Assignment 2

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Download all python codes from

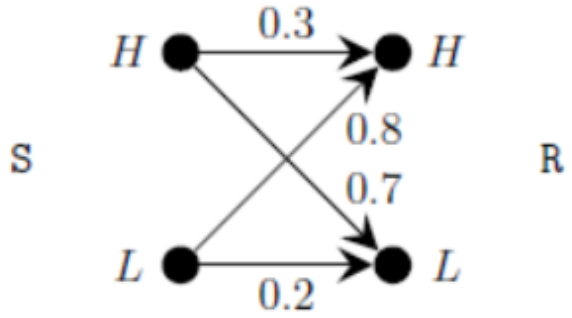
https://github.com/tyagio/AI1103/tree/main/assignment2/codes

and latex-tikz codes from

https://github.com/tyagio/AI1103/tree/main/assignment2/assignment2.tex

1 Problem

A sender(S) transmits a signal,which can be one of two kinds: H and L with probabilities 0.1 and 0.9 respectively, to a receiver (R).
In the graph below,the weight of an edge(u,v) is the probability of receiving v when u is transmitted,where u,v ∈ {H,L}.For example the probability that the received signal is L given the transmitted signal is H is 0.7.



If the received signal is H, the probability that the transmitted signal was H is _____ ?

2 Solution

In our problem we have a binary channel which is not symmetric as crossover probabilities differ
Let $A \in \{0, 1\}$ represent the random variable, where 0 represents H being transmitted, 1 represents L being transmitted.
Let $B \in \{0, 1\}$ represent the random variable, where 0 represents H being received, 1 represents L being received.

TABLE 0: Probability for random variables

$\Pr(A = 0)$	0.1	$\Pr(A = 1)$	0.9
$\Pr(B = 0\|A = 0)$	0.3	$\Pr(B = 0\|A = 1)$	0.8
$\Pr(B = 1\|A = 0)$	0.7	$\Pr(B = 1\|A = 1)$	0.2

Now we need to find $\Pr(A = 0|B = 0)$
Using Bayes theorem

$$\Pr(A = 0|B = 0) = \frac{\Pr(A = 0) \times \Pr(B = 0|A = 0)}{\sum_{i=0}^{1} \Pr(A = i) \times \Pr(B = 0|A = i)} \tag{2.0.1}$$

Putting in values given in question

$$\Pr(A = 0|B = 0) = \frac{1}{25} = 0.04 \tag{2.0.2}$$

The probability that transmitted signal was H is 0.04