

Q1: Briefly describe the services provided by data-link layer.

A1) Data link layer consists of frames, it is responsible for receiving of data and dividing it into manageable units from network layer. It is also responsible for error control.

Q2:- Compare and Contrast.

Byte Oriented Protocol: It is a communication protocol, in this protocol bytes are used as control codes, also known as Character - Oriented Protocol.

Bit Oriented Protocol:- It is a type of communication protocol that sees the transmitted data as an stream of bite with no meanings.

**Bit Stuffing:-** It is a process of inserting one or more bits into a transmission unit to provide signalling information to the receiver.

**Byte Stuffing:-** In this process, it transforms a sequence of data which may have some 'reserved' values or 'illegal' words into longer sequence and removing those reserved words.

**Flow Control:-** It manages the flow of data between different computers or devices or nodes of any computer.

**Error Control:-** Error Control is the technique of detecting and correcting data blocks when any communication takes place b/w two devices.

**HDLC:-** It stands for High-Level Data link Control. It is a bit oriented code and a synchronous data link layer product developed by ISO. It is both connection-oriented and wireless service.

**PPP:-** It is a communication protocol of data link layer between two routers directly without having any host or other networking b/w them.

**Go-Back-N ARQ:-** It is a repeat request protocol, which continues to send number of frames in specified window sizes without receiving a packet from receiver.

**Selective-Repeat-ARQ-protocol:-** It is a specific instance of repeat request protocol which is responsible for managing sequence numbers and retransmission in reliable communications.

**Circuit Switched Network:-** In this type of network the communication b/w two end devices must be set up before they can communicate. It connects for the duration of that connection.

**Packet Switched Network:-** It moves data in separate, small blocks in form of packets. They move based on destination address in each packet. After receiving, packets are reassembled in proper sequence to make up the message.

Q3: Explain protocols for noiseless and noisy channels?

Ans:- A channel in which no frames are lost or corrupted is known as noiseless channel.

- 1) **Simplest Protocol:** There is no flow and error control mechanism. It is one-way protocol.
  - The receiver can handle and receive any frame.

- The protocol runs in data-link layer of source machine and receiver is in the destination machine.
- 2) Stop and Wait Protocol:- It is the simplest retransmission protocol.
- The sender sends one frame and waits for acknowledgement, this process is known as stop-and-wait.

Noisy Channels:- A communication channel that makes error in which frames may be either damaged or lost is called Noisy Channels.

- 1) Stop and Wait Auto Repeat Request:-
- 2) Go-Back-NARC
- 3) Sequence numbers.

Q6: \_\_\_\_\_

Answer a:- Before A sends any frame

Sender: 0 1 2 3 4 5 6

Window of PDU that may be transmitted = 4 bit

Receiver: 0 1 2 3 4 5 6

Answer b:- After A sends frame 0, 1, 2 and receives ack from B for 0, 1

Sender: 0 1 2 3 4 5 6

Ack received only for two bits.

Receiver: 0 1 2 3 4 5 6

Q7:- List three techniques of digital-to-digital conversion?

Ans:- The three techniques of conversion are

- 1) Line coding
- 2) Block coding
- 3) Scrambling

Line coding is always needed. It is the process of converting digital data to digital signals.

Q8) Distinguish b/w signal element and data element?

Data element is the smallest entity that can represent a piece of info. A signal element is the shortest unit of a digital signal. Data elements are the data we need to send and signal elements are the data we can send.

Q9:- Distinguish between data rate and signal rate?

Ans:- Data rate is the number of elements that are transmitted per second whereas signal rate is the number of signals elements have to be transmitted per second.

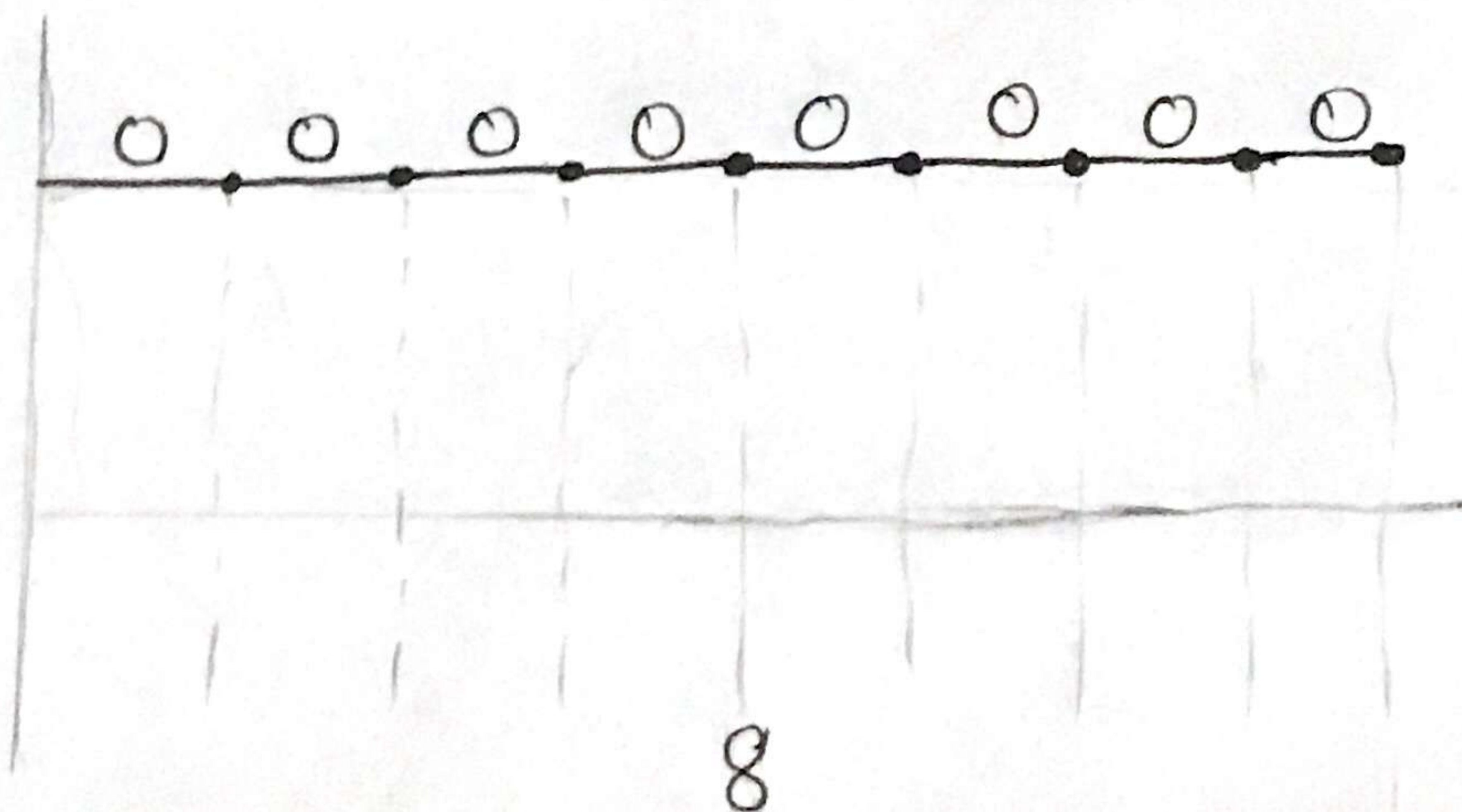
Q10:- -----

Average number of changes

$$(0+0+8+4)/4 = 3; N=8$$

Bandwidth is proportional to  $3/8 N$

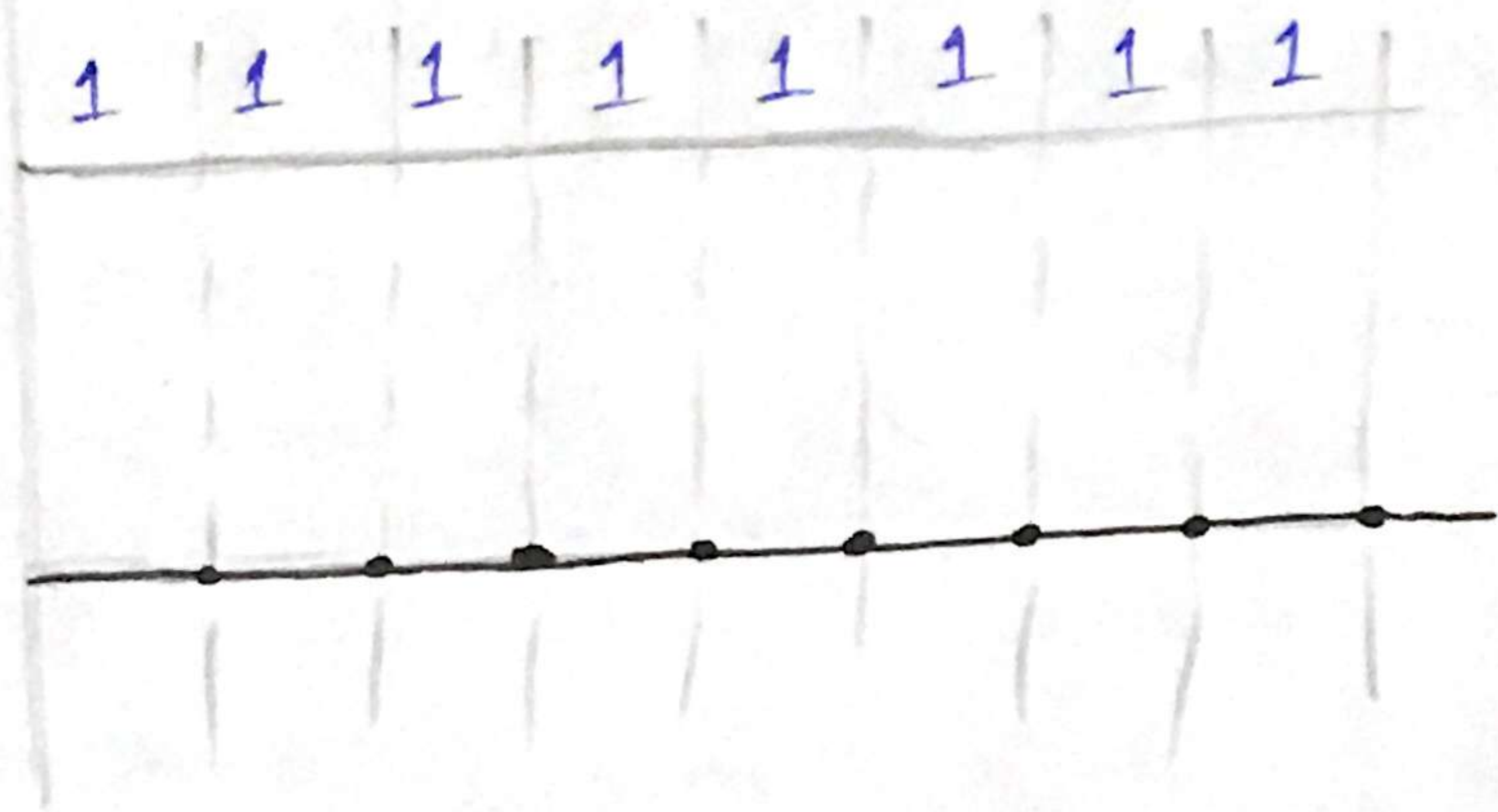
(i) 00000000





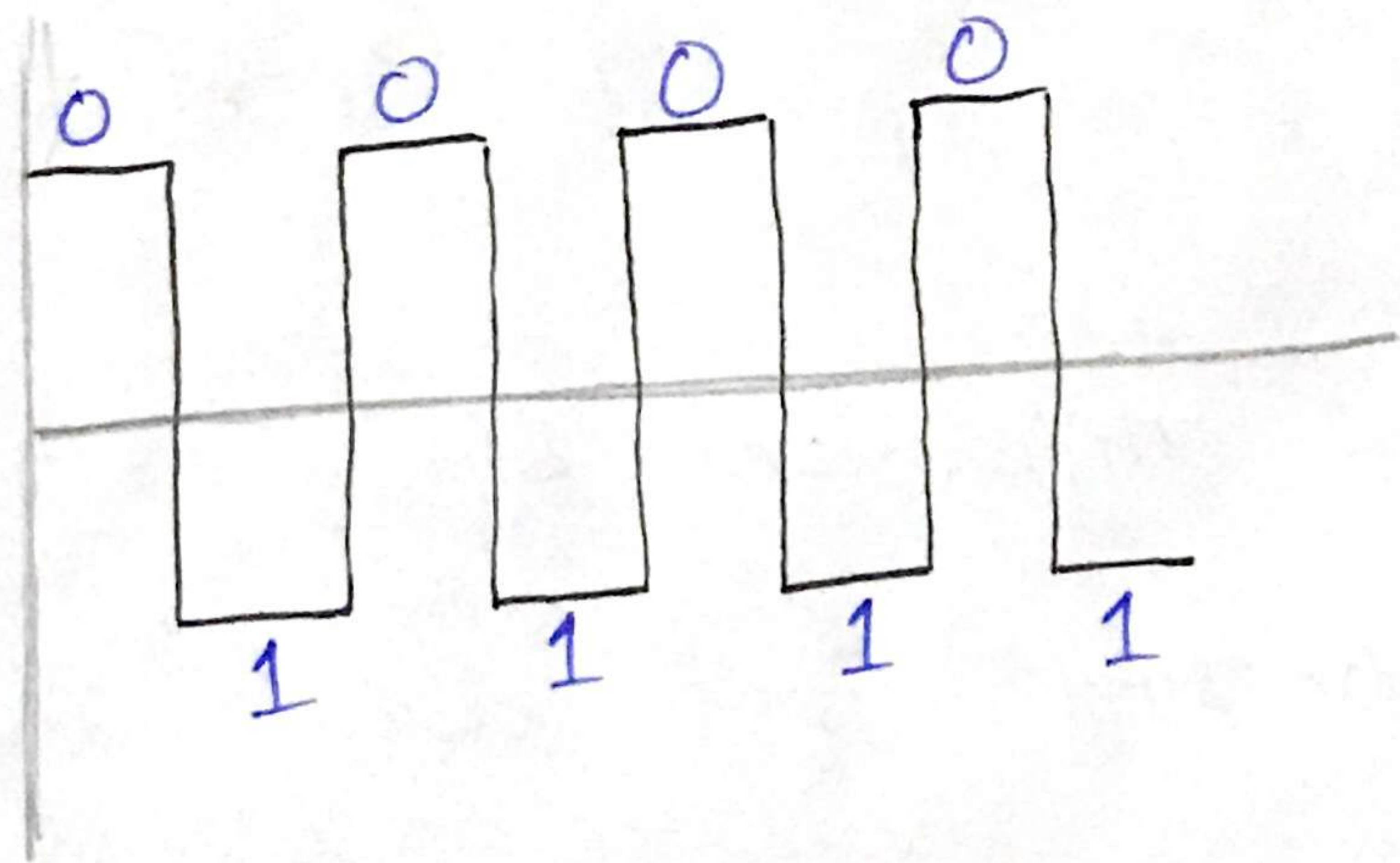
(ii)

11111111



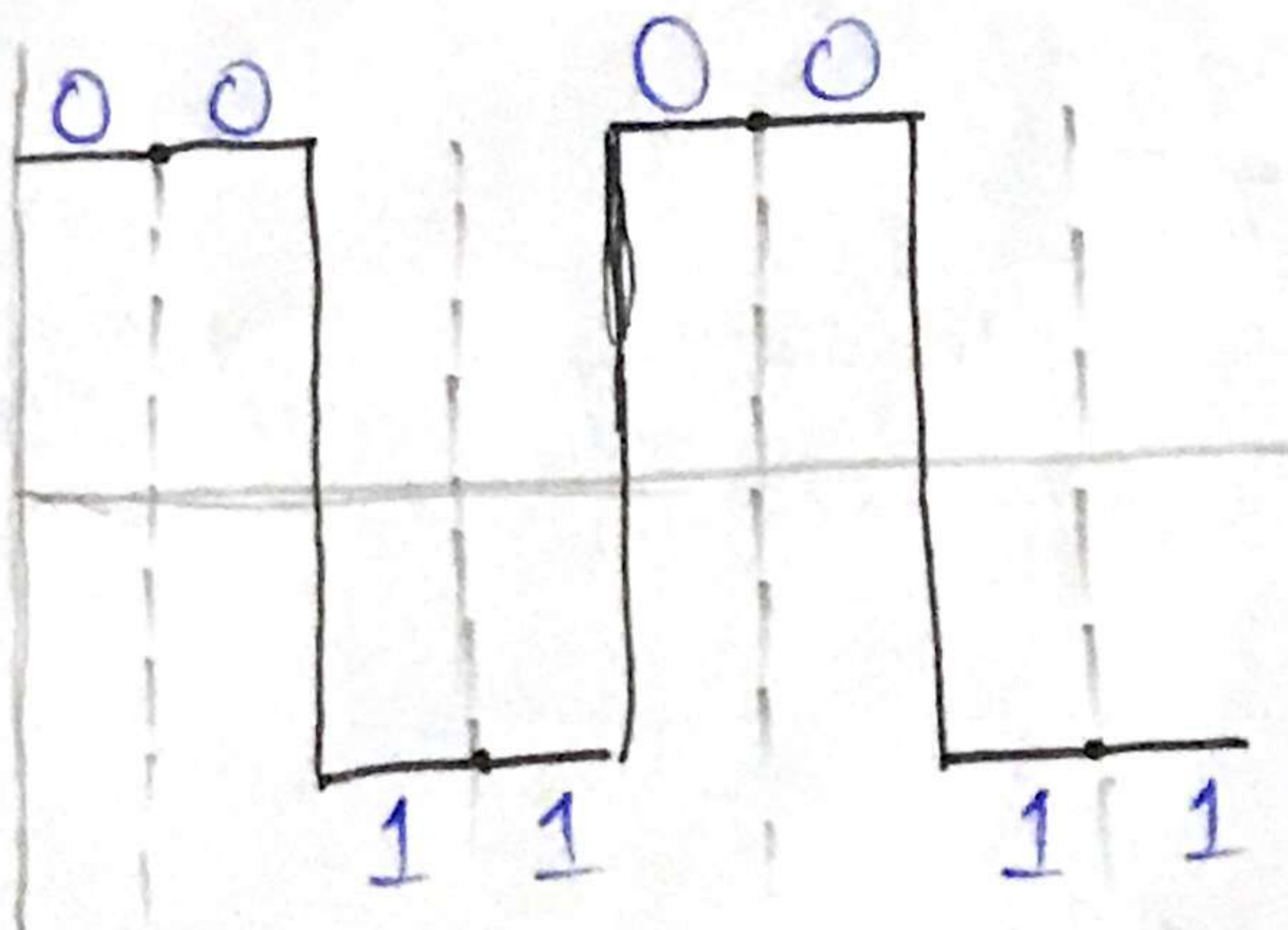
(iii)

01010101



(iv)

00110011



Q11:- What is the number of bits in IPv4 address and IPv6 address?

Ans:- IPv4 address is a 32-bit number, it is divided into four 8-bit numbers making the address more straightforward. In octets it is separated by a decimal point.

IPv6 addresses are written in a series of eight 4-character hexadecimal numbers, ~~with~~ each represent 16 bit.

Q12:- What are difference b/w ----- ?

Classful addressing:- In classful addressing it divides the available address space of IPv4 into five classes A, B, C, D and E.

Classless addressing:- This is an improved IP system of addressing. It does the allocation of IP addresses more efficiently.

Q 15:- What is the network address -----  
-----?

Ans. Network address is known as the identifier of the network and makes identifying of the network easy. It routes the packet to its final destination. We can find the network address if block of addresses is given by:  
(prefix in decimal)  $\times 2^{32-n}$

Q 16:- What is NAT? How NAT helps in address depletion?

Ans:- NAT stands for network address translation. Its job is to translate IP addresses of computers in local networks to a single IP. They are used in routers to connect PC's to internet. It helps in address depletion by decreasing number of IP addresses in an organization.

Q17) What is the address space in 16-bit address?

One address can only address one byte. Using 16 bits, we can write :

65536 addresses

0 to 65535

Q19) Change IP addresses from dotted.decimal to binary notation.

a) 129.14.8.6

2	129
2	64-1
2	32-0
2	16-0
2	8-0
2	4-0
2	2-0
	1-0

2	14
2	7-0
2	3-1
	1-1

2	6
2	3-0
	1-1

2	8
2	4-0
2	2-0
	1-0

129.14.8.6 = 10000001 0001110 0001000 0000110

(b) 208 · 34 · 54 · 12

$$\begin{array}{r|l} 2 & 208 \\ \hline 2 & 104 - 0 \\ \hline 2 & 52 - 0 \\ \hline 2 & 26 - 0 \\ \hline 2 & 13 - 0 \\ \hline 2 & 6 - 1 \\ \hline 2 & 3 - 0 \\ \hline & 1 - 1 \end{array}$$

$$\begin{array}{r|l} 2 & 34 \\ \hline 2 & 17 - 0 \\ \hline 2 & 8 - 1 \\ \hline 2 & 4 - 0 \\ \hline 2 & 2 - 0 \\ \hline & 1 - 0 \end{array}$$

$$\begin{array}{r|l} 2 & 54 \\ \hline 2 & 27 - 0 \\ \hline 2 & 13 - 1 \\ \hline 2 & 6 - 1 \\ \hline 2 & 3 - 0 \\ \hline & 1 - 1 \end{array}$$

$$\begin{array}{r|l} 2 & 12 \\ \hline 2 & 6 - 0 \\ \hline 2 & 3 - 0 \\ \hline & 1 - 1 \end{array}$$

$$208 \cdot 34 \cdot 54 \cdot 12 = 11010000 \ 00100010 \ 00110110 \ 00001100$$

Q20 Change address — — —

(a) 01111111 11110000 01100111 01111101

$$\begin{aligned} 01111111 &= 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\ &= 64 + 32 + 16 + 8 + 4 + 2 + 1 \\ &= 127 \end{aligned}$$

$$\begin{aligned} 11110000 &= 1 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\ &= 128 + 64 + 32 + 16 \\ &= 240 \end{aligned}$$

$$\begin{aligned} 01100111 &= 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\ &= 64 + 32 + 4 + 2 + 1 \\ &= 103 \end{aligned}$$

$$\begin{aligned}
 001111101 &= 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\
 &= 64 + 32 + 16 + 8 + 4 + 1 \\
 &= 125
 \end{aligned}$$

$$127 \cdot 240 \cdot 103 \cdot 125$$

(b) 10101111    110000000    111110000    00011101

$$\begin{aligned}
 10101111 &= 1 \times 2^7 + 0 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\
 &= 128 + 32 + 8 + 4 + 2 + 1 \\
 &= 175
 \end{aligned}$$

$$\begin{aligned}
 110000000 &= 1 \times 2^7 + 1 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\
 &= 128 + 64 \\
 &= 192
 \end{aligned}$$

$$\begin{aligned}
 111110000 &= 1 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 \\
 &= 128 + 64 + 32 + 16 + 8 \\
 &= 248
 \end{aligned}$$

$$\begin{aligned}
 00011101 &= 0 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\
 &= 16 + 8 + 4 + 1 \\
 &= 29
 \end{aligned}$$

$$175 \cdot 192 \cdot 248 \cdot 29$$

Q21)

As the IP address of host is  
 $25.34.12.56/16$ , so

host first address =  $25.34.0.1$

Network address =  $25.34.0.0$

Last address =  $25.34.255.255$ .