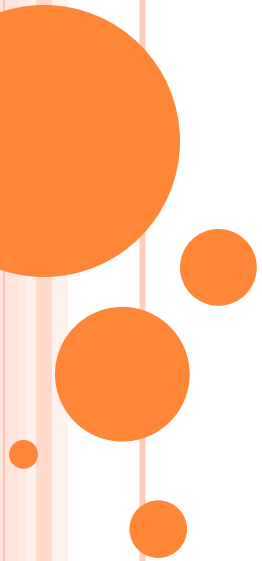
COMMUNICATION ENGINEERING

Mutual Information



MUTUAL INFORMATION

- Prior to the reception of a message the state of knowledge at the receiver about the transmitted signal x_j (channel input) is the probability $p(x_j)$

- After the reception and selection of symbol y_k (channel output) the state of knowledge about x_j is the conditional probability $p(x_j \mid y_k)$

- Before y_k is received uncertainty is $-\log p(x_j)$
- After y_k is received uncertainty is $-\log p(x_j \mid y_k)$

- The information gained about x_j by the reception of y_k is the net reduction in its uncertainty known as MUTUAL INFORMATION $I(x_j , y_k)$ ie. uncertainty about the channel input that is resolved by observing channel out put

MUTUAL INFORMATION

- $I(x_j, y_k)$ =initial uncertainty –final uncertainty

  $= -\log p(x_j) - (-\log p(x_j \mid y_k))$

  $I(x_j, y_k) = \log (p(x_j \mid y_k) / p(x_j))$

  Also, $= \log (p(y_k \mid x_j) / p(y_k))$

  $I(x_j, y_k) = I(y_k, x_j)$

- Average of mutual information is the entropy corresponding to mutual information

$$I(X;Y) = \overline{I(x_j, y_k)}$$

- $I(X;Y) = H(X) - H(X|Y)$

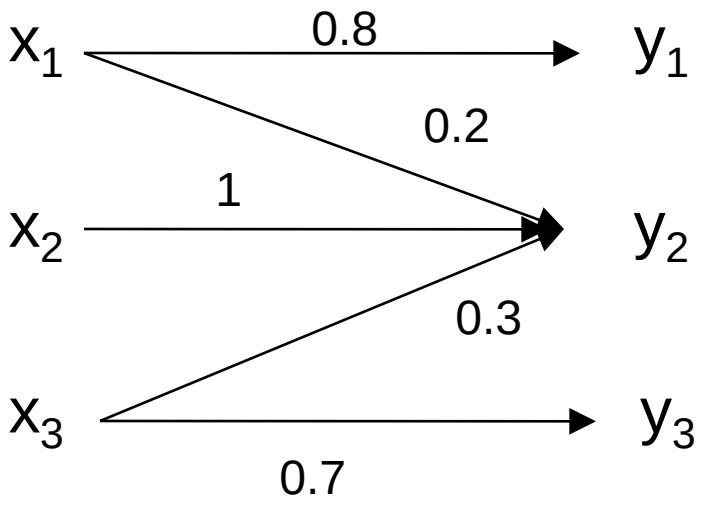
  $= H(Y) - H(Y|X)$

  $= H(X) + H(Y) - H(X,Y)$

- It is a measure of information transferred through the channel also called transferred information of the channel or trans information of the channel

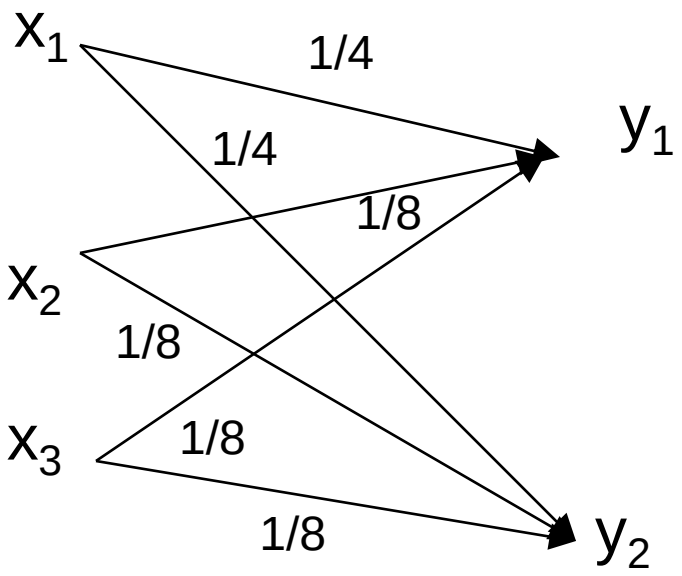
PROBLEMS

1. A discrete source transmits messages x_1 , x_2 , x_3 with probabilities 0.3,0.4 and 0.4 The source is connected to the channel given in figure. Calculate all the associated entropies and mutual information.



PROBLEMS

2.Find the mutual information of the channel




THANK YOU