United International University (UIU)

Dept. of Computer Science & Engineering (CSE)

Final Exam Total Marks: **40** Fall 2021

Course Code: CSE 315 Course Title: Data Communications

Duration: 2 h 15 min, including 15 minutes for downloading the questions and uploading the answer script.

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

Figures in the right-hand margin indicate full marks.

Q1 a) Suppose that you have a bin that contains 20 balls of 4 different colors namely blue, yellow, black, and white. Among them if there are equal number of balls of each color, calculate the amount of information that you will receive by choosing a ball from the bin. **[3]**

b) Suppose in Q1(a) you have replaced the balls with 4 more black balls in the bin. Investigate whether the information that you have calculated in the previous question *Q1 (a)* increase or decrease. Explain with proper calculations. **[3]**

c) For a discrete memoryless source there are three symbols with probability $P_1 = P_3$ and $P_2 = \alpha$. Find the entropy of the source. **[4]**

Q2 a) A receiver has received a codeword of **100111** which is transmitted using Cyclic Redundancy Check (CRC) as an error detection scheme. Consider a polynomial generator of $G = x^2+x+1$, demonstrate the procedure and action of the receiver part in detecting an error. **[5]**

b) Given below a set of Code Words and a set of Message Words representing the Code Word set. **[5]**

Message Word	Code Word
00	0000
01	0101
10	0110
11	0111

Demonstrate an example of Forward Error Correction (FEC) for the following cases: **(i)** one bit of error, and **(ii)** two bits of error, when 0111 Code Word is transmitted in a system.

Q3 a) What is the advantage of using Quadrature Amplitude Modulation over ASK, PSK and FSK? **[2]**

b) Five (05) channels, each with a 25-kHz bandwidth, are to be multiplexed together. What is the minimum bandwidth of the link if there is a need for a guard band of 5 kHz between the channels to prevent interferences? Demonstrate the configuration using frequency domain. **[3]**

c) Write down the prime difference between TDM and FDM.
Suppose, 10 links are used in a TDM. If each time slot duration is **t** seconds and data are taken from each line every 10**t** seconds, then how many slots does a single frame contain? **[3]**

Q4

a) Describe the step-by-step procedures how a cellular phone user A gets connected to another cellular phone user B, where both users reside in the same cell. **[2]**

b) Describe the principle of frequency reuse in the context of a cellular network. Demonstrate how the capacity of cellular system can be increased. **[2]**

c) Compare between 4G and 5G cellular system based on data rate, multiplexing, and core network. **[3]**

d) Suppose that there is a cellular system of 64 cells with a cell radius of 0.8 km, a total frequency bandwidth that supports 336 traffic channels, and a reuse factor of N, where the value of N will be determined considering $I = 2$ and $J = 2$. **[5]**

- What geographic area is covered?
- What is the total number of concurrent calls that can be handled?

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