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Submitted By

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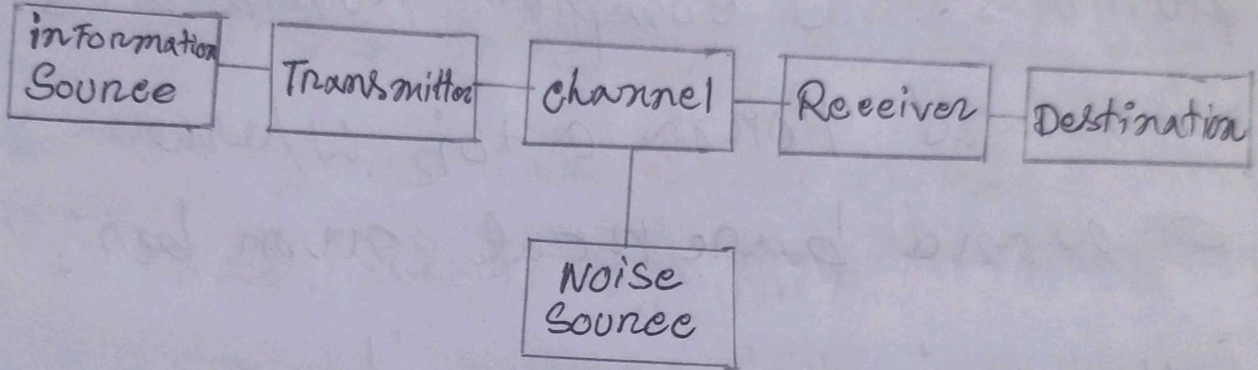
Ans To The Q. NO. 1(a)

Draw and define the Basic Communicati-on system:



The block diagram of a communication system will have five blocks, including the information source, transmitter, channel, receiver and destination blocks

1. Information Source:

The objective of any communication system is to convey information from one point to the other. The information comes from the information source, which originates it.

*information is a very generic word signifying at the abstract level anything intended for communication which may include some thoughts, news feeling visual scene, and so on.

2. Transmitter:

*The objective of the transmitter block is to collect the incoming message signal and modify it in a suitable fashion such that, it can be transmitted via the chosen channel to the receiving point

*channel is physical medium which connects the transmitter block with the receiver block.

3. channel:

* channel is the physical medium which connects the Transmitter with that of the receiver

* The physical medium includes copper wire, coaxial cable, fibre optic cable wave guide and free space

4. Receiver:

The receiver block receives the incoming modified version of the message signal from the channel and process it to recreate the original from the message signal.

5. Destination:

* The destination is the final block in the communication system which receives the message signal and process it to comprehend the information present in it.

* usually, humans will be the destination block.

Ans To The Q. NO. 1(b)

prove that Average information

$$H = I_T/L = \sum_{i=1}^{K} LP_i \log_2(1/P_i)$$

Let an information Source generate message $m_1 + m_2 + m_3 + \ldots m_q$ with probability of occurrences $P_1 + P_2 + P_3 + \ldots P_q$ For a long observation period [O,T] L messages were generated therefore $LP_1 + LP_3 + \ldots LP_q$ are The number of symbol of $m_1 + m_2 + m_3 + \ldots m_4$ were generated over the observation time [O.T]

information Source $\longrightarrow$ $\{m_1 + m_2 + m_3 + \ldots m_I\}$

$\{P_1 + P_2 + P_3 + \ldots P_I\}$

Now total information will be.

$$I_T = LP_1 Log(1/P_1) + LP_2 Log(1/P_2) + LP_3 Log(1/P_3) + \dots$$
$$\dots + LP_i Log(1/P_i)$$

$$= \sum_{i=1}^{K} LP_i Log_2 (1/P_i)$$

Average information

$$H = I_T / L = P_i Log_2 (1/P_i)$$

Average information H is called entropy.

(proved)

Ans to The Q.NO.2(a)

(i) Here's The Lempel-Ziv code For the Sequence "a a a b b b a b a b a b a b b b b a a a b a b a b"

1. 1a: The First character "a" is assigned code 1 (or any unused code) and added to the dictionary.

2. 1a: Since "aa" isn't in the dictionary yet, we reuse code 1 For The Second "a"

3. 1a : Similarly, reuse code 1 For the third "a

4. 2b: "b" is a new character, so it's assigned code 2 and added to The Second "b"

5. 2b: Reuse code 2 For the Second "b"

6. 2b: Reuse code 2 again for the third "b"

7. 1a: "a" already exist (code 1), so reuse it.

8. 2b: Reuse code 2 for the fourth "b"

9. 1a: Reuse code 1 for the fifith "a"

10. 2b: Reuse code 2 for the sixth "b"

11. 1a: Reuse code 1 for the seventh "a"

12. 2b: Reuse code 2 for the eighth "b"

13. 1a: Reuse code 1 for the ninth "a"

14. 2b: Reuse code 2 for the tenth "b"

15. 2b: Reuse code 2 for the eleventh "b"

16. 2b: Reuse code 2 for the twelfth "b"

17. 1a: Reuse code 1 for the thirteenth "a"

18. 1a: Reuse code 1 for the fourteenth "a

19. 1a: Reuse code 1 for the fifteenth "a"

20. 2b: Reuse code 2 for the Sixteenth "b"

21. 1a: Reuse code 1 for the Seventeenth "a"

22. 2b: Reuse code 2 for the eighteenth "b"

23. 1a: Reuse code 1 for the nineteenth "a"

24. 2b: Reuse code 2 for the Twentieth "b"

Therefore, the Lempel-Ziv code for the given Sequence is:

1a 1a 1a 2b 2b 2b 1a 2b 1a 2b 1a 2b 1a 2b 2b 2b 2b 1a 1a 1a 2b 1a 2b 1a 2b

Ans To The Q. NO. 2(b)

(ii) Here's the decoded Lempel-Ziv Sequence "pq 1P 2q 3q 4P 5P 4q 6P":

1. P: The first code "p" directly represent the character "p". (Add "p" to the dictionary)

2. q: The code "q" represents a new character "q" (Add "q" to The dictionary)

3. 1P: The code "1P" refers back to the previously seen character "p" (since theres only one character so far "p" is referenced)

4. 2q: The code "2q" refers back to the second character "q"

5. 3q: The code "3q" refers back to the Second character "q" again (Since no new character have been introduced)

6. 4P: The code "4P" refers back to The First character "p"

7. 5P: The code "5p" represents a new Occurrence of the character "p" (Since codes 1-4 have used this is new "p")

8. 4q: The code "4q" refers back to the Second character "q"

9. 6P: The code "6P" represents a new character, likely another occurence of "p" (Since codes 1-5 have been used for "p", this is likely a new one)

Therefore, The decoded Sequenceis:

p q p q q p p q p (assuming code 6p represent a new "p")

or

Ans To The Q. No (5)

Let,

x_1 be the number of arrivals for A1 (can be 0, 1, 2, 3)

x_2 be the number of arrivals for A2 (can be 0, 1, 2)

x_1 \ x_2	0	1	2
0	(0, 0)	(2, 0)	(4, 0)
1	(2, 1)	(4, 1)	(6, 1)
2	(4, 2)	(6, 2)	(8, 2)
3	(6, 3)	(8, 3) - (overload)	

States exceeding the total bandwidth (9 KbPS) are not valid (overload)

To Find the probability of each State we need the probability distribution functions of A1 and A2, which are Typically modeled using poisson distribution for Erlang traffic. However, we are not given the average arrival rates for A1 and A2 which are crucial for calculating the poisson distributions.

While we can't calculate Specific probabilites without arrival rates we can make some general observation about QoS.

The Total offered traffic (5 Erlangs -3 Erlangs from A1 + 2 Erlangs from A2 is less than the total bandwith (9 Kbps) This suggests potential for good overall QoS for both A1 and A2.

States closer to the diagonal ($X1+X2\leq 8$) represent lower congestion levels. lower congestion generally translates to better QoS This would allow for a quantitative comparison of the QoS experienced by A1 and A2 under the given network conditions.

Ans to the Q. NO. 3(b)

The entropy (H) of the system can be calculated using the following formula

$H = -\Sigma (p_i \times log_2(p_i))$

Where

p_i is the probability of message i

Log_2 is the logarithm with base 2

Here's the breakdown for each message

$m_1 : p(m_1) = 1/2$

$m_2 : p(m_2) = 1/8$

$m_3 : p(m_3) = 1/8$

$m_4 : p(m_4) = 1/4$

Now apply the formula:

$$H = -((1/2) \times \log_2(1/2) + (1/8) \times \log_2(1/8) + (1/8) \times \log_2(1/8) + (1/4) \times \log_2(1/4))$$

$\log_2(1/2) = -1$ (property of logarithms)

$\log_2(1/8) = -3$ (property of logarithms)

$$H = -((1/2) \times (-1) + (1/8) \times (-3) + (1/8) \times (-3) + (1/4) \times (-2))$$

$$H = (1/2) + (3/8) + (3/8) + (1/2)$$

$$H = 2 + 3/8 + 3/8$$

$$H = 2.75 \text{ bits}$$

Therefore. The entropy of the system is 2.75 bits. This value represents the average amount of information conveyed by each message when cosidering all possible message and their probabilities.