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Q1:) In a block of address, we know the IP address of one host is 101.10.11.X/ID_{4+5}. What are first address (network address) and the last address (Limited broadcast address) in this block.

Given:- IP of one host = 101.10.11.X/ID_{4+5}

Required:- X = ? , ID_{4+5} = ?

First address (network address) = ?
Last address (Limited broadcast address) = ?

Solution:-

101.10.11.X/ID_{4+5} —— (1)

X = Sum of ID

ID = 14461 ⇒ Sum = 1+4+4+6+1 = 16
X = 16 —— (2)

ID_{4+5} = Sum of 4^{th} and 5^{th} digit of ID
= 4^{th} = 6 , 5^{th} = 1
= 6+1
ID_{4+5} = 7 —— (3)

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Putting values of ② and ③ in ①

IP = 101.10.11.16/7

(a) First address (Network address)

IP = 101.10.11.16/7

Converting to Binary Notation.

101 = 01100101
10 = 00001010
11 = 00001011
16 = 00010000

In Binary Notation

01100101.00001010.00001011.00010000

⇒ First address can be found by:
32-n ⇒ n = net mask = 7
32-7 = 25

We will convert 25 right most bit's to 0's for first address

01100101.00001010.00001011.00010000
Converting right most 25 bits to 0's

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01100100 · 00000000 · 00000000 · 00000000

Converting above to Decimal notation

$01100100 = 0\times2^7+1\times2^6+1\times2^5+0\times2^4+0\times2^3+1\times2^2+0\times2^1+0\times2^0$
$= 64+32+4$
$= 100$

$00000000 = 0\times2^7+0\times2^6+0\times2^5+0\times2^4+0\times2^3+0\times2^2+0\times2^1$
$+0\times2^0$
$= 0$

we get
100.0.0.0/7 as first address

b) Last address.
IP = 101.10.11.16/7

Converting to Binary Notation

101 = 01100101
10 = 00001010
11 = 00001011
16 = 00010000

In Binary Notation
01100101 · 00001010 · 00001011 · 00010000

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=> Last address can be found by changing 32-n bits of most right to '1'.

$32 - n \Rightarrow 32 - 7 \Rightarrow 25$

$\therefore$ net mask = n

Converting 25 right most bit's to '1'

01100101 . 00001010 . 00001011 . 00010000

converting these bits to 1

01100101 . 11111111 . 11111111 . 11111111

Converting above to Decimal Notation

$01100101 = 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 64 + 32 + 4 + 1$

$= 101$

$11111111 = 1 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$= 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1$

$= 255$

101 . 255 . 255 . 255 / 7

(Last address)

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Q2) Take your Roll No as decimal Notation now convert it into Binary Notation. Draw the graph of the NRZ-L scheme using the Binary Notation of your Roll no as data stream, assuming that last signal level has been positive.

ID = 14461

14461

Converting to ~~Hexa~~ Binary notation

2	14461
2	7230-1
2	3615-0
2	1807-1
2	903-1
2	451-1
2	225-1
2	112-1
2	56-0
2	28-0
2	14-0
2	7-0
2	3-1
	1-1

14461 = 11100001111101

Now creating NRZ-L scheme.

As we have to keep our last value positive, our last value is already positive, No changes will be made.

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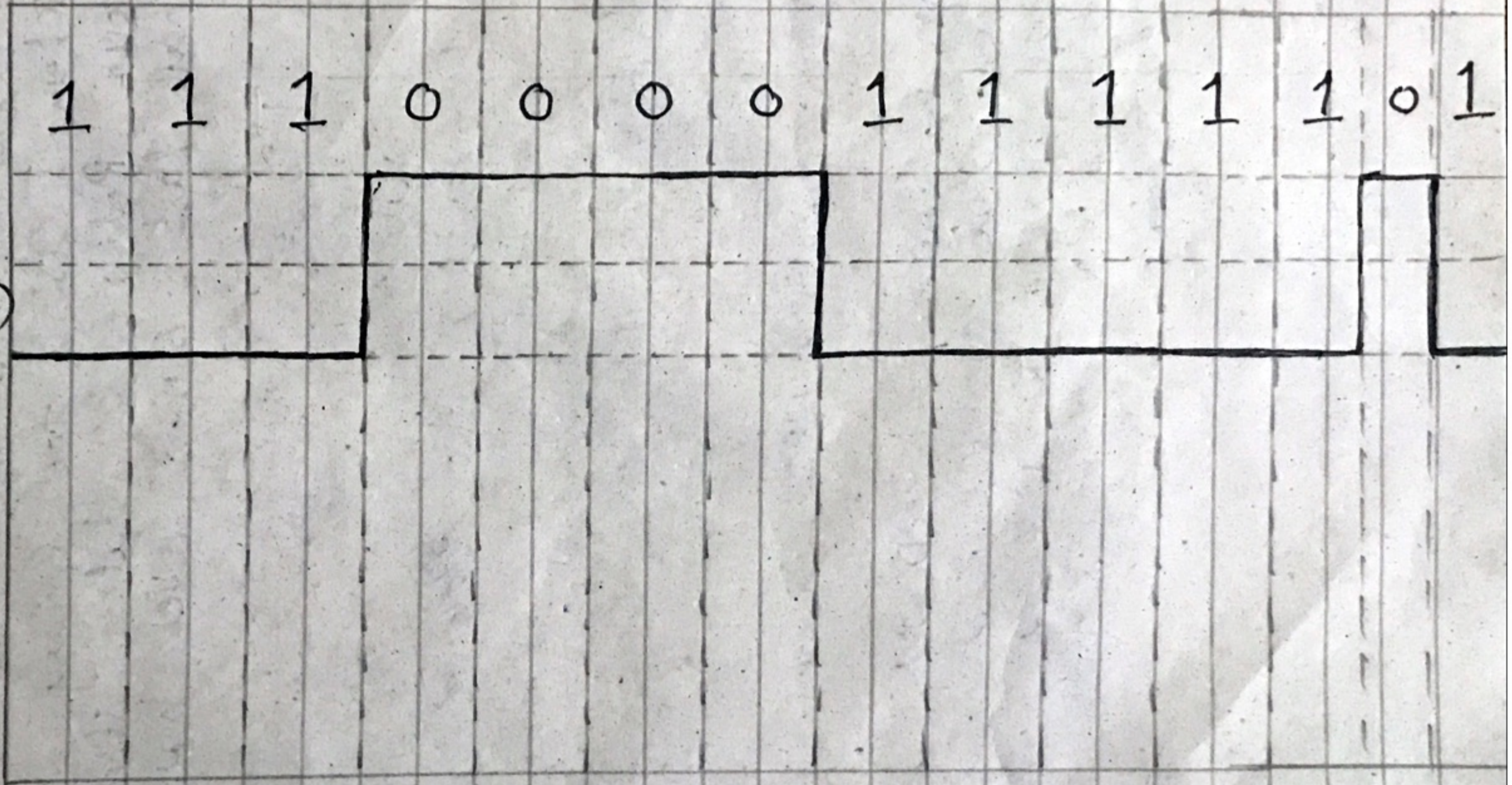
NRZ-L
(scheme)



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Q3)

Window Size = ID_{Last}

$ID = 14461$
$ID_{Last} = 1$

Window size = 1

(a) Before A sends any frame.

Sender:-
0 1 2 3 4 5 6
windows of PDU transmitted = 1 bit window

Receiver:-
0 1 2 3 4 5 6

(b) After A sends frame 0,1,2 ---

Sender:-
0 1 2 3 4 5 6
A shrunk it's window, keeps copy of PDU

Receiver:-
0 1 2 3 4 5 6

Receives all data.

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Q4)

160 · (X) · (ID 3+4) · 0/16
160 · 16 · 10 · 0/16

(a)

16 customers needs 64 addresses

6 ($\log_2 64$)
36 bits for each host.

length of prefix :
32 − 6 = 26

1st customer:-
160·16·10·0/26 160·16·10·63/26

2nd customer:-
160·16·11·0/26 160·16·11·127/26

3rd customer:-
160·16·12·0/26 160·16·12·191/26

⋮

16th Customer:-
160·16·25·0/26 160·16·25·255/26

Total = 16×64 = 1024 addresses.

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(b) Second group has 64 customers, each needs 32 addresses

∴ 5 ($\log_2 32$)
25 bits for each host.

length of prefix:

32 - 5 = 27

1st customer:-
160.16.26.0/27 160.16.26.31/27

2nd customer:-
160.16.27.32/27 160.16.27.63/27

3rd customer:-
160.16.28.64/27 160.16.27.95/27

⋮

64th customer:-
160.16.89.255/27 160.16.89.255/27

Total addresses = 64 x 32 = 2048

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(c) Third group has 64 customers each needs 16 addresses.

i 6 ($\log_2 16$)
24 bits for each host.

32 - 4 = 28

1st customer:-
160.16.90.0/28 160.16.90.15/28

2nd customer:-
160.16.91.16/28 160.16.91.31/28

3rd Customer:-
160.16.92.32/28 160.16.92.47/28

⋮

164th customer:-
160.16.153.255/28 160.16.153.255/28

Total = 64×16 = 1024 address

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Numbers of granted address = 65,536
addresses used = 4096
Available addresses = 61,440