

# Probability&RV Assignment-08

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## Download Latex code from

[https://github.com/Anuradha-Uggi/Assignments-AI5002-Probability-and-Random-Variables/blob/main/Prob\\_ass08/rvsp\\_8.tex](https://github.com/Anuradha-Uggi/Assignments-AI5002-Probability-and-Random-Variables/blob/main/Prob_ass08/rvsp_8.tex)

## Download Python code from

[https://github.com/Anuradha-Uggi/Assignments-AI5002-Probability-and-Random-Variables/blob/main/Prob\\_ass08/rvsp\\_8.py](https://github.com/Anuradha-Uggi/Assignments-AI5002-Probability-and-Random-Variables/blob/main/Prob_ass08/rvsp_8.py)

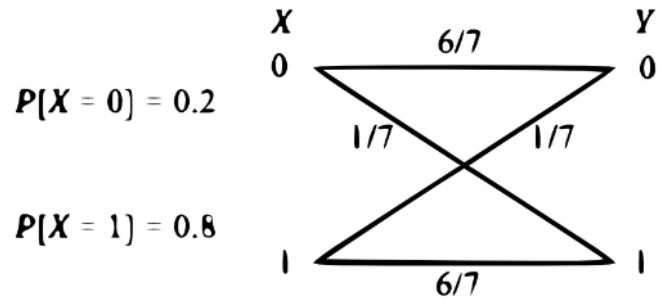


Fig. 1.

## I. QUESTION(GATE-Q17)

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

## II. SOLUTION

Given

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

$$\Pr(Y = 0|X = 1) = \Pr(Y = 1|X = 0) = \frac{1}{7} \quad (2)$$

we know that

$$\Pr(A \cap B) = \Pr(B \cap A) \quad (3)$$

Above equation can also be written as

$$\Pr(A|B) \Pr(B) = \Pr(B|A) \Pr(A) \quad (4)$$

from above equation

$$\Pr(X = 1|Y = 0) = \frac{\Pr(Y = 0|X = 1) \Pr(X = 1)}{\Pr(Y = 0)} \quad (5)$$

From the given data

$$\Pr(Y = 0) = \Pr(Y = 0|X = 0) \Pr(X = 0) + \Pr(Y = 0|X = 1) \Pr(X = 1) \quad (6)$$

$$\Pr(Y = 0) = \frac{6}{7} \times 0.2 + \frac{1}{7} \times 0.8 = \frac{2}{7} \quad (7)$$

we have

$$1) \Pr(Y = 0|X = 1) = \frac{1}{7}$$

$$2) \Pr(X = 1) = 0.8$$

$$3) \Pr(Y = 0) = \frac{2}{7}$$

Substituting above values in equation (5) results

$$\Pr(X = 1|Y = 0) = \frac{0.8}{2} = 0.4 \quad (8)$$

## III. CONCLUSION

Probability that  $X=1$  is transmitted given that  $Y=0$  is received is

$$\Pr(X = 1|Y = 0) = 0.4 \quad (9)$$