Department: CSE

Course No: CSE 3211

Examination: Final

Student ID: 170204004

Program: B.Sc in CSE

Course Tile: Data Communication

Semester: Spring 2020

Sign and date: Rukaiya
08.06.21

ID: 170204004

CourseNo: CSE 3211

Sign: Rukaiyej

Answer to Question 1

(A)

For successful communication, both the sender and reciever must follow a common set of rules or protocols. But these protocols are very complex, therefore Layered approach is used to deal with this complexity. In this approach, each complex problem is divided into a number of pieces of manageable size. It provides structured modular approach, therefore each module can be developed and tested indepently. This allows enhancement and implementation of the functions of a particular layer without affecting other layers.

Two adjacent layers in a layered network communicate through an interface. Between each pair of adjacent layers there is an interface and ~~refers~~ refers to the connecting point between them. The ~~inf~~ interface defines which primitive services the lower layer offers to the upper layer.

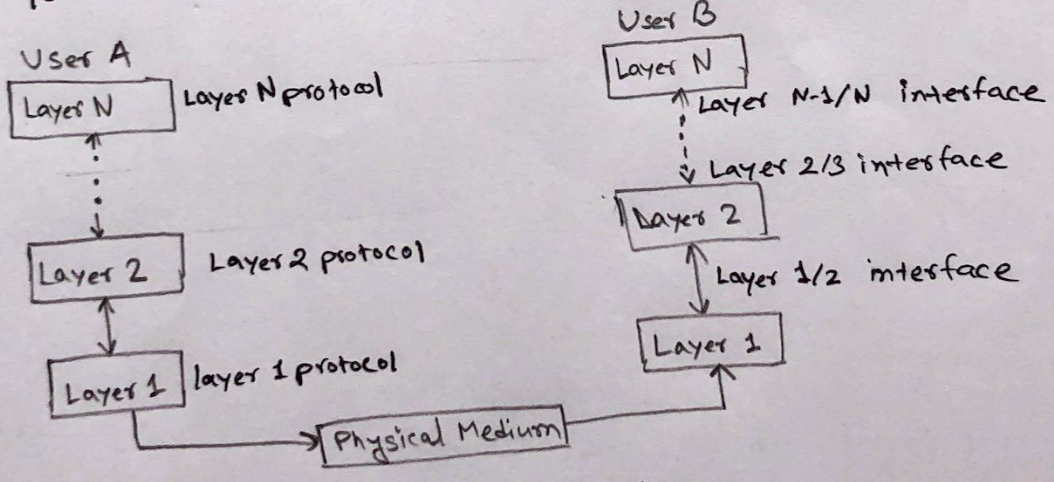


fig: Layers and interface.

ID: 1702041004
Course No: CSE3211
Sign: Rukaiya

Ans to 1(B)

The function of the Data Link layer is to transform the physical layer to a reliable transmission and reception of structured stream. The key functions are discussed below:

1. Framing: The data link layer divides the stream of bits ~~recie~~ received from the network layer into manageable data units called frames.

2. Physical Addressing: If the frames are to be distributed to different systems on the network, the data link layer adds a header to the frame to define the sender and/or receiver of the frame. If it is for a system outside the network, the receiver's address ~~of the~~ is the address of the device that connets the network to the next one.

3. Synchronization: When two or more devices are connected to the same link, data link layer protocols determine which device has control over the link ~~air~~ at any given time.

4. Error Control: This layer adds reliability to the physical layer by adding mechanisms to ~~dect~~ detect and retransmit damaged or lost frames.

5. Flow control: If the rate of data ~~absorb~~ absorption of the receiver is less than the rate of data production of the sender, the data-link layer uses a flow control mechanism so that the receiver is not overwhelmed.

These are the functions of the data link layer. The layer also decides whether the transmission will be character oriented or bit oriented.

ID: 170204004

Course No: CSE 3211

Sign: Rukaiya

Ans to 1(C)

2 million bytes $= 2 \times 10^6 \times 8$ b

$= 16 \times 10^6$ b

$= 16000$ Kb

Time taken to down load in 56 Kbps channel $= \frac{16000}{56}$

$= 285.7$s

" " " " in 1Mbps channel $= \frac{16000}{1024}$

$= 15.6$s

Ans to 7(A)

(i) Relationship between the size of the data word and the size of the codeword is:

$$n = k + r$$

here,

n = size of the codeword.

k = size of the dataword

r = size of the rieminder.

(ii) The remainder is always one bit smaller than the divisor

(iii) The degree of polynomial generator is one less than the size of the divisor.

(iv) The degree of polynomial generator is the same as the size of the remainder.

ID: 170204004

Course No: CSE324

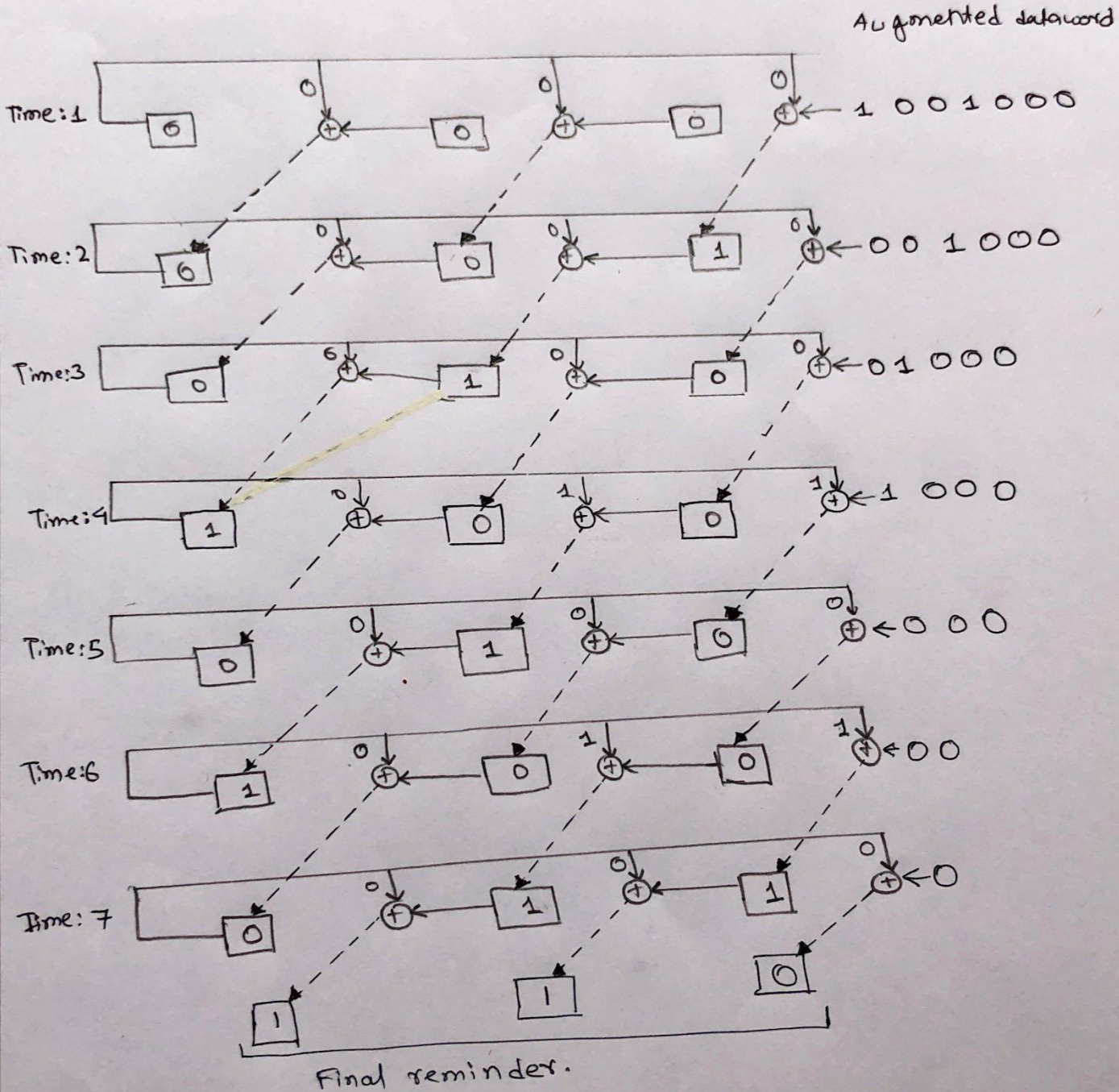
Sign: Rukaiya

Answer to 7(B)

ID: 17020400 4, the second last digit is 0, ie. even

∴ dataword = 1001000

Simulation of divisor in CRC encoder for 1001000.

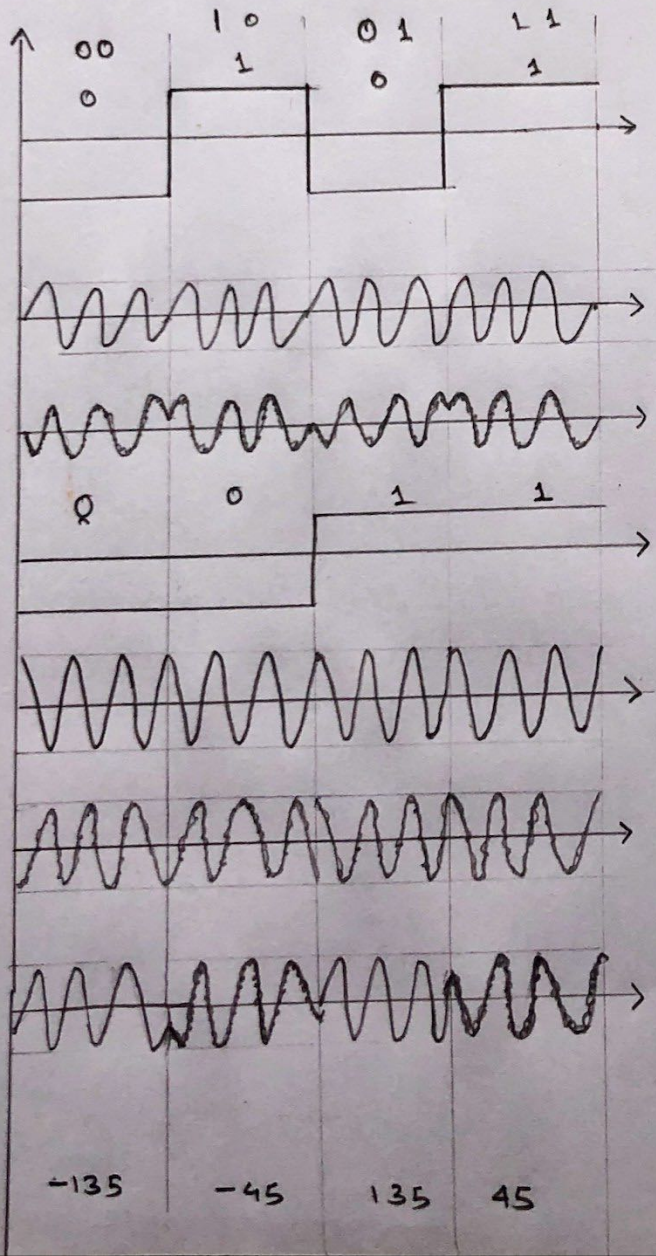


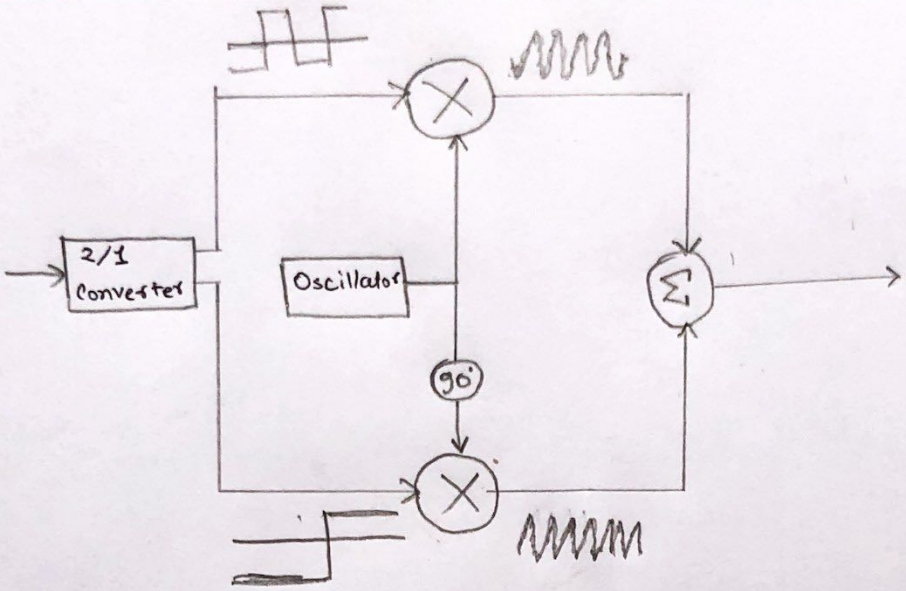
ID: 170204004
CourseNo: CSE3211
Sign: Rukaiya

Answer to 3(A)

Quadrature phase shift keying (QPSK) is a digital modulation process which ~~modulates~~ conveys data by changing the phase of a constant frequency reference signal. We used QPSK instead of BPSK because QPSK has ~~the adv~~ double data rate compared to BPSK. It uses two separate BPSK modulation, one is in-phase and the other is quadrature. It ~~ha~~ can send 2-bit per carrier compared to one bit per carrier in the case of BPSK.

Implementation of QPSK:





The incoming bits are first passed through a serial-to-parallel conversion that sends one bit to one modulator and the next one to ~~the other~~ another modulator. The two composite signals created by each multiplier are sine waves with same frequency ~~and~~ but different phases. When they are added they form another sine wave. with ~~one of~~ four possible phases: 45°, -45°, 135°, -135°. There are 4 kinds of signal element in the output signal, so we can send 2 bits per signal element.

Ans to 3(e)

(I) Yes, it is possible to understand if a signal is ~~peri~~ periodic or not just by looking at its frequency-domain plot.
Frequency is the number of complete waves per second, we can write $f = \frac{1}{T}$, where T is the time period of the wave.
If a signal is periodic then its frequency is discrete.
If it is aperiodic it is continuous.

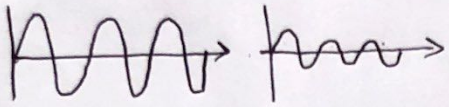
II
Causes of Impairment:

1) Attenuation means loss of energy
2) Distortion means the signal changes its form or shape.
3) Noise is another cause of impairment, such as thermal noise, crosstalk etc.

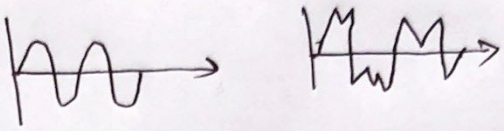
ID: 170204004
Course No: CSE 321
Sign: Rukaiya

~~Ans to 3(B)~~

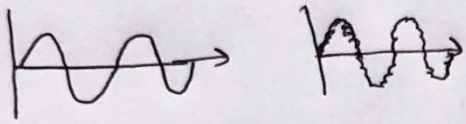
~~Nois~~ Attenuation:



Distortion:



Noise:



Ans to 3(B)

Nyquist Theorem, also called the sampling theorem, is a principle that engineers follow in the digitization of analog signal. It states that a periodic signal must be sampled at more than twice the highest frequency component of the signal.

We know, $S = (1/r) \times N$

(I) $r = \log_2 2 = 1$ $\therefore S = 1/1 \times 2000 = 2000$ baud

(II) $r = \log_2 2 = 1$ $S = 1/1 \times 4000 = 4000$ baud

(III) $r = \log_2 4 = 2$ $S = 1/2 \times 6000 = 3000$ baud

(IV) $r = \log_2 64 = 6$ $S = 1/6 \times 36,000 = 6000$ baud

Here we can see that 64-QAM has the highest baud rate while the FSK has the lowest baud rate.

Answer to 4(A)

Checksum uses a small number of bits to detect errors in a message of any size. It is not very strong as other methods. If the value of one word is incremented and the value of another is decremented by the same amount, the two errors can not be detected as the sum and the checksum remains the same. Also if the values of several words are incremented but the total change is a multiple of 65535, the sum and the checksum does not change and the error goes undetected. ~~Due to~~ It some of the bits get corrupt and the bits changed.

Most of time the bits are shuffled and the order of bits are changed, but they can not be detected by checksum because the sum remains the same.

Ans to 4(B)

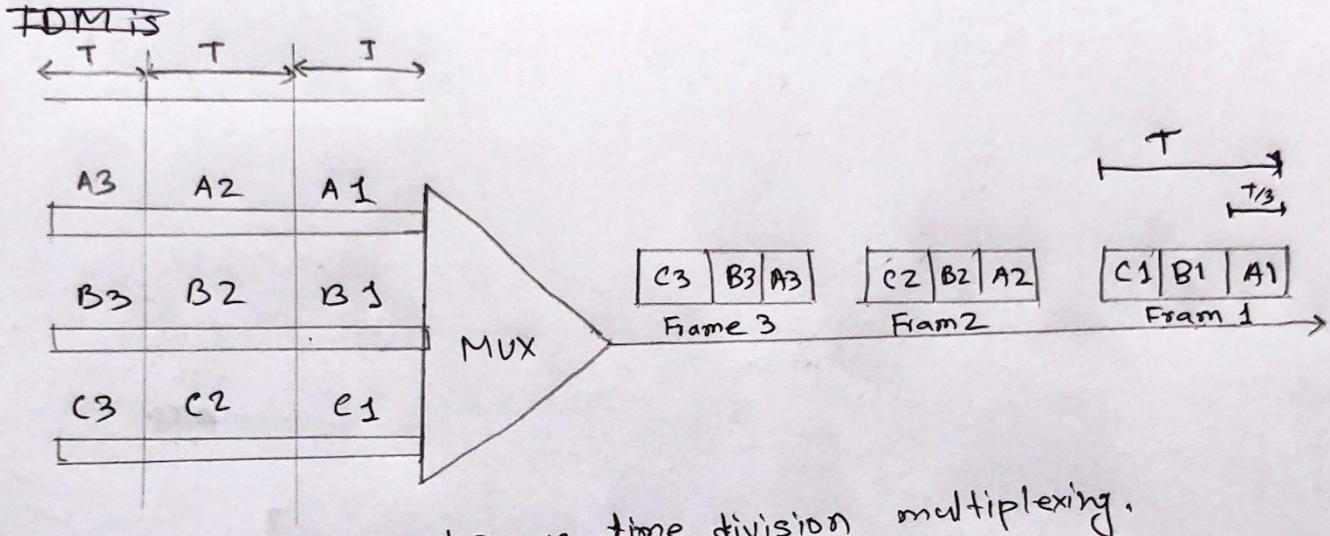


Fig: Synchronous time division multiplexing.

In synchronous TDM, the data flow of each input connection is divided into units, where each input can be one block of data. Each input unit becomes one output unit and occupies one output time slot. A unit in the output connection has a shorter duration therefore it travels faster.
Here a round of data units each input connection is collected into frame. If we have n connections frames is divided into n time slots and one slot is allocated for each input line. If the duration of the input unit is T, the duration of each slot is T/n and the duration of each frame is T.

ID: 170204004
CourseNo: CSE 3211
Sign: Rukaiya

Ans to 4(c)

Each band is 25 MHz, and after dividing by 30kHz we get 833.33 Hz. In reality, the band is divided into 832 channels. Of these, 42 channels are used for control, that means 790 channels will be available. Therefore 790 people can use them.

Ans to 2.(A)

For analog-to-digital conversion (ADC) to result in a faithful reproduction of signal, samples of analog waveforms are taken frequently. Any analog signal consists of components of various frequencies, the simplest case is the sine wave, in which all signal energy is concentrated at one frequency. The highest frequency component in an analog signal determines the bandwidth of the signal. Greater the frequency greater the bandwidth considering that all other factors are constant,

Suppose the highest frequency component for a signal is fmax. According to the theorem, the sampling rate must be at least 2fmax.

PCM or Pulse Code Modulation is a technique to change an analog signal to digital data. Here, analog signal is sampled, then the sampled signal is quantized. Then the quantised values are encoded as streams of bits. Here while sampling, also referred to as pulse amplitude modulation (PAM), Nyquist theorem is used.

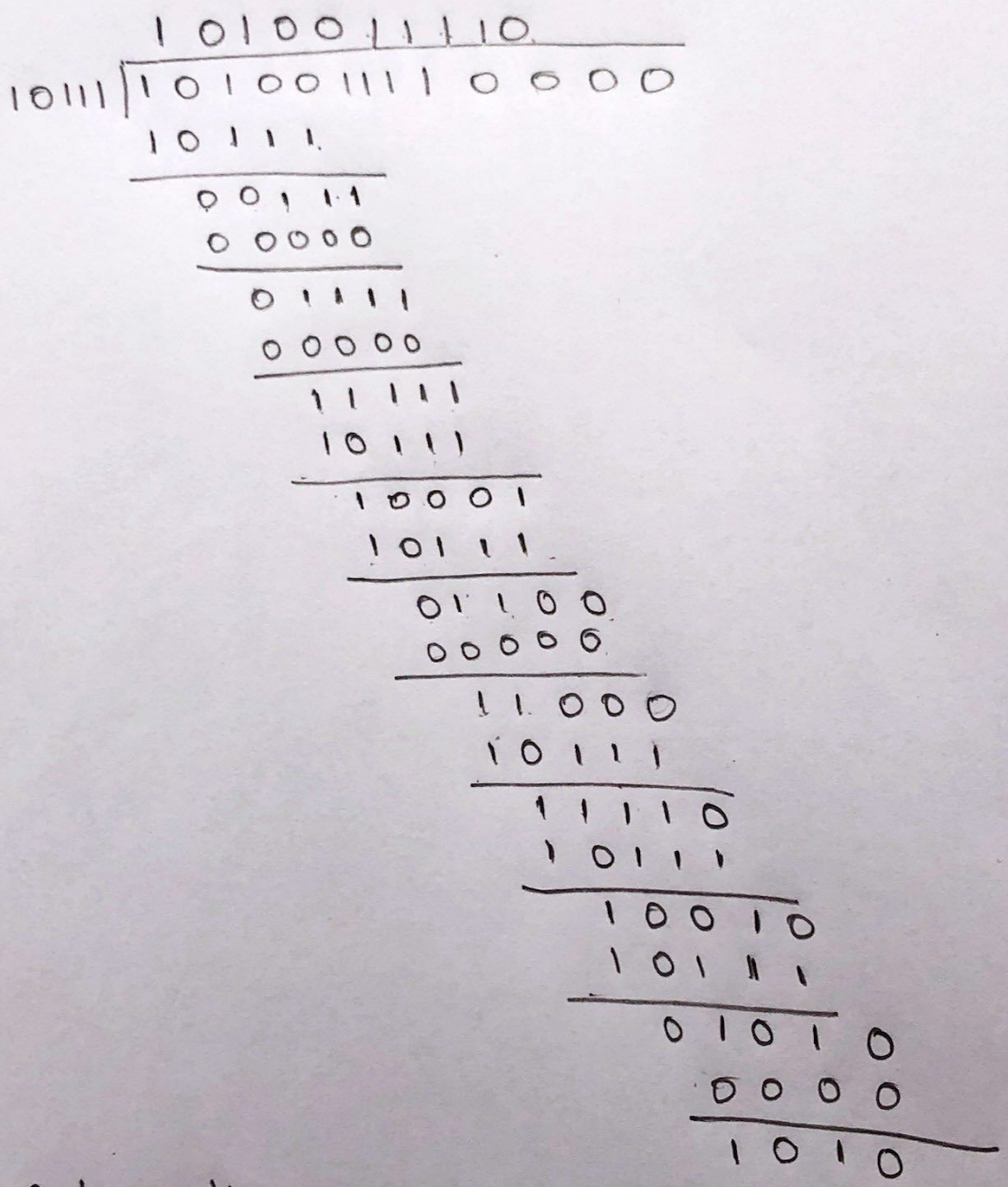
ID: 170204004

Course No: CSE 3211

Sign: Rukaiya

Ans to 2(B)

dataword 1010011110 divisor 10111



Code word:

1010011110 1010