Answer Key CS 352

Q. 1. (a) 2nd half

Messages	
	M
Layer 1	M+h.
Layer 2	M+h+h = M+2h.
Layer 3	M+2h+h = M+3h.
⋮	
Layer n	M+(n-1)h+h = M+nh.

Total no. of header bytes with n-layers and h-bytes per header is "nh".

Fraction of N/w bandwidth filled with header is $\boxed{\dfrac{nh}{M+nh}}$.

Q. 1. (b) 2nd part

$$\text{Signal to Noise Ratio} = \frac{P_{signal}}{P_{noise}} = \frac{\text{Mean}}{\text{Standard deviation}}$$

$$\text{Mean } \mu = \frac{(6+24+6+14+10)}{5} = \frac{60}{5} = 12.$$

$$\text{standard deviation}, \sigma = \sqrt{\frac{(6-12)^2+(24-12)^2+(6-12)^2+(14-12)^2+(10-12)^2}{5}}$$

$$= \sqrt{\frac{36+144+36+4+4}{5}}$$

$$= \sqrt{\frac{224}{5}} = 6.69.$$

$$\boxed{S.N.R = \frac{12}{6.69} = 1.79}$$

Q. 2(a) Ans

Ascii character, U = 85, m = 1010101 = 7 bits.

$m+r+1 \leq 2^r$. r = lower limitation.

$r=4$, $7+4+1 \leq 2^4$ (Satisfy the condition)

$n = m+r = 7+4 = 11$ bits.

$2^0, 2^1, 2^2, 2^3$

P1, P2, P4, P8

1	2	3	4	5	6	7	8	9	10	11
P1	P2	1	P4	0	1	0	P8	1	0	1

P1 ⇒ 1 3 5 7 9 11

0 1 0 0 1 1

$\boxed{P1=0}$

P2 = 2 3 6 7 10 11

0 1 1 0 0 1

$\boxed{P2=0}$

P4 = 4 5 6 7

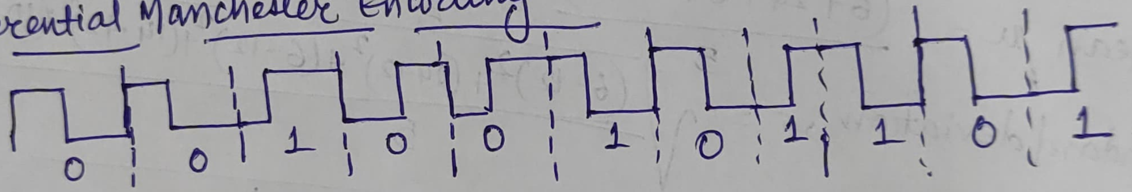
$\boxed{0}$ 0 1 0

P8 = 8 9 10 11

$\boxed{1}$ 1 0 1

$\boxed{\text{Hamming codeword} = 00100101101}$

Differential Manchester Encoding



Q. 3(b) Probability of sending a frame in the first slot without any collision by any of these four station.

= Probability that S1 sends a frame and no one else does + Probability that S2 sends a frame and no one else does + Probability that S3 sends a frame and no one else does + Probability that S4 sends a frame and no one else does.

$= P(S_1)\, P(\bar{S_2})\, P(\bar{S_3})\, P(\bar{S_4}) + P(\bar{S_1})\, P(S_2)\, P(\bar{S_3})\, P(\bar{S_4}) +$
$P(\bar{S_1})\, P(\bar{S_2})\, P(S_3)\, P(\bar{S_4}) + P(\bar{S_1})\, P(\bar{S_2})\, P(\bar{S_3})\, P(S_4)$

$= 0.1 * 0.8 * 0.7 * 0.6 + 0.9 * 0.2 * 0.7 * 0.6 + 0.9 * 0.8 * 0.3 * 0.6 + 0.9 * 0.8 * 0.7 * 0.4$

$$= 0.4404 = \frac{x}{1000}$$

$$\boxed{x = 440.4}$$

2nd part

Frame Size = 500 bits

Bandwidth = 50 Mbps = 50×10^6 bits/sec.

Velocity = 2,50,000 Km/sec

$$Td = \frac{L}{B} = \frac{\overset{10}{50\cancel{0}} \text{ bits}}{5\cancel{0} \times 10^6 \text{ bits/sec}} = 10\ \mu sec.$$

$$Td \geq 2 * Pd$$

$$\Rightarrow 10\ \mu sec \geq 2 * Pd$$

$$Pd \Rightarrow 5\ \mu sec$$

$$\Rightarrow \frac{d}{v} = 5\ \mu sec$$

$$d = 5\ \mu sec * v$$

$$\Rightarrow d = 5 \times 10^{-6} \text{ sec} * 2,50,000 * 10^3.$$

$$d = 1250\ m$$

No. of station can be connected $= \frac{1250}{10} + 1$ [$\because$ Since it is bus topology $n+1$]

$= 126$.

Q.3(b) Solution Bandwidth $= 10^6$ bits/sec Pd = 1.25 sec

Frame Size = 1 KB = 1024 Byte = 8192 bits.

$$Td = \frac{L}{B} = \frac{8192}{10^6} \Rightarrow 0.008192 \text{ sec.}$$

$$\eta = \frac{Td(\text{frame}) * N}{Td(\text{frame}) + 2 * Pd} \Rightarrow \frac{0.008192 * N}{0.008192 + 2 * 1.25}$$

$$1 = \frac{N * 0.008192}{0.008192 + 2.50}$$

$$N * 0.008192 = 2.508192$$

$$\boxed{N = 306.17}$$

$$\boxed{N = \lceil 306.17 \rceil = 307}$$

Go-Back-N	Selective Repeat.
min. sequence NO.	min sequen no.
$N+1 = 307+1 = 308$	$N+N$
	$= 307 + 307$
	$= 614$.
$2^K = 308 = 2^9$	$2^K = 614 \Rightarrow 2^K = 2^{10}$
$\boxed{K=9}$	$\boxed{K=10}$

Q. 4.(a) Bandwidth $= 10^6$ bytes/sec   FileSize $= 10^3$ bytes.

Header = 100 Bytes.

Case-I   File Size $= 10^3$ byte, header = 100 bytes.

Total packet Size = data + header.

$= (1000 + 100) = 1100$ bytes

$$Td = \frac{\text{Total packet Size}}{\text{Bandwidth}} = \frac{1100 \text{ bytes}}{10^6 \text{ bytes/sec}}$$

$$= 11 * 10^{-4} \text{ sec}$$

$$Td = 1.1 * 10^{-3} \text{ sec} \Rightarrow 1.1 \text{ msec}$$

For X-hop and 1 pkt.

$$\boxed{T_1 = X(Td + Pd) + X-1(Qd + Prd)}$$

$T_1 = X(Td)$ No. of hops = no. of links = 3.

$= 3 * 1.1$

$$\boxed{T_1 = 3.3 \text{ msec.}}$$

Case II   File Size = 1000 bytes.

N = 10 packets.

Data in each packet $= \frac{1000}{10} = 100$ bytes.

Header = 100 byte

Total pkt Size = Data + header

= 100 + 100

= 200 bytes.

$$Td = \frac{200 \text{ bytes}}{10^6 \text{ bytes/sec}} = 2 \times 10^{-4} \text{ sec} = 0.2 \text{ msec}$$

X-hop and N-packets

$$T2 = X(Td + \underset{0}{Pd}) + X-1(\underset{0}{Qd} + \underset{0}{Prd}) + N-1(Td)$$

$= X(Td) + N-1(Td)$

$= 3 * 0.2 + 10-1(0.2)$

$T_2 = 0.6 + 1.8 = 2.4$ msec. $\boxed{T_2 = 2.4 \text{ msec}}$

Case III   File Size = 1000 bytes

N = 20 packet.

Data in each packet $= \frac{1000}{20} = 50$ Bytes

Header = 100 Bytes

Total packet Size = data + header = (50 + 100) bytes

$$= 150 \text{ bytes}$$

$$T_d = \frac{150 \text{ bytes}}{10^6 \text{ bytes/sec}} = 15\times10^{-5} \text{ sec} = 0.15 \text{ msec}$$

For x-hop and N packet

$$T3 = x(T_d + P_d) + x-1(Q_d + P_{rd}) + N-1(T_d)$$

$$= x(T_d) + N-1(T_d)$$

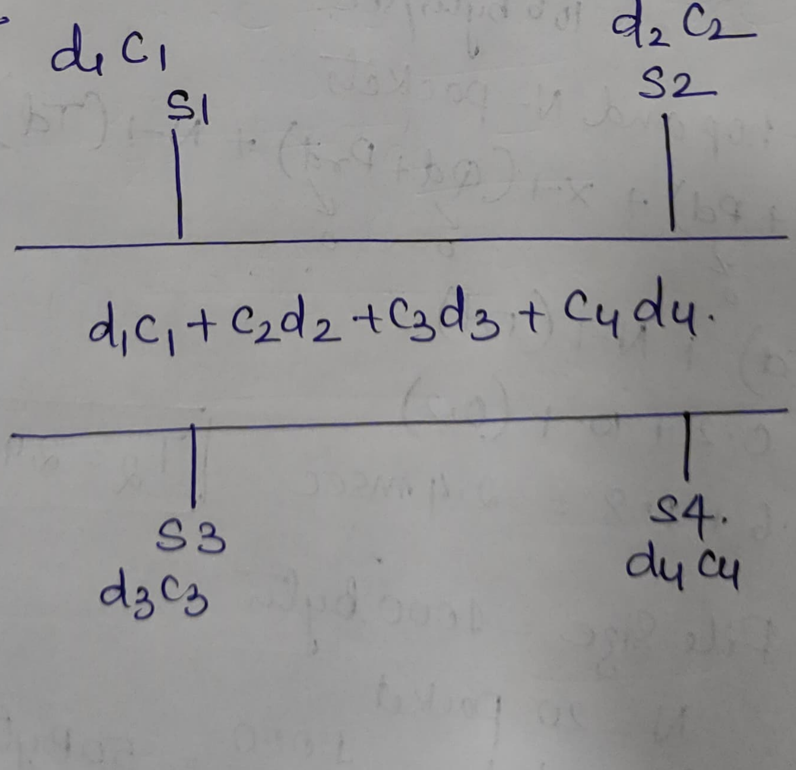
$$= 3 * 0.15 + 20-1(0.15)$$

$$= 0.45 + 19(0.15)$$

$$T_3 = 0.45 + 2.85$$

$$\boxed{T3 = 3.3 \text{ msec}}$$

Q.5(b) Solution



4

$$R_1 = c_1 * (c_1 d_1 + c_2 d_2 + c_3 d_3 + c_4 d_4)/4$$

$$= \frac{c_1 * c_1 * d_1 + c_1 * c_2 * d_2 + c_1 * c_3 * d_3 + c_1 * c_4 * d_4}{4}$$

$$= \frac{4 d_1 + 0 + 0 + 0}{4}$$

$$\boxed{R_1 = d_1}$$

Two properties
(i) $c_i * c_j = 0$.
(ii) $c_i * c_i = n$ (no. of station) $= 4$

$$R_2 = c_2 * (c_1 d_1 + c_2 d_2 + c_3 d_3 + c_4 d_4)/4.$$

$$= \frac{c_1 * c_2 * d_1 + c_2 * c_2 * d_2 + c_2 * c_3 * d_3 + c_2 * c_4 * d_4}{4}$$

$$= \frac{0 + 4 d_2 + 0 + 0}{4} = \boxed{d_2}$$

$$R_3 = c_3 * (c_1 d_1 + c_2 d_2 + c_3 d_3 + c_4 d_4)/4$$

$$= \frac{c_1 * c_3 * d_1 + c_2 * c_3 * d_2 + c_3 * c_3 * d_3 + c_3 * c_4 * d_4}{4}$$

$$= \frac{0 + 0 + 4 d_3 + 0}{4} = \boxed{d_3}$$

$$R_4 = c_4 (c_1 d_1 + c_2 d_2 + c_3 d_3 + c_4 d_4)/4$$

$$= \frac{(c_4 * c_1 * d_1 + c_2 * c_4 * d_2 + c_3 c_4 d_3 + c_4 * c_4 * d_4)}{4}$$

$$= \frac{0+0+0+4d_4}{4}$$

$$\boxed{R_4 = d_4}$$

2nd part.

Pure Aloha,

$$T_d = \frac{L}{B} = \frac{200 \text{ bits}}{200 \text{ kbps}}$$

$$= \frac{\cancel{200 \text{ bits}}}{\cancel{200} * 10^3 \cancel{\text{bits}}/\text{sec}}$$

$$\boxed{T_d = 1 \text{ msec}}$$

Time required to make the frame collision free

$$= 2 * T_d$$

$$= 2 * 1 \text{ msec}$$

$$= \boxed{2 \text{ msec}}$$