. Converting analog signals to digital is done by sampling and _____.

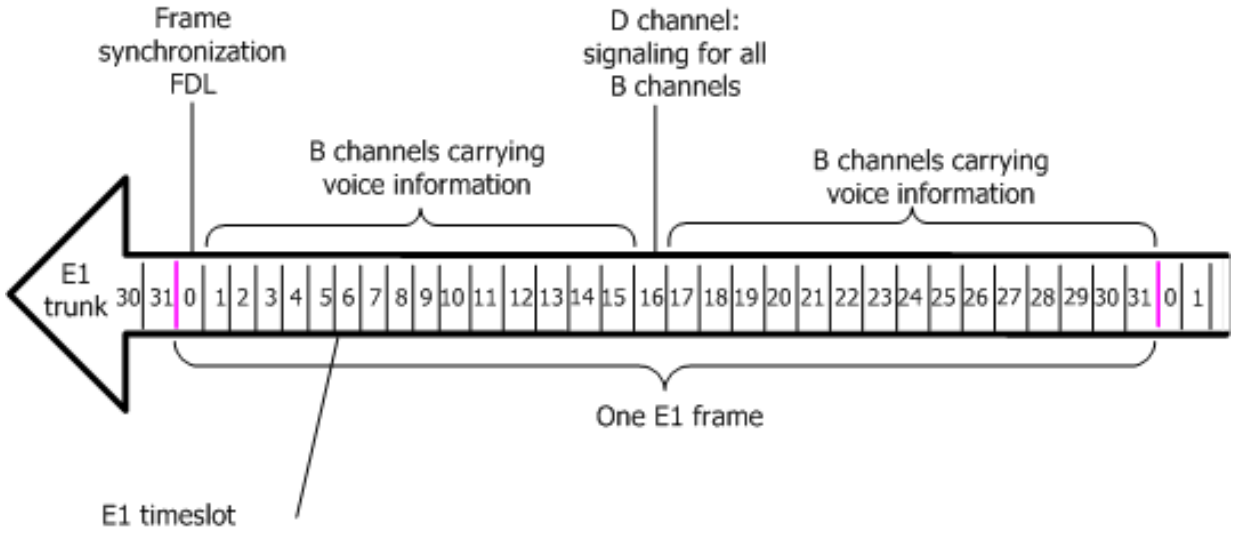
16. Converting analog signals to digital is done by sampling and _____.

- ○ Quantizing
- ○ Companding
- ○ Pre – emphasis
- ○ All the above



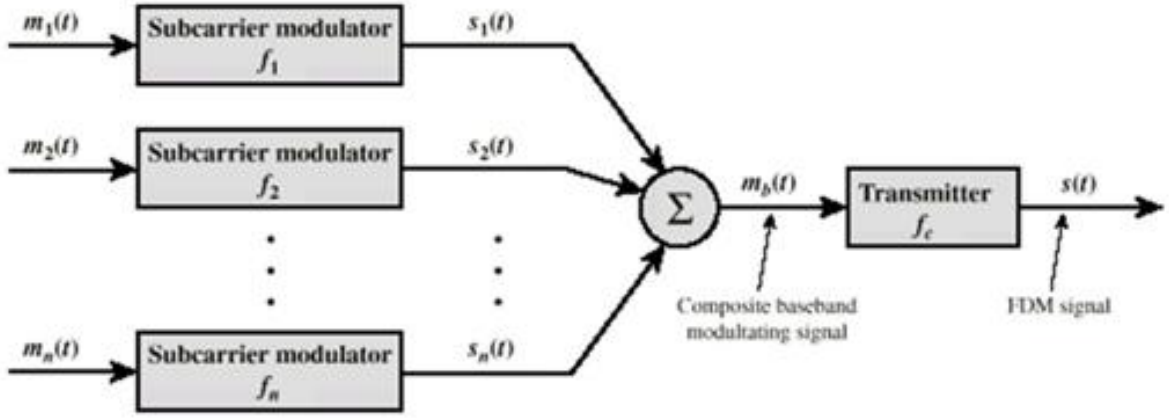
17. In E1 PDH system, the following is equal to the reciprocal of the sample rate

- ○ Slot Time
- ○ Transmission time
- ○ Frame time
- ○ Bit rate



18. What is the final output of a frequency division multiplexer?

- ○ Broadband
- ○ Composite baseband
- ○ Information
- ○ Composite carrier



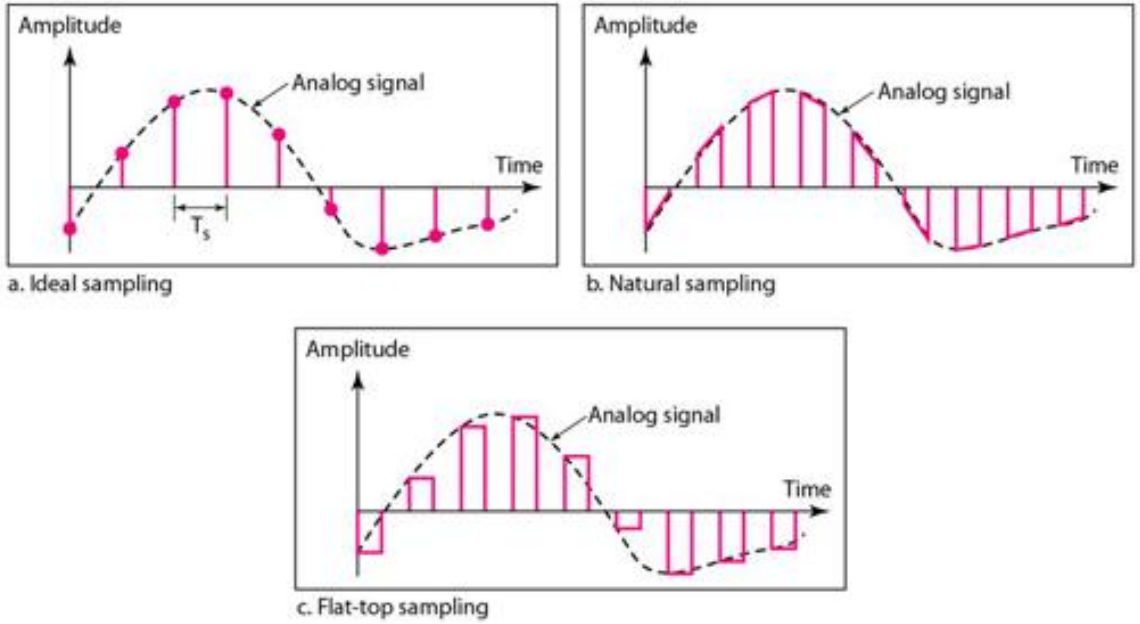
19. It is the processing of analog signals using digital methods and includes band limiting and signals with filters, amplitude equalization, and phase shifting

- ○ Digital communications
- ○ Digital Signal Processing
- ○ Data communications
- ○ Carrier recovery method

Digital signal processing (DSP) is the use of digital processing, such as by computers, to perform a wide variety of signal processing operations.

20. The most common method used for sampling voice signals in PCM systems.

- ○ Ideal sampling
- ○ flat top sampling
- ○ natural sampling
- ○ free sampling



21. Which coding method uses entropy coding?

- ○ Lossless coding
- ○ Lossy coding
- ○ Lossless & Lossy coding
- ○ None of the mentioned

Entropy encoding is a lossless data compression scheme that is independent of the specific characteristics of the medium.

Further Reading

Chapter 8: Information, Entropy, and Coding

22. Which are uniquely decodable codes?

- ○ Fixed length codes
- ○ Variable length codes
- ○ Fixed & Variable length codes
- ○ None of the mentioned

Further Reading:

CSC 310 – Information Theory, University of Toronto

23. Entropy of a random variable is

- ○ 0
- ○ 1
- ○ Infinite
- ○ Cannot be determined

LOWER AND UPPER BONDS ON ENTROPY FOR M SYMBOLS

Source entropy H(X) satisfies the following relation:

$$0 \leq H(X) \leq log_2 m$$

Where m is the number of symbols in the source alphabet.

1. H(X) = 0 when only one symbol has probability $P(x_i)=1$ while $P(x_j)=0$ for $j \neq i$.

2. H(X)=1 when $P(x_i) = \frac{1}{m}\ for\ all\ i$

Activate Windows

24. Which among the following compression techniques is/are intended for still images?

- ○ JPEG
- ○ H.263
- ○ MPEG
- ○ All of the above

1. **JPEG** is a commonly used method of lossy compression for digital images, particularly for those images produced by digital photography.
2. **Joint Photographic Experts Group (JPEG)** is the joint committee between ISO/IEC JTC 1 and ITU-T Study Group 16 (formerly CCITT) that created and maintains the JPEG, JPEG 2000, and JPEG XR standards.

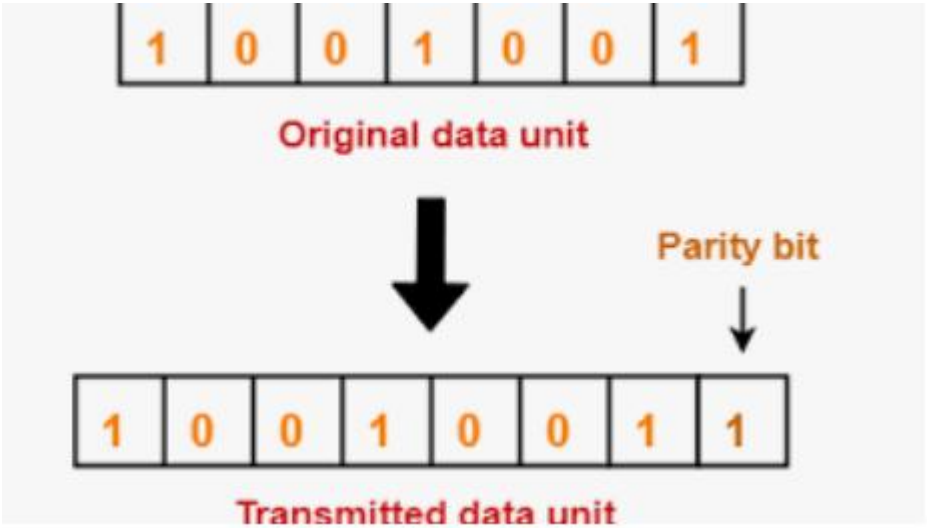
1. **MPEG (OR . MPG)** file extension is an MPEG video file format, which is a popular format for movies that are distributed on the internet. They use a specific type of compression that makes streaming and downloading much quicker than other popular video formats.

2. Moving Picture Experts Group (MPEG) is an alliance of working groups of ISO and IEC that sets standards for media coding, including compression coding of audio, video, graphics and genomic data, and transmission and file formats for various applications

H.263 is a video compression standard originally designed as a low-bit-rate compressed format for videoconferencing. It was standardized by the ITU-T Video Coding Experts Group (VCEG) in a project ending in 1995/1996.

25. How error detection and correction is done?

- By passing it through equalizer
- By passing it through filter
- By amplifying it
- By adding redundancy bits



26. Which can detect two bit errors?

- ○ Parity check
- ○ Cyclic redundancy check
- ○ Parity & Cyclic redundancy check
- ○ None of the mentioned

1. **Cyclic redundancy check (CRC)** is an Error detection and correction code commonly used in digital Telecommunications networks and storage devices to detect and correct errors.
2. Blocks of data entering these systems get a short check value attached, based on the remainder of a Polynomial long division of their contents.

27. CRC uses .....

- ○ Multiplication
- ○ Binary division
- ○ Multiplication & Binary division
- ○ None of the mentioned

```
                111111000
110111 | 100101011 00000
         110111
          100100
          110111
           100111
           110111
            100001
            110111
             101100
             110111
              110110
              110111
                  1000
```

Binary form: 10010101100000

Divided by: 110111

Quotient / Result is :111111000

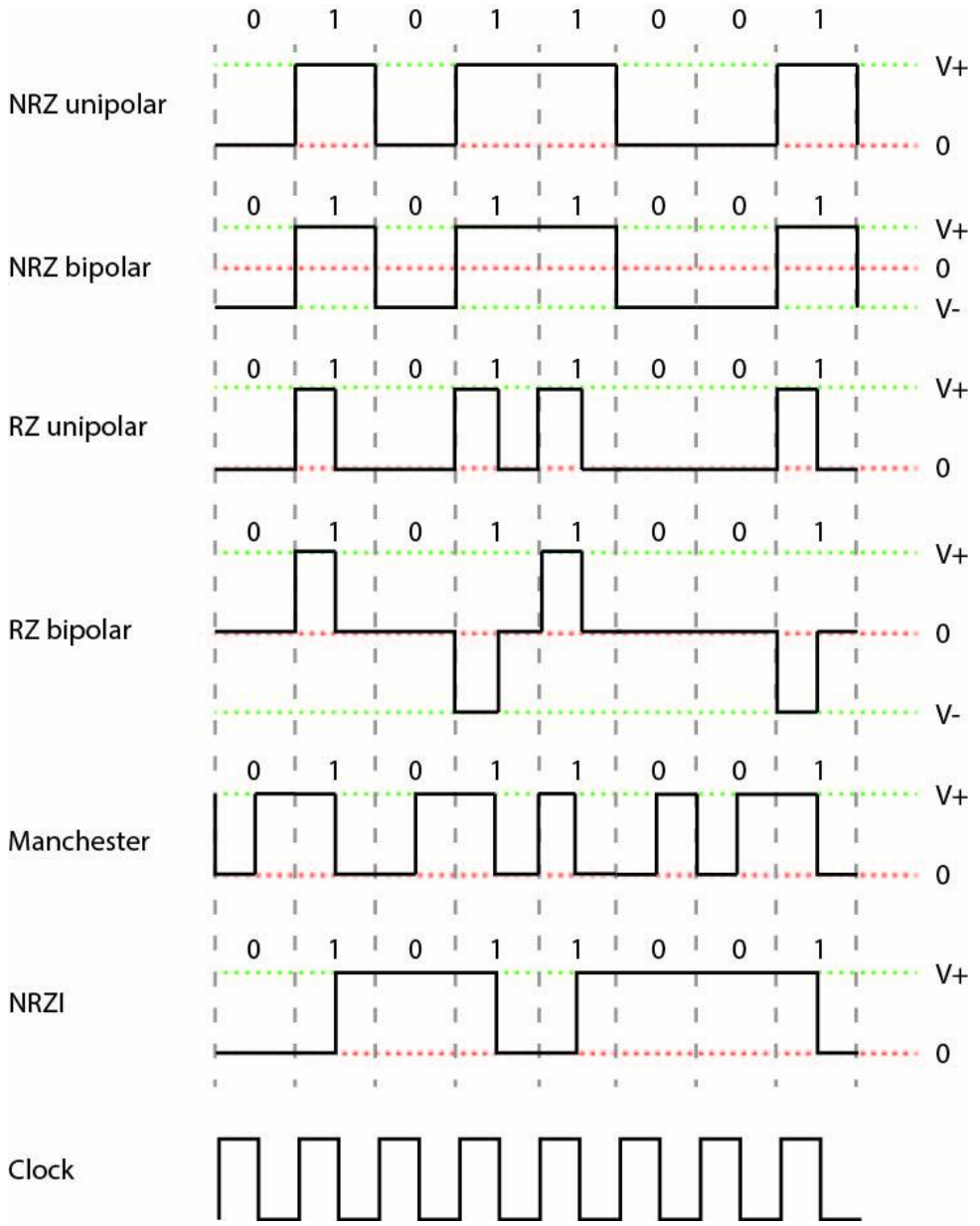
Remainder / CRC bits: 01000

Data 10010101101000 is sent

28. RZ encoding involves _____ levels of signal amplitude.

- ○ 1
- ○ 3
- ○ 4
- ○ 5
- ○ None of the mentioned

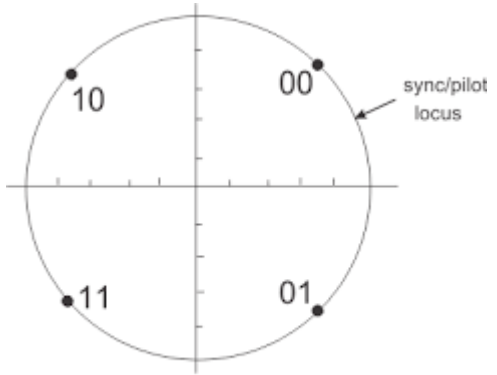
3 levels, i.e. +ve, zero and -ve



29. In QAM, both phase and _____ of a carrier frequency are varied.

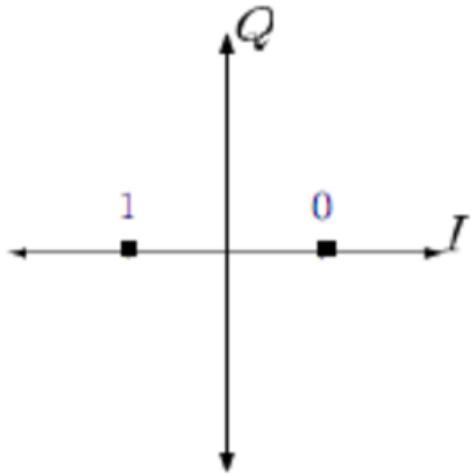
- ○ Amplitude
- ○ Frequency
- ○ Bit rate
- ○ Baud rate

QAM conveys two analog message signals, or two digital bit streams, by changing (modulating) **the amplitudes of two carrier waves**, using the amplitude-shift keying (ASK) digital modulation scheme or amplitude modulation (AM) analog modulation scheme.



4-QAM Symbol Constellation

2, 4, 16QAM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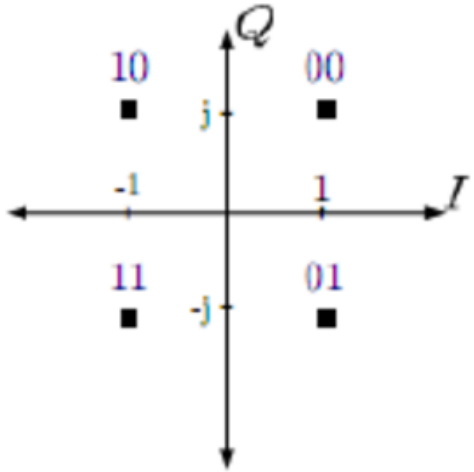
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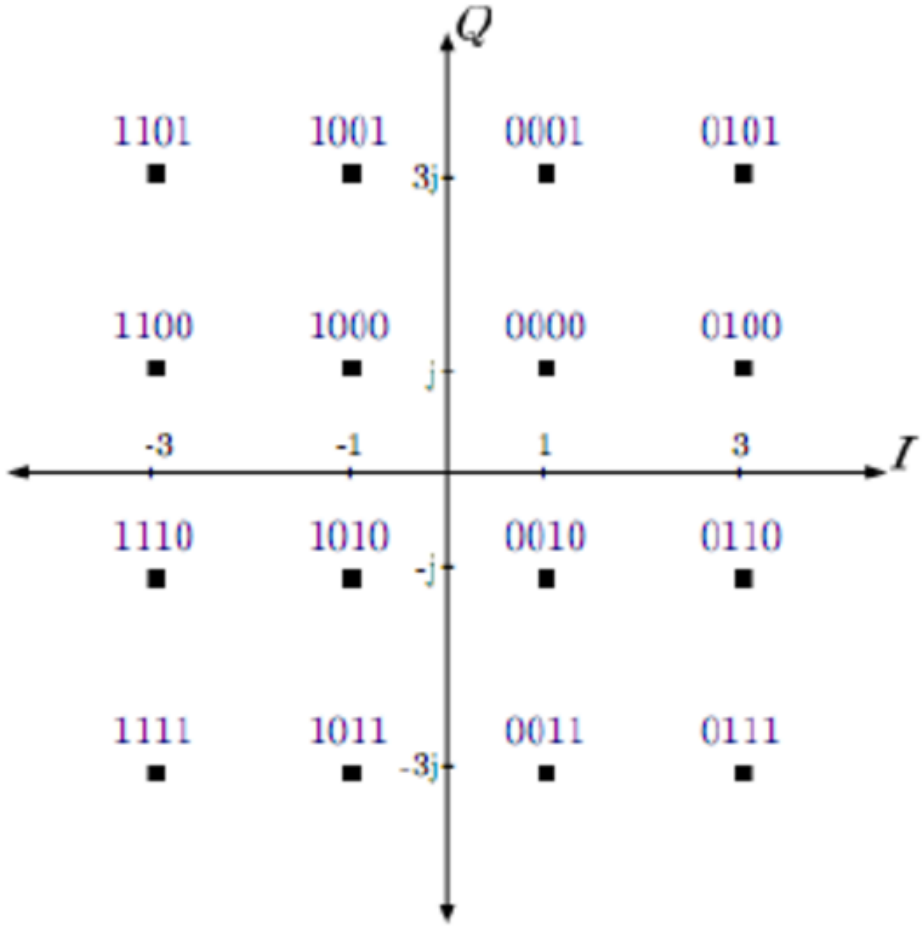
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0011
0111
-3j

30. For a PCM system with a maximum decoded voltage at the receiver of ±2.55 V and minimum dynamic range of 46 dB, determine the maximum quantization error.

- ○ 5.0 V
- ○ 0.5 V
- ○ 0.005 V
- ○ 0.05 V

Dynamic range is the difference between the largest and smallest signal a system can record or reproduce. Without dither, the dynamic range correlates to the quantization noise floor.

For example, 16-bit integer resolution allows for a dynamic range of about 96 dB.