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DCN Fall 2024.

Quiz #01 – Solution.

Topic: The physical Layer of TCP/IP Model.

1. From graph BER Vs SNR

BER = 10^{-4} corresponds to 7 dB unit

Shanon Capacity formula:

$$C = B \log_2 (1 + SNR)$$

$$= 1 \times 10^6 \log_2 (1+7)$$

$$= 3 \text{ Mbps}.$$

For maximum bit rate, take bit rate = 2 Mbps (less than)

As per Nyquist formula

$$\text{Bit rate} = 2 \times B \times \log_2 (L)$$

$$2 = 2 \times 1 \times \log_2 L$$

$$L = 2$$

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For option – 2.

For same ~~SNR~~ BER = 10^{-9}, the new SNR = 14 unit

Shannon capacity

$$C = B \times \log_2 (1 + SNR)$$

$$= 1 \times \log_2 (15)$$

$$= 3.9 \text{ Mbps.}$$

Select New bit rate value of 3 mbps (greater than option #01)

Nyquest formula:-

$$\text{Bit rate} = 2 \times B \times (\log_2 L)$$

$$3 = 2 \times 1 \times \log_2 L$$

$$L = 3.86$$

Conclusion: Option – 2 requires higher SNR to meet ~~requi~~ BER value of 10^{-4}. In return it offers high bit rate and signal level.

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02.

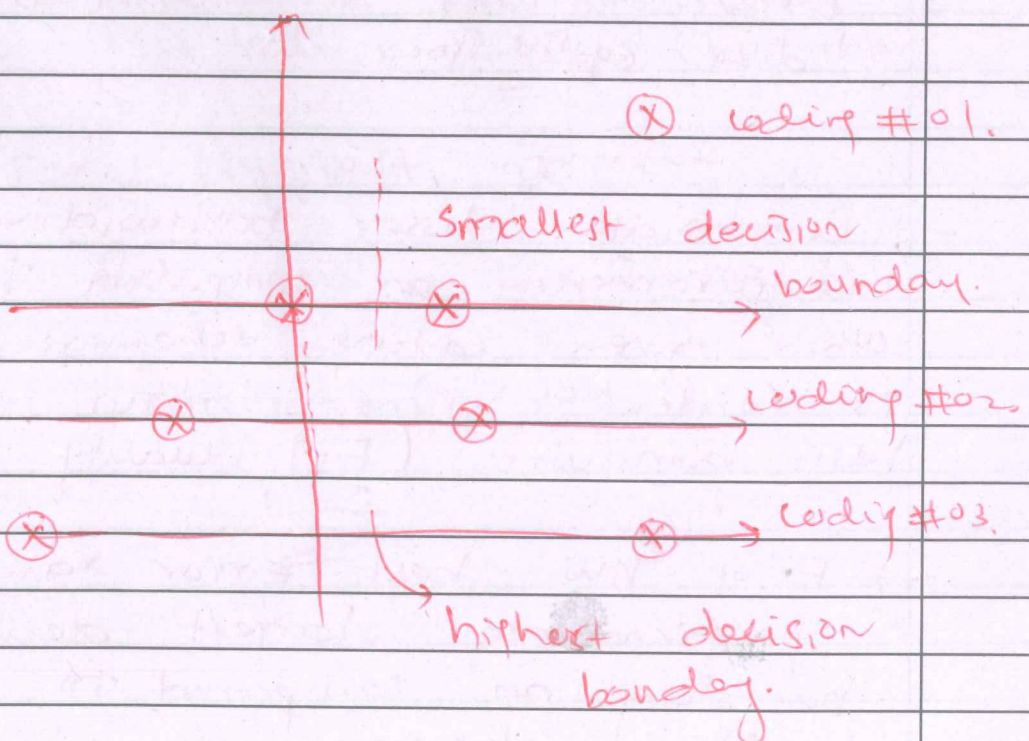
annel coding Seq #01.

→ Power efficient as signal is 50% ON only (duty cycle).

→ It requires higher bandwidth, as per F.T duality property

→ Its bit error rate capability is worst as compared to other two scheme as per bellow constellation diagram.

Channel coding → constellation diagram.



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oding #02

→ Power :- it requires two power supplies and doubles the power as compared to coding #01.

→ Band width :- Same bandwidth requirement as option #01.

→ Error rate :- Better performance due to wider decision boundary as compared to option #01.

coding #03.

→ Power :- Highes power requirement. duty cycle 100%.

→ Bandwidth : lesser bandwidth requirement as compared to other given coding schemes. Signal is wider in time domain requires less bandwath (F.T duality property)

→ Error rate : best error rate performance, largest decision boundary as compared to other given schemes.