

# Assignment 2

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Download all python codes from

<https://github.com/srikan-p/AI1103/tree/main/Assignment2/codes>

and latex codes from

<https://github.com/srikan-p/AI1103/tree/main/Assignment2>

## PROBLEM

(Gate-EC 17) The input  $X$  to the binary Symmetric Channel (BSC) shown in Fig. 0 is '1' with probability 0.8. The cross-over probability is  $\frac{1}{7}$ . If the received bit  $Y = 0$ , the condition probability that '1' was transmitted is ...

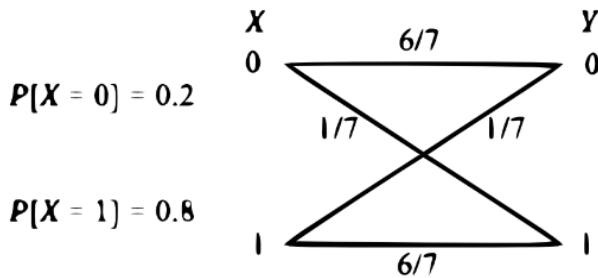


Fig. 0: Binary Symmetric Channel

## SOLUTION

$$\Pr(X = 1|Y = 0) = \frac{\Pr(\{X = 1\}\{Y = 0\})}{\Pr(Y = 0)} \quad (0.0.1)$$

$$\Pr(Y = 0|X = 1) = \frac{\Pr(\{X = 1\}\{Y = 0\})}{\Pr(X = 1)} \quad (0.0.2)$$

From (0.0.2),

$$\Pr(\{X = 1\}\{Y = 0\}) = \Pr(Y = 0|X = 1) \Pr(X = 1) \quad (0.0.3)$$

Substituting (0.0.3) in (0.0.1),

$$\Pr(X = 1|Y = 0) = \frac{\Pr(Y = 0|X = 1) \Pr(X = 1)}{\Pr(Y = 0)} \quad (0.0.4)$$

Given data,

$$\Pr(Y = 0|X = 1) = \frac{1}{7}, \Pr(Y = 0|X = 0) = \frac{6}{7} \quad (0.0.5)$$

$$\Pr(Y = 0) = \Pr(Y = 0|X = 1) \Pr(X = 1) + \Pr(Y = 0|X = 0) \Pr(X = 0) \quad (0.0.6)$$

Substituting the values from (0.0.5) and the data given in the question in (0.0.6),

$$\Pr(Y = 0) = \frac{2}{7} \quad (0.0.7)$$

Substituting (0.0.5), (0.0.7) and the data given in the question in (0.0.4),

$$\Pr(X = 1|Y = 0) = 0.4 \quad (0.0.8)$$

If the received bit is  $Y = 0$ , the conditional probability that '1' was transmitted is 0.4.

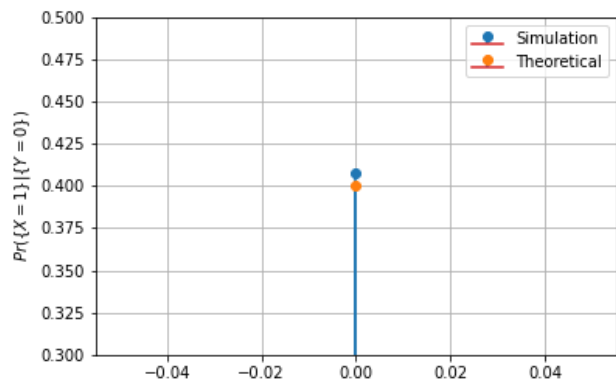


Fig. 0: Plot for Simulation v/s Theoretical