United International University (UIU)
Dept. of Computer Science and Engineering (CSE)
CSE 3715, Data Communication
BSCSE Final Examination, Spring 2024
**Total Marks: 40**   **Time: 2 hours**

Any examinee found adopting unfair means will be expelled from the trimester / program as per UIU disciplinary rules.

Answer all of the following questions

1. Given the dataword 1010011110 and the divisor 10111, **[2+2](CO3)**
   a. Show the generation of the codeword at the sender site (using binary division).
   b. Show the checking of the codeword at the receiver site (assume no error).

2. Assuming that a voice channel occupies a bandwidth of 5 kHz, we need to combine four voice channels into a link starting from a 20 kHz frequency using FDM, with a 1 kHz guard band frequency between the channels to prevent interference. What is the bandwidth of the link? Find the logical diagram for Multiplexing and Demultiplexing for the above scenario. **[2+4] (CO4)**

3. The following figure shows a multiplexer in a synchronous TDM system. Each output slot is only 10 bits long (3 bits taken from each input plus 1 framing bit). What is the outputstream? The bits arrive at the multiplexer as shown by the arrows. **[4] (CO4)**
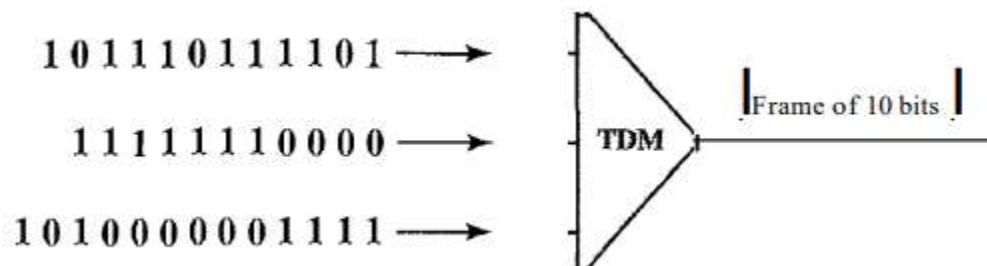
4. Using the following Hamming Code Table **[4+2](CO3)**

Datawords	Codewords	Datawords	Codewords
0000	0000000	1000	1000110
0001	0001101	1001	1001011
0010	0010111	1010	1010001
0011	0011010	1011	1011100
0100	0100011	1100	1100101
0101	0101110	1101	1101000
0110	0110100	1110	1110010
0111	0111001	1111	1111111

   a. What will be the correct data if 1110110 data is received by the receiver, assuming a maximum single-bit error in that code?
   b. What data will be transmitted from the sender for the 010100111001000010111100 message?

5. Find the bit rate and baud rate of the following signal encoding. Also, show the relative amplitude, frequency, and phase of all signals given below. **[3+2] (CO4)**
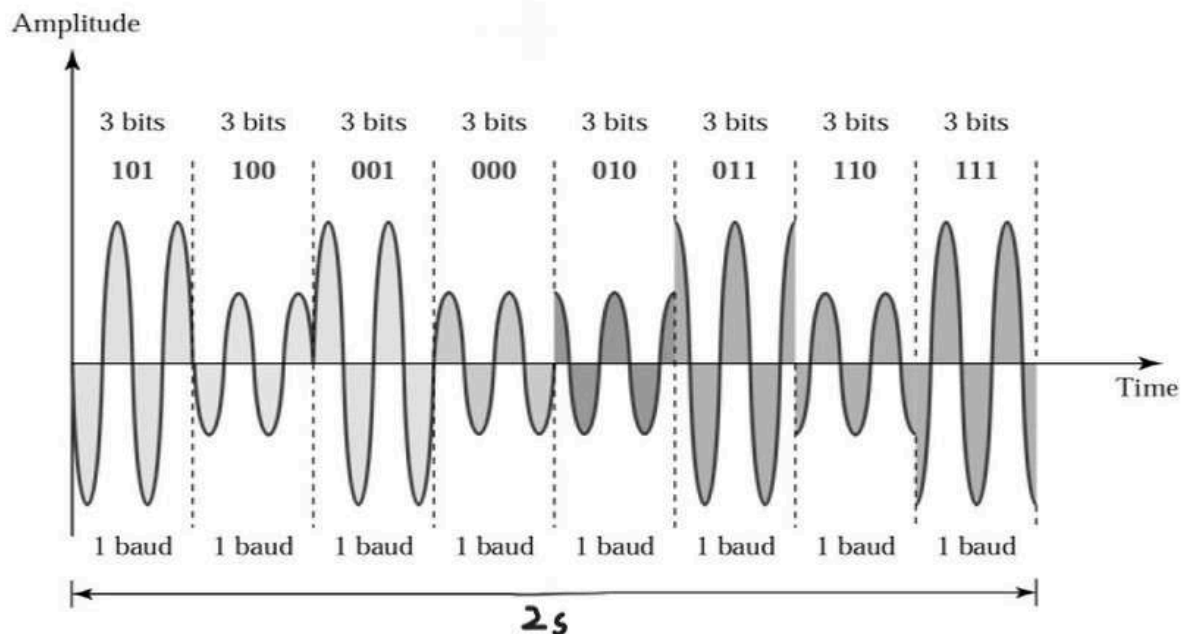
6. There are 25 balls in a closed basket. Among them, 10 balls are green, 7 balls are yellow, and 8 balls are blue. On the other hand, 6 balls are small, 7 balls are medium, and the rest are large in size. You want to guess two properties of the balls: one is color and the other one is size. Find the information gain for each color and size. Also, calculate the entropy based on color and size separately. Compare them and describe the significance of the comparison. **[4] (CO3)**

7. What is Quadrature Amplitude Modulation (QAM)? How does it differ from ASK and PSK? Explain with relevant diagrams. **[2+3] (CO4)**

8. What is the principle of frequency reuse in the context of a cellular network? Explain with a diagram. What is the major difference between 3G and 4G networks? **[3+3] (CO5)**

Course Outcomes (COs)	
CO1	**Learn** fundamentals of data communication. **Explain**, describe and design layered architecture of communication according to OSI and TCP/IP model
CO2	**Measure** information content in a signal and convert a time domain signal to frequency domain version.
CO3	**Analyze** various Encoding Techniques and Information Theory. **Learn** error detection and error correction techniques.
CO4	**Describe** different modulation and multiplexing techniques to send signals in different forms using different properties.
CO5	**Describe** the basic principles of Cellular Technology and Wireless Communication.