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Exam Roll - CSE 214021
Semester - 2nd
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Group-A

Q1.

No. of signal level $L = (200000)_8$

$= 2 \times 8^5 = 2^1 \times 2^{3\cdot 5}$

$= 2^{(1+15)}$

$= (2^{16})_{10}$

~~So, N =~~

~~So here N =~~

~~So, from Nyquist formula~~

~~We know~~

Now, here difference between data rate (N) and signal rate (S) $= (3A98)_{16} = (15000)_{10}$

So, $N - S = 15000$

$\Rightarrow N = S + 15000$

Now, we know $S = \dfrac{N}{\log_2 L}$

$\Rightarrow S = \dfrac{S+15000}{\log_2 2^{16}}$

$\Rightarrow S = \dfrac{S+15000}{16}$

$\Rightarrow 16S - S = 15000$

$\Rightarrow S = \dfrac{15000}{15} = 1000$ baud

So, ~~1 - d~~

So, $\boxed{1 - b}$

Q2.

data rate N = 10 Mbps

We know for manchester encoding

average signal rate

$S_{avg} = N$

So, Here S_{avg} = 10 Mbaud = 10000 Kbaud

and also B_{min} (minimum bandwidth) = S

So, B_{min} = 10 MHz = 10000 KHz

So, $\boxed{2-d}$ → None of these above

Q3:-

~~P) 0 1 1 R) 0 1 0 following manchester~~

Scheme

Q3.

P) 0 1 1 Q) 0 1 0 following manchester scheme

R) 0 1 1 S) ~~1001~~ 0 1 0 following differencial manchester scheme

$\boxed{3-c}$

Q-6) $SNR = \frac{V_S^2}{V_N^2}$ [where V_S = peak voltage of signal
V_N = peak voltage value of noise]

So, $SNR_{DB} = 10 \log_{10} SNR$

$= 10 \log_{10} \frac{V_S^2}{V_N^2}$

$= 20 \log_{10} \left(\frac{V_S}{V_N}\right)$

So, Here

$$20 \log_{10}\left(\frac{V_S}{V_N}\right) = 20 \frac{\ln N}{\ln 10}$$

$$\Rightarrow \log_{10}\left(\frac{V_S}{V_N}\right) = \log_{10} N$$

$$\Rightarrow \frac{V_S}{V_N} = N$$

$$\Rightarrow V_N = \frac{1}{N} V_S \rightarrow (a) \quad \boxed{6-a}$$

256

$2^6 = 64$

Q.5) Bandwidth $B = 1\ MHz$

$SNR = 127$

from Shanon's capacity formula

$$C = B \log_2 (1 + SNR)$$

$$= 1 \times 10^6 \times \log_2 128$$

$$= 10^6 \times 7 = 7\ Mbps$$

So, N max of the channel = 7 Mbps

now from nyquist formula we know, minimum datarate needed for a given level

$$N = 2 B \log_2 L$$

$$\Rightarrow 7 \times 10^6 = 2 \times 10^6 \log_2 L$$

$$\Rightarrow \log_2 L = 3.5$$

$$\Rightarrow L = 2^{3.5}$$

for better result we need to take $2^3 = 8$ levels

so, $N = 2 \times 1 \times 10^6 \times 3 = 6\ Mbps$

- So, for better result we need $N = 6\ Mbps$ and $L = 8$ (d) None of these above)

$\boxed{5-d}$

~~9~~)
97)

data rate $N = 6000$ bps

type of modulation = QPSK, so there are

4 levels so, $r = 2$

$\therefore S = \frac{N}{r} = \frac{6000}{2} = 3000$ baud

$\therefore$ signal rate $= 3000$ baud (a) $\boxed{7-a}$

98) available band width

$B = 44500$ Hz

Voice channel have 4 KHz band width

guard band = 500 Hz

let max No. of voice channel is N.

So, $4000N + (N-1)500 = 44500$

$\Rightarrow 4500N = 45000$

$\Rightarrow N = 10$

~~no.~~ no. of voice channel = 10 (c) $\boxed{8-c}$

99) $N_1 = 190$ Kbps $N_2 = 180$ Kbps

In pulse stuffing tecnique higher data rate

of signals is considery as ~~frame~~ rate so

here frame rate

$X = 190000$ frames/s

Q9)

$N_1 = 190$ Kbps $N_2 = 180$ Kbps

Here if frame size $w=2$ then one bit taken from first channel and another from other, So here frame rate will be

$x = 190 \times 10^3 = 190000$ frames/s

frame duration $= \frac{1}{190000}$ S $= \frac{\cancel{10^6}\ 100}{19 \times \cancel{10^4}}$ microsecond

≈ 5.3 microsecond

So here datarate = framerate $\times$ frame size

$= 190000 \times 2$ bps

$= 380000$ bps

$= 380$ Kbps (c)

$\boxed{9-c}$

Q10) line L_1 has bandwidth $B_{L_1} = 8$ KHz

noise = 10 mV

signal = 20 V

$SNR = \frac{(20)^2}{(10 \times 10^{-3})^2} = 4000000$

So, by Shanon capacity, capacity of channel

$C = B \log_2 (1 + SNR)$

$= 8 \times 10^3 \times \log_2 (1 + 4000000)$

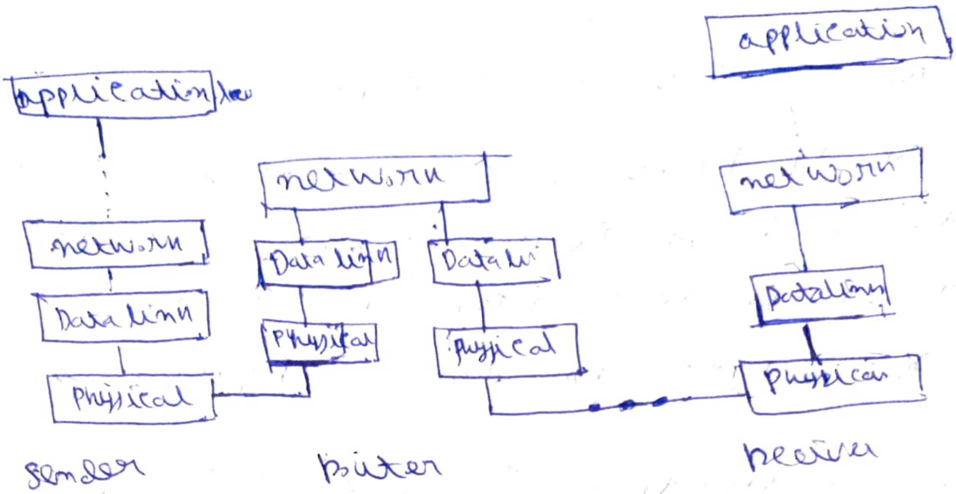
$= 175452.5$ bps

for higher data rate $N = C/2$

So ans = None of the above (d)

$\boxed{10-d}$

94)



So, in sender and reciever we passes through network and datalink layer once, and for router we passes networkre layer once and data link layer 2 times.

So Here

$X_1 = 1 + (N+1) + 1 = N+3$

$X_2 = 1 + 2(N+1) + 1 = 2N+4$

$Y_1 = 1 + (K+1) + 1 = K+3$

$Y_2 = 1 + 2(K+1) + 1 = 2K+4$

So, $X_2 + Y_2 = 2N+4+2K+4 = 2N+2K+8$

$2(X_1+Y_1) - 4 = 2\times(N+3+K+3) - 4 = 2N+2K-8$

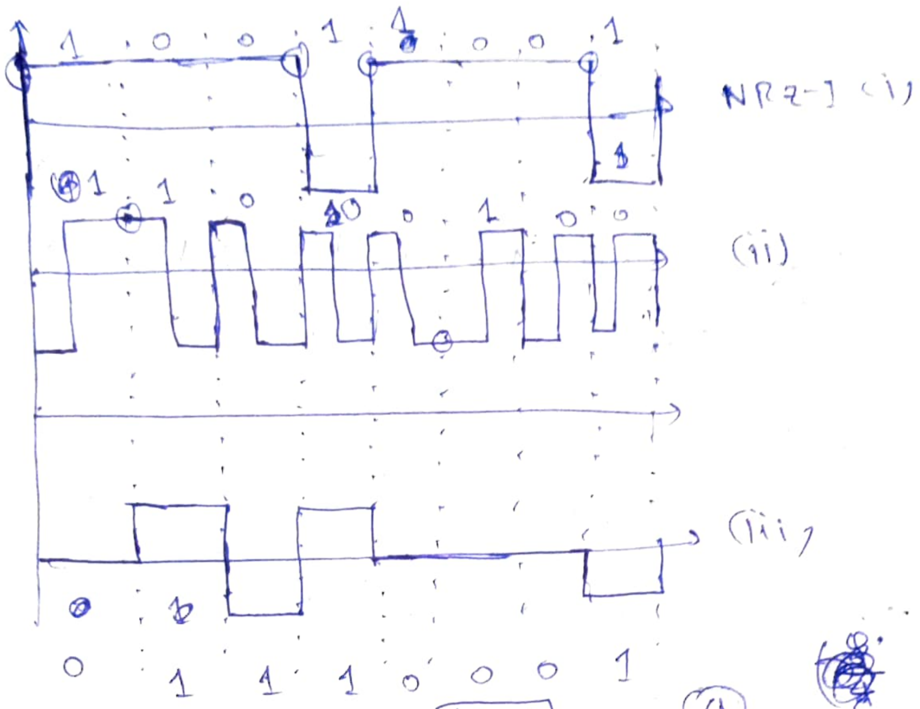
So, $\boxed{X_2 + Y_2 = 2(X_1+Y_1) - 4}$

$X_2 = 2N+4$

$\Rightarrow \boxed{N = \frac{X_2 - 4}{2}}$

$\boxed{4-6}$

Q11)



$\boxed{11-a}$ (a)

12) $N = 9$ Mbps

4B/5B and NRZ-I

for NRZ-I $p=1$ so $S_{avg} = N/2$

$B_{min} = N/2$

for 4B/5B encoding $N = 9 \times \frac{5}{4}$ Mbps

$= 9 \times \frac{5}{4} \times 10^6$ bps

So $B_{min} = \frac{1}{2} \times 9 \times \frac{5}{4} \times 10^6$ bps

$= 9 \times \frac{5}{8} \times 10^6$ KHz

$= 625\,9$ KHz (b)

$\boxed{12-b}$

Q13)

Here, quantization level $L = 12$

So, $n_b = \log_2 12 = 3.58$

but here fraction is not possible for the no. of bits for each signal, so we take $n_b' > n_b$ because if we take $n_b' < n_b$ then error occure

So, $n_b' = 4$

So, $SNR_{dB} = 6.02 \times n_b' + 1.76$

$= 6.02 \times 4 + 1.76 = 25.84$ (b)

$\boxed{13-b}$

Q14)

nyquist sampling rate $f_s = 600000$ samples/s

minimum frequency of bandpass channel

$f_{min} = 100 KHz$

we know sampling rate $= 2\times$ maximum frequency of the channel

So, $f_s = 2 \times f_{max}$

$\Rightarrow f_{max} = \frac{f_s}{2} = \frac{600000}{2} = 300 KHz$

So, bandwidth of the signal is

$B = f_{max} - f_{min} = 300 - 100 = 200$ KHz (b)

$\boxed{14-b}$

Q15)

So Size of Syncronous charrector is x-bits

Size of asyncronous charrector is

x + Start bits + stop bits

$= (x + y + z)$

data rate $N = N$ bps

So no. of ~~charrect~~ charactery s can be send ~~in 1 second is~~

So q Syncronous charactery can be sent in 1 sec

So $q \times x$ bits can be sent in 1 s

So $N = qx$ ...(i) $\Rightarrow q = \frac{N}{x}$

Similarly,

p asyncronous charactery can be send in 1 sec

So, $p(x+y+z) = N$ ...(ii)

$\Rightarrow p = \frac{N}{x+y+z}$

~~$\frac{(i)}{(ii)}$ $qx = p(x+y+z)$~~

~~$\Rightarrow p/x = \frac{q}{x+y+z}$~~ $= \frac{q}{\frac{N}{x}+y+z}$

So $p(\frac{N}{q}$

$$q - p = \frac{N}{x} - \frac{N}{x+y+z} = N\left[\frac{x+y+z-x}{x(x+y+z)}\right]$$

$$= \frac{N(y+z)}{x(x+y+z)}$$

So, $$\frac{q-p}{y+z} = \frac{N}{x(x+y+z)} = \frac{p}{x} \quad \left[\because p = \frac{N}{x+y+z}\right]$$

$$\therefore \; p/x = \frac{q-p}{y+z} \quad (b)$$

$\boxed{15-6}$

Group-B

Q10)

1	2	3	4	5	6	7	8	9	10	11	12
0	1	1	0	0	1	0	C	B	A	1	1
P_1	P_2		P_4				P_8				

P_1 = XOR of bits (3, 5, 7, 9, 11)

$= 1 \oplus 0 \oplus 0 \oplus B \oplus 1$ ...(i)

P_2 = XOR of bits (3, 6, 7, 10, 11)

$= 1 \oplus 1 \oplus 0 \oplus A \oplus 1$ ...(ii)

P_4 = XOR of bits (4, 5, 6, 7, 12) $\quad \therefore P_4 = 0$, it is a even parity

~~$= 1 \oplus 1 \oplus 1 \oplus 0 \oplus 0$~~

$= 0 \oplus 0 \oplus 1 \oplus 0 \oplus 1$ ... (iii)

P_8 = XOR of bits (8, 9, 10, 11, 12)

$= C \oplus B \oplus A \oplus 1 \oplus 1$ —(iv)

from eqn (iii), we can see that this code was coded in even parity.

If there is no error then, ~~$P_1 = P_2 = P_3 = P_4 = 0$~~

$\because P_2 = 1$ So, for even pairity $A = 0$,

$\because P_1 = 0$ so, for even pairity $B = 0$

So Here ABC = 0 0 0 (b) $\boxed{16 - b}$

Q17)

maximum size of reciever window = 16

we, know sequence no starts from 0

Lets Here for Go back N instead of Selective repeat sequence number after sending 100 frames will be S

S = ~~...~~

$16 \times 6 = 96$

So, Sequence no of 97 → 0 [∵ sequence no. starts from 0]

98 → 1

99 → 2

100 → 3

101 → 4

∴ sequence no. after 100 frames will be 4 (b) $\boxed{17 - b}$

Q) 18)

1) ~~each~~ frame size = 1000 bits

distance between sender and ~~reciever~~ reciever is 5000 km, propagation speed = 2×10^8 m/s

So, Here data frame trip time =

$$\frac{5000 \times 10^3}{2 \times 10^8} \text{ s}$$

$$= 25 \text{ ms}$$

ack trip time is also = 25 ms

Here, transmission, waiting and and processing delays are ignored

Data frame transmission time = $\frac{1000}{10^6} = 1$ ms

So, total ~~trip time~~ delay for a frame is

$1+25+25 = 51$ milisecond

we have to send 1 million bits so no. of data frames is

$$N = \frac{10^6}{1000} = 1000$$

So, total delay $= 1000 \times 51$ milisecond

$= \cancel{5005} = 51\ S$

(ii) for Go-Back-N with window size 7

Here, In worst case, we send full window of size 7 and then wait for ack of the whole window,

So Here, Transmission time for 1 window =

$$7 * \frac{1000}{10^6} = 7\ ms$$

data frame trip time $= \frac{5000 \times 10^3}{2 \times 10^8} = 25\ ms$

ack transmission time is ignored

ack trip time $= \frac{5000}{2 \times 10^8} = 25\ ms$

So, Here delay for 1 window $= 7+25+25 = 57\ ms$

$\therefore$ Total delay $= 143 \times 57\ ms$

$= 8151\ ms$

So) option (d)

$\boxed{18-d}$

Q19)

Here for both case,

window size $S = 32 = 2^5$

So, no of binary bits in a sequence no. is 5

So, no of Hexadecimal digit in sequence no will be 2 [0000 ecdf]

So, for each case $S = 32$ $n = 2$

for, Go-back-N receiver window size is always 1

So for statement 1

$S = (32-1)$ $n = 2$ $R = 1$
$= 31$

So, $S - n - R = 31 - 2 - 1 = 28 \neq (1D)_{16}$

$(1D)_{16}$
$= 2 \times 8^0$
$+ 2 \times 8^1$

So Statement 1 is F

for, selective repeat protocol sender and receiver window size must be half of max sequence no

So, $S = R = \frac{32}{2} = 16$ for statement-2 and $n = 2$

So, $2S + n - R$
$= 2 \times 16 + 2 - 16$
$= 18 = (22)_8$

So Statement-2 is T

c

$\boxed{19-c}$

Q20) for linear block code, minimum no of 1s in 1's in a codeword is the minimum hamming distance d_{min}. So Here $d_{min} = 2$

$\therefore d_{min} = S + 1$ [where S = no. of errors can be detected]

So, $S = d_{min} - 1 = 2 - 1 = 1$

$\boxed{20-b}$

So, 1 error can be detected

Q21)

U = 1111 0000

V = 01P1 0101

W = 0000 0000

X = 0q00 1111

Y = 1010 1010

$V + V = (145)_{16}$ ... (i)

0000
0101
0101

0100 5

So 1111 0000

+ 01P1 0101

$\underbrace{1}_{1}\ \underbrace{0100}_{4}\ \underbrace{0101}_{5}$ [If we take P = 0]

So, If we take P = 1 then (i) is satisfied

So, P = 1   So V = 0101 0101

$V + X = (144)_8$

0111 0101

+ 0q00 1111

$\underbrace{01}_{1}\ \underbrace{100\,01}_{4}\ \underbrace{00}_{4}$ [If we take q = 0]

So, If we take q = 0 then (ii) satisfied.

$\therefore$ X = 0000 1111

So, U = 1111 0000

V = 0101 0101

W = 0000 0000

X = 0000 1111

Y = 1010 1010

$5 = 2t+1$

$t = 2$

~~1 0000101~~

1 0000101

~~Hamming~~ d_{min} =

$d(U,V) = 1+1+1+1 = 4$

$d(U,W) = 1+1+1+1 = 4$

$d(U,X) = 1+1+1+1+1+1+1+1 = 8$

$d(U,Y) = 1+1+1+1 = 4$

$d(V,W) = 1+1+1+1 = 4$

$d(V,X) = 1+1+1+1 = 4$

$d(V,Y) = 1+1+1+1+1+1+1+1 = 8$

$d(W,X) = 1+1+1+1 = 4$

$d(W,Y) = 1+1+1+1 = 4$

$d(X,Y) = 1+1+1+1 = 4$

So, $d_{min} = 4$

we know $d_{min} = 2t+1$ [where t is the no. of bits ~~gurant~~ guaranted to be corrected]

So, $t = \frac{d_{min}-1}{2} = \frac{4-1}{2} = 1.5$

So, Here 1 bit is guaranted to be corrected. (b)

$\boxed{21-b}$

22) CRC generator is 1101 so

CRC pollynomial = $x^3 + x^2 + 1$

$$x^3+x^2+1 \overline{) x^6 + x^2 + x} \left(x^3 + x^2 \right.$$
$$x^6 + x^5 + x^3$$
$$x^5 + x^3 + x^2 + x$$
$$x^5 + x^4 + x^2$$

(1) multiplying x^3 to argument we get $x^9 + x^5 + x^4$

$$x^3+x^2+1 \overline{) x^9 + x^5 + x^4} \left(x^6 \right.$$
$$x^9 + x^8 + x^6$$

Q22) CRC generator ⇒ 1101

(i) Data Word = $x^6 + x^3 + x$

= 1001010

```
1101) 1001010000 (1111001
      1101
      ----
       1000
       1101
       ----
        1011
        1101
        ----
         1100
         1101
         ----
          0010
          0000
          ----
           0100
           0000
           ----
            1000
            1101
            ----
             101
```

Code word ⇒ $\boxed{1001010|101}$ ⇒ $1 + x^2 + x^4 + x^6 + x^9$

(i) → (2)

(ii)

dataword = $x^6+x^3+x^2+x$

$= 1001110$

1101) 1001110000 (1111110

1101

1001

1101

1001

1101

1000

1101

1010

1101

1110

1101

0110

0000

110

So, Code Word = $\boxed{1001110|110}$

$= x+x^2+x^4+x^5+x^6+x^9$

(ii) — (1)

(iii)

Data word = $x^8 + x^7 + x^6$

$= 1\,1\,1\,0\,0\,0\,0\,0\,0$

```
1101) 111000000000 (101001110
      1101
      0110
      0000
       1100
       1101
       00010
        0000
        0100
         0000
         1000
          1101
          1010
           1101
            1110
            1101
            00110
              0000
               110
```

So, Code word = $\boxed{1\,1\,1\,0\,0\,0\,0\,0\,0\,|\,1\,1\,0}$

$\Rightarrow x + x^2 + x^9 + x^{10} + x^{11}$

(iii) – 5

d) none of these above

$\boxed{22-d}$

23)

data words → 100100 1101011011

$\uparrow$ 1101 $\qquad$ $\uparrow$ 10011

D - 100100 → $x^5 + x^2$

$x^8 + x^5$ → augmented dataword

```
1101) 100100000 (111101
      1101
      ----
       1000
       1101
       ----
        1010
        1101
        ----
         1110
         1101
         ----
          0110
          0000
          ----
           1100
           1101
           ----
            001
```

So, code word ⇒ $\boxed{100100|001}$

⇒ $1 + x^5 + x^8$

So) (iii) -(3)

11010110110000 → augmented dataword

$x^4 + x^5 + x^7 + x^8 + x^{10} + x^{12} + x^{13}$

~~1101~~

10011) 1101011011 0000 (1100001 01
10011
10011
10011
00001011 0
10011
01010
00000
~~11001~~
10100
10011
01110

So, Codeword $\Rightarrow$ $\boxed{1101011011 \mid 01110}$

$x + x^2 + x^3 + x^4 + x^5 + x^7 + x^8 + x^{10} + x^{12} + x^{13}$

(v) – 5

(iii) — (3) (v) - 5 (c) $\boxed{23-c}$

24) let's take even parity

1

1	1	1	1	0
1	1	1	0	1
0	0	0	1	1
1	0	0	0	1
1	0	0	0	1

(i)

1	1	1	1	0
1	1	1	0	1
1	0	0	1	0
1	0	0	1	0
0	0	0	1	1

So here error will be detected

(ii)

1	1	1	1	0
1	1	1	0	1
1	0	0	0	1
0	0	0	1	1
1	0	0	0	1

here same parity bits are generated So can't detect error

(iii)

1	1	0	0	0
0	0	1	0	1
0	0	0	1	1
1	0	0	0	1
0	1	1	1	1

here error can be detected

option - b

$\boxed{24-b}$

Q25)

Statement-1 is True

CRC can detect more error than checksum due to it's more complex function. CRC is an improvement over checksum

Statement-2 is ~~false~~ true

If several 16-bit words are ~~[illegible]~~ increments during transmission, but the total change is multiple of 65535, the sum and checksum doesn't change. So, it fails to detect errors.

Ans - option (c)

$\boxed{25-c}$

26.

CRC pollynomial is

$$x(x^{n-1}+1)+(x^{n-6}+1)$$

taking $n=8$

Division $g(x) = x(x^7+1)+(x^2+1)$

$$= x^8+x^2+x+1$$

degree of $g(x) = p = 8$

(i) Burst errors of size $8+1 = p+1$ will be deleted with probablity $1-(\frac{1}{2})^7$ i.e. $1-(1/2)^{p-1}$

$= 0.992$

(ii) Burst errors of size $(2n+1)$) $(p+1)$ will be deleted with probablity, $1-(\frac{1}{2})^{p}$

$= 1-(\frac{1}{2})^8 \approx 0.996$

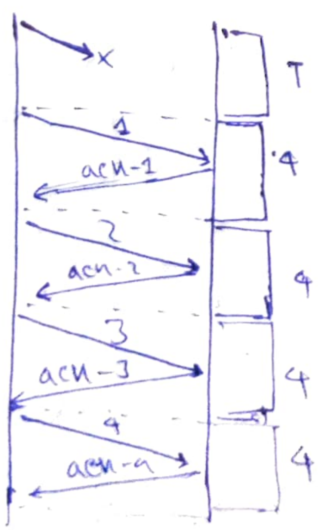
So, option (d) $\boxed{26-d}$

Q27)

~~Here 0th frame is lost~~

Here first frame is lost so a timeout will occure then first frame resended

So.1



So, Here we can see total time required to send 4 frames is

$T+4\times4 = T+16$

So Here total time ~~too~~ to complete this process is 22 ms,

So,

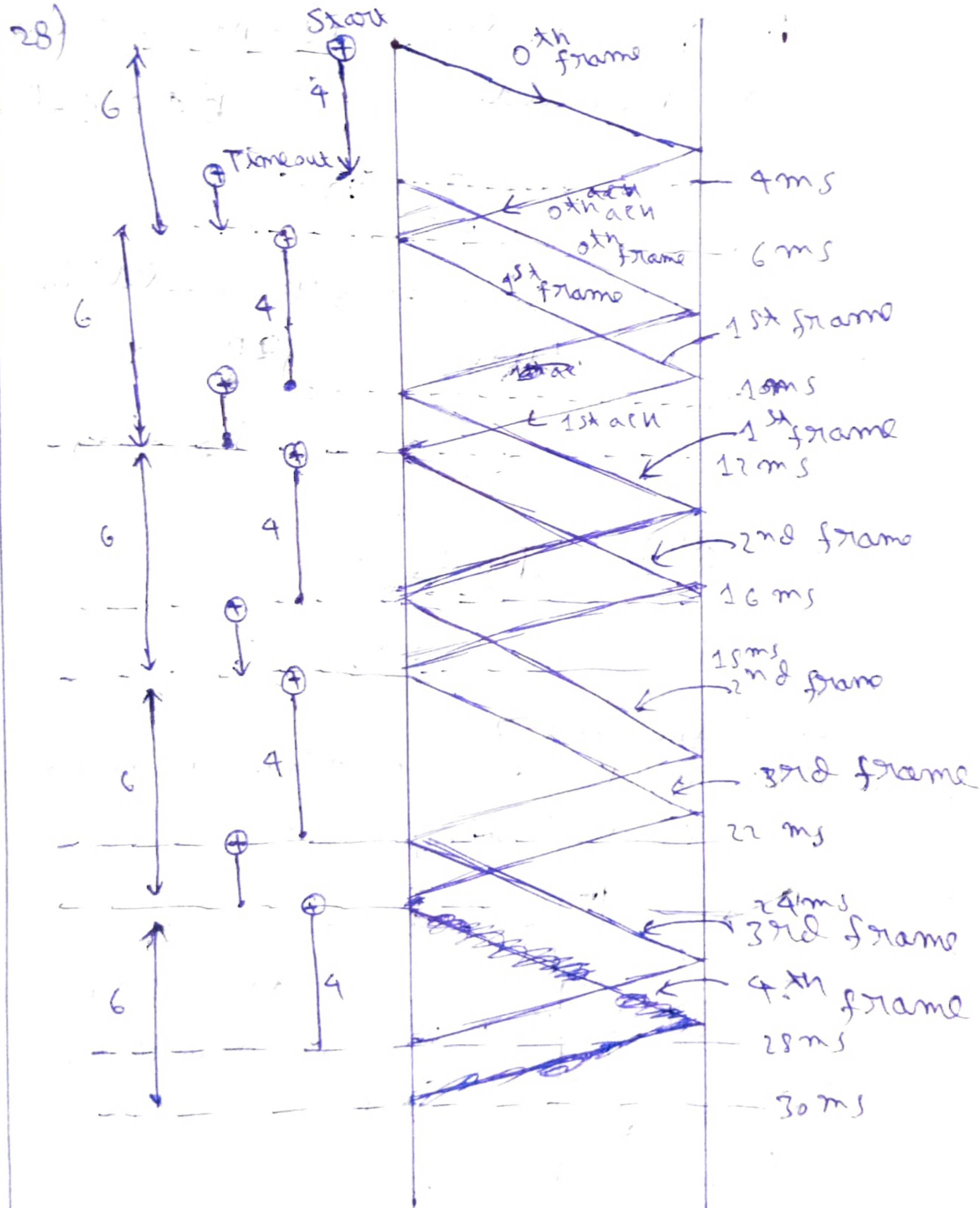
$$T + 16 = 22$$

$$\Rightarrow T = 22 - 16 = 6 \qquad \text{So, } T <= 7$$

$$\left[\frac{T}{\text{Round Trip delay}} \right] = \left[\frac{6\,3}{\cancel{4}\,2} \right] = [1.5] = 2$$

$\boxed{27-e}$

28)

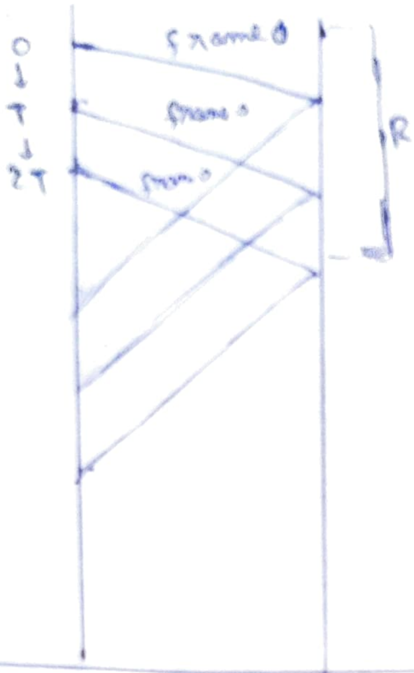


So from Diagram we can say total time required to complete this process is 28 ms

So answer is (d)

$\boxed{28-d}$

Q29)



This is clearly shown in the picture that the round trip time must be >= 2T

So, here

R >= 2T

$\boxed{29 - d}$

Q30) We need to insert a zero after 5 consecutive 1's for bit-stuffing to work in this case. X = 1 because we will check whether the incoming bit from buffer is 1 or not. If bit is 1, we increment a counter (to keep track of incoming 1's), or else set it to 0 to indicate a con-secutive 1 group has been processed. Y = 5 because we need to keep track of the moment where the number of consecutive 1's (stored in counter) becomes 5. When it becomes 5, we will add bit Z = 0 as per bit-stuffing rule.

$\boxed{30 - e}$