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Ans to the ques No - 1 (a)

Here is the drawing of basic communication sistem:-

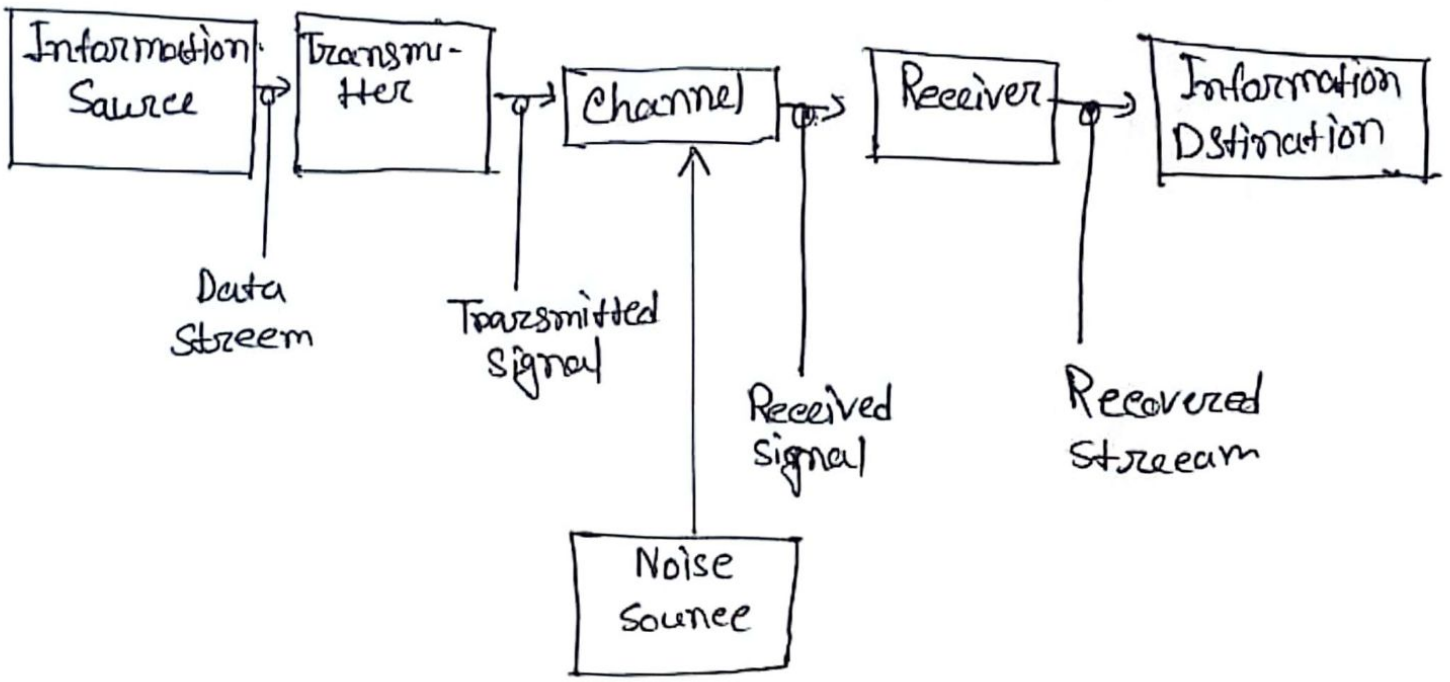


Figure: Block diagram of a basic Communication System.

Definition: The basic communication system is a system which describes the information exchange between two points. The process of trans-mission and reception of information is called communication major elements are Transmiter, channel and the receiver.

Ans to the ques No-1 (b)

Here, given,

$$H, \frac{I_T}{L}$$

and also,

$$= \sum_{i=1} L_i \log\left(\frac{1}{P_i}\right)$$

Given, $H = \frac{I_T}{L}$

$\Rightarrow I_T = H \times L$

$= I_T = (L_1 P_1 \log_2 (\frac{1}{P_1}) + L_2 P_2 \log_2 (\frac{1}{P_2}) + L_3 P_3 \log_2 (\frac{1}{P_3}) + L_4 P_4 \log_2 (\frac{1}{P_4}) + L_5 P_5 \log_2 (\frac{1}{P_5}) + \cdots)$

$\times (L_1 P_1 \times n_1 + L_2 P_2 \times n_2 + L_3 P_3 \times n_3 + L_4 P_4 \times n_4 + L_3 P_3 \times n_5 + L_6 P_6 \times n_6 + \cdots)$

Ans to the ques No-2(a)(i)

a(i)

a	aa	b	bb	ab	abe	ba	bbb	baa	abab	ab
1	2	3	4	5	6	7	8	9	10	4

a → 0, b, 1

position 1 2 3 4 5 6 7 8 9 10 4

Sequence a aa b bb ab aba ba bbb baa abab ab

Numerical sep. 0a 1a 0b 2b 1b 5a 3a 4b 7a 6b 5

Code 000 10 001 101 11 1010 110 1001 1110 1101

Ans to the ques No-2(a)(ii)

a(ii) Decoding the Lempel-Ziv encoded sequence

P q 1P 2q 3q 4P 5P 4q 6P

Codeword	Information bit	Location
P	P	1
q	q	2
1P	PP	3
2q	qq	4
3q	PPq	5
4P	qqP	6
5P	PPqq	7
4q	qqq	8
6P	qqPP	9

Now,

Information: Pq PP qq PPq qqP PPqq qqq qqPP

Ans to the ques No - 3(a)

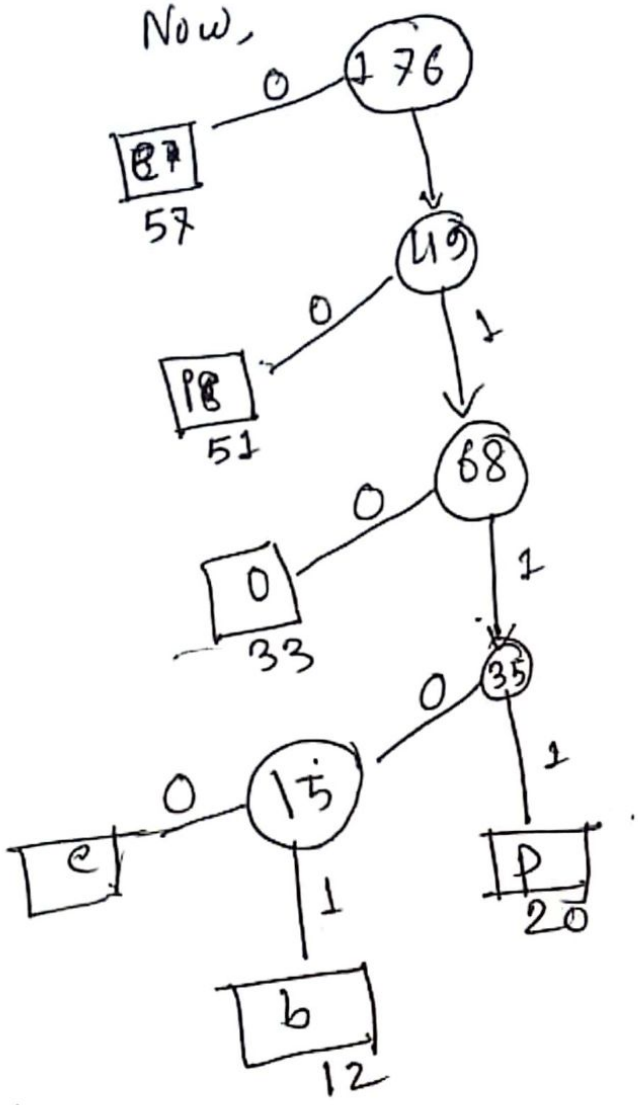
e	i	o	p	b	c
57	51	33	20	12	3

$m = 57 + 51 + 33 + 20 + 12 + 3$

$= 176$

e = 000
i = 001
o = 010
p = 011
b = 100
c = 101

Now,



Again,

e = 0, 57 × 1 = 57
i = 10, 51 × 2 = 102
o = 110, 33 × 3 = 99
p = 1111, 20 × 4 = 80
b = 11101, 12 × 5 = 60
c = 11100, 3 × 5 = 15

= 413 bits

Now, Avarage bits required to represent each characters = $\frac{413}{176} = 2.34$ bits / character.

efficiency :-

e	i	o	p	b	c
↓	↓	↓	↓	↓	↓
57	51	33	20	12	3

Solution:-

message	Probability	1st Reduction	2nd Reduction	3rd Reduction	4th Reduction
e	57	57	57	68	108
i	51	51	51	57	68
o	33	33	35	51	
p	20	20	33		
b	12	15			
c	3				

Now,

$e = 57$, $c_1 = 00$, $n_1 = 2$

$i = 51$, $c_2 = 01$, $n_2 = 2$

$o = 33$, $c_3 = 11$, $n_3 = 2$

$p = 20$, $c_4 = 100$, $n_4 = 3$

$b = 12$, $c_5 = 1010$, $n_5 = 4$

$c = 3$. $c_6 = 1011$, $n_6 = 4$

$$\text{efficiency} = (\eta) = \frac{H(X)}{L}$$

$$\therefore H(X) = \sum_{k=1}^{6} P_k \log_2 P_k$$

$$= -P_1 \log_2 P_1 - P_2 \log_2 P_2 - P_3 \log_2 P_3 - P_4 \log_2 P_4 - P_5 \log_2 P_5 - P_6 \log_2 P_6$$

$= 0.528 + 0.464 + 0.367 + 0.291 + 0.291 + 0.243$

$= 2.427$ bits / symbol

$\therefore$ Code Length $(L) = \sum_{k=1}^{7} P(x)\, ni$

$= (0.4 \times 2) + (0.2 \times 2) + (0.12 \times 2) +$

$(0.08 \times 4) + (0.08 \times 4) + (0.06 \times 4) + (0.06 \times 4)$

$= 2.56$ letters / message

Now, Coding efficiency $= \frac{2.427}{2.56}$

$= 0.94$

$= 0.94 \times (100)\%$

$= 94\%$

$\therefore$ Coding efficiency 94 %.

———— o ————

$= -57 \log_2 57 - 51 \log_2 51 - 33 \log_2 33 - 20 \log_2 20 - 12 \log$
$12 - 3 \log_2 3$

$= -332.47 - 289.29 - 166.46 - 86.43 - 43.01$

$= -4.75$

$= -922.41$

$L = \sum_{k=1}^{6} - P(x_1) n_1 + P(x_2) n_2 + P(x_3) n_3 + P(x_4)$
$n_4 + P(x_5) n_5 + P(x_6) n_6$

$= (57 \times 2 + 51 \times 2 + 33 \times 2 + 20 \times 3 + 12 \times 4 + 3 \times 4$

$= (114 + 102 + 66 + 60 + 48 + 12)$

$= 402$

$\text{efficiency} = \frac{H(X)}{L}$

$= \frac{-922.41}{402}$

$= -2.294$

efficiency $= -2.294$.

Ans to the qeces No - 3(b)

Given, $m_1 = \frac{1}{2}$, $m_2 = \frac{1}{8}$, $m_3 = \frac{1}{8}$, $m_4 = \frac{1}{4}$

Now, Source entropy $= \sum_{k=1}^{m=4} m_k \log_2 \frac{1}{m_k}$

$= m_1 \log_2 \frac{1}{m_1} + m_2 \log_2 \frac{1}{m_2} + m_3 \log_2 \frac{1}{m_3}$

$+ m_4 \log_2 \frac{1}{m_4}$

$= \frac{1}{2} \log_2 2 + \frac{1}{8} \log_2 8 + \frac{1}{8} \log_2 8 + \frac{1}{4} \log_2 4$

$= 1.75$ bits / symbol

$\therefore$ System entropy $= 1.75$ bits / symbol.

Ans to the ques No – 4 (a)

Solution:

$P(m_1) = 0.4$, $P(m_2) = 0.2$, $P(m_3) = 0.12$, $P(m_4) = 0.08$; $P(m_5) = 0.08$, $P(m_6) = 0.06$, $P(m_7) = 0.06$.

message no	Probability P(asp)	Step 1	Step 2	Step 3	Step 4	Code	no of bits (ns)
m_1	0.4	0	0			00	2
m_2	0.2	0	1			01	2
m_3	0.12	1	0			10	2
m_4	0.08	1	1	0	0	1100	4
m_5	0.08	1	1	0	1	1101	4
m_6	0.06	1	1	1	0	1110	4
m_7	0.06	1	1	1	1	1111	4

Coding efficiency = $\frac{H(X) \rightarrow \text{entropy}}{L \rightarrow \text{Code length}}$

$$H(X) = \sum_{k=1}^{7} P_k \log_2 P_k$$

$$= 0.4 \log_2 0.4 - 0.2 \log_2 0.2 - 0.12 \log_2 0.12$$

$$= 0.08 \log_2 0.08 - 0.08 \log_2 0.08 - 0.06 \log$$

$$0.06 - 0.06 \log_2 0.06$$