# Quiz 2 – 281 – 2225

# There are 5 questions – answer all 5

## Question 1

Determine the Maximum Data Rate (MDR) if we use a 10-level DIGITAL code transmitted in a Bandwidth of 100 KHz?

Nyquist Bit Rate -> MDR = 2 \* Bandwidth \* log2(# level) = 2 \* 100 \* 10^3 \* log2(10) = 664.38 (kbps)

## Question 2

Choose either OPTION A or OPTION B of Question 2 – DO NOT CHOOSE BOTH

Option A

Determine the Frame Check Sequence (FCS):

M = 1100111101

P = 1101

Option B

Using Hamming Codes, show that bit 7 will be Forward Error Corrected given the following message:

M = 11000110011

**Solution:**

m = 11, n must be the lowest number to satisfy the equation

2^n => m + n + 1

n = 4; 2^n => 12 + n; 16 => 16 (true)

H 1 H 1 H 0 H 0 0 1 1 1 1 0 1 {Even Parity}

Bit 1 000**1**

Bit 3 00**11**

Bit 4 0**1**00

Bit 5 0**1**0**1**

Bit 6 **11**00

Bit 10 **1**0**1**0

Bit 11 **1**0**11**  
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  **1110 <- Hamming code for msg M**

New Message M1: 111110000111101 (15 bits)

Bit 1 000**1**

Bit 3 00**11**

Bit 4 0**1**00

Bit 5 0**1**0**1**

Bit 6 **11**00

Bit 10 **1**0**1**0

Bit 11 **1**0**11**

Bit 12 **11**00

Bit 13 **11**0**1**

Bit 14 **111**0

Bit 15 **1111**

**1110 <-** **New Hamming Code for M1**

## Question 3

For a BER = 10-7 determine the C/N ratio for 256 QAM to support 1 Mbps in a bandwidth of 50 KHz. Show all work

**Solution:**

Given: BER = 10-7, 256 QAM, BW = 50 kHz ,Transmission Rate = 1 \* 10^6 bps|   
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Find C/N – ?

## Question 4

List and explain 3 characteristics of digital line encoding schemes which are beneficial/desirable.

## Question 5

Automatic Request for Retransmission – GO-BACK-N ARQ

Using the ARQ flow control method, fill in the “X” and “Y”….. with the appropriate values 0-7 for each of the following conditions:

Condition A – ALL frames are received error free

X =

Y =

Condition B – Frame 5 is received in error.

X =

Y =

A =

B =

C =

D =

E =

F =

G =

H =

N(s) 1 2 3 4 5 6 7 A C E G

N(r) 0 0 1 2 2 2 2 B D F H

N(s) 0 1 X

N(r) 3 4 Y

N(s) – field that within the frame

[|||N(s)|P|N(R)||]

This is a flow control part of the frame (Layer 2 and Layer 4)

N(s) – number of frames currently being sent (side A).

N(r) – Number of the that want to be sent from the other side (side B).

We assume that we use 2^3 bit fields (0-7)

The window size is 2^3-1 = 6, because 0 -7 frames