Communication System
Assignment 6

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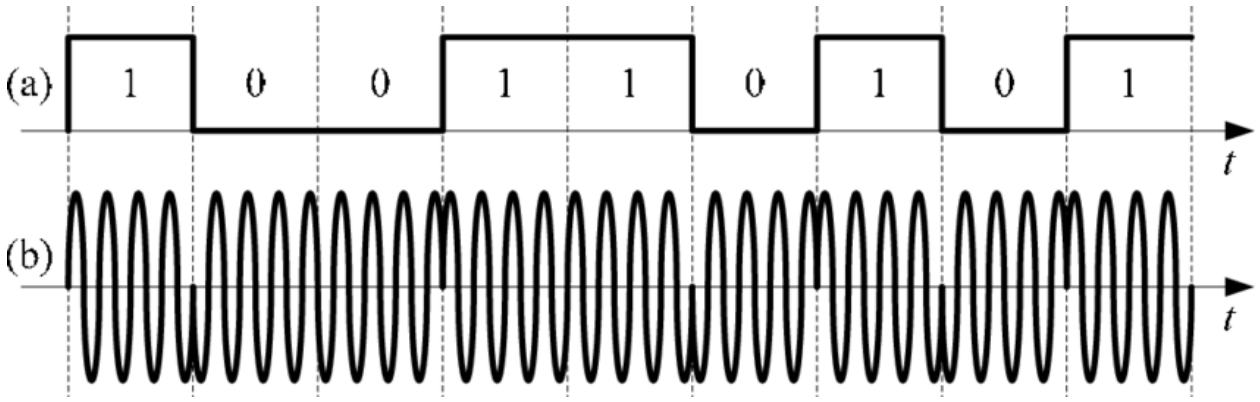
We simulated the performance of BPSK, in terms of probability of bit error , as a function of signal-to-noise ratio (SNR).

Binary Phase-shift keying (BPSK) is a digital modulation under which the data is conveyed by change of phase in the carrier waveform. Let's say when 1 is sent then the phase remains the same (0 degree) whereas when 0 is sent then the phase is set to 180 degrees.



We simulate the system by generating random signals and then adding AWGN noise to it and then make a decision of which symbol was sent.

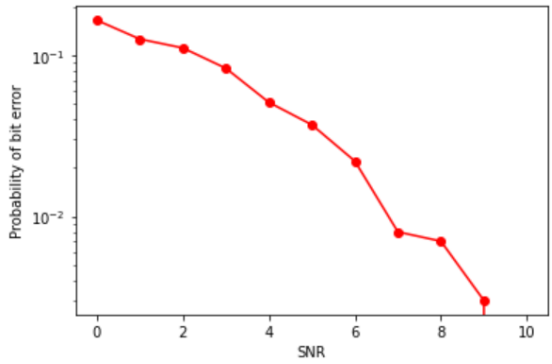
Results :

Problem 1

When we send a limited number of bits and estimate the error, the graph looks like the below. When the SNR is high which means the signal

strength is high the probability of the bit to be decided wrong reduces to a huge extent. Due to less data points the plot is not uniform.

$$Probability\ of\ error\ = \frac{number\ of\ wrong\ received\ bits}{number\ of\ transmitted\ bits}$$

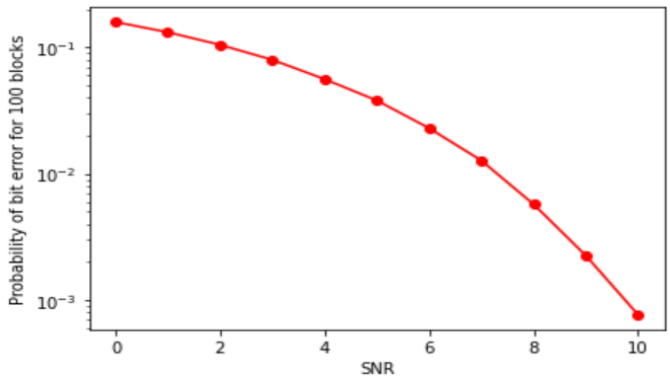


Problem 2 and 3

As in the real world we have millions of bits transmitted, we try to simulate the same in this problem.

We do by sending blocks of bits at each SNR value and find the probability of error using

$$Probability\ of\ error\ = \frac{\sum_{i=1}^{Nf} number\ of\ error\ bits\ in\ each\ block}{number\ of\ blocks\ *number\ of\ transmitted\ bits}$$

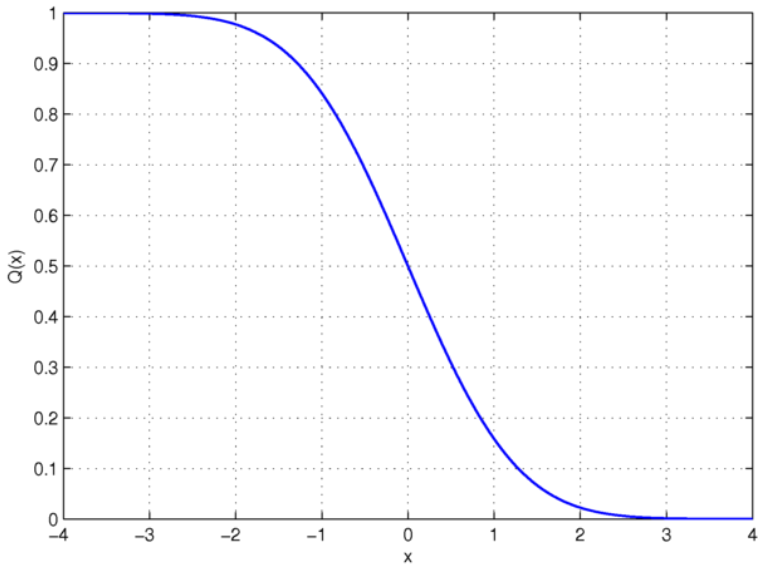


We get the above plot.

It matches with the theoretical result of error in bpsk as :

Probability of error = Q (sin($\frac{\pi}{M}$) *$SNR^{1/2}$)

Where Q function is of the form :



Hence our system gives us the correct output for BPSK

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