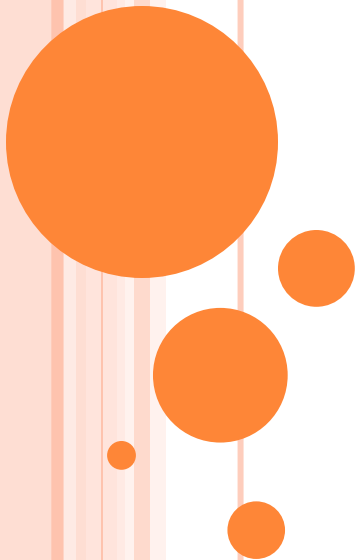


# COMMUNICATION ENGINEERING

## Channel Capacity



# CHANNEL CAPACITY

- **Mutual information**  $= I(X;Y) = H(X) - H(X|Y)$   
 $= H(Y) - H(Y|X)$



- **CHANNEL CAPACITY**  
 $C = \max (I(X;Y))$

- capacity depends on input probabilities because the transition probabilities are fixed



# MUTUAL INFORMATION

- $I(x_j, y_k)$  = initial uncertainty – final uncertainty  
=  $-\log p(x_j) - (-\log p(x_j | y_k))$

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

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

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

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

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

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

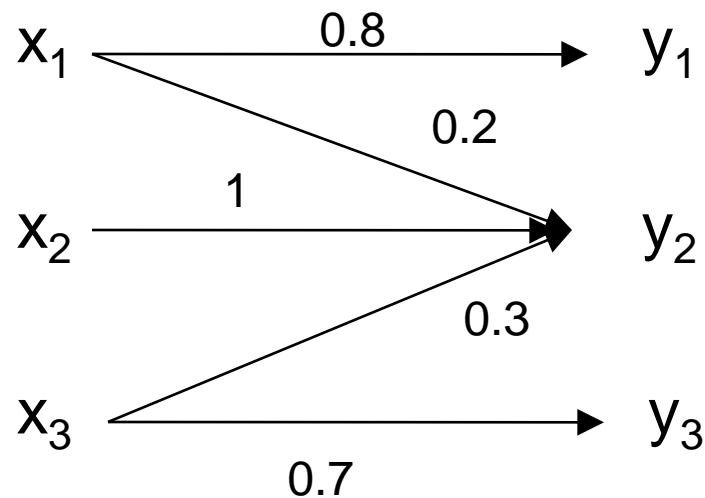
$$= H(Y) - H(Y|X)$$

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

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

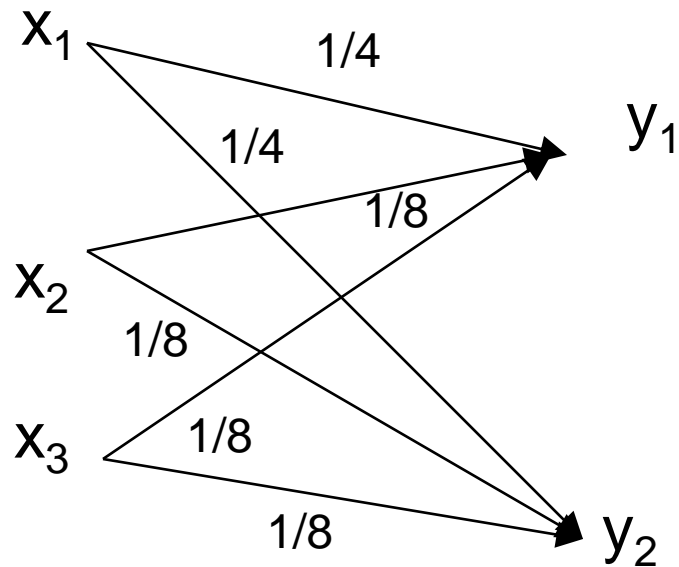
# PROBLEMS

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

