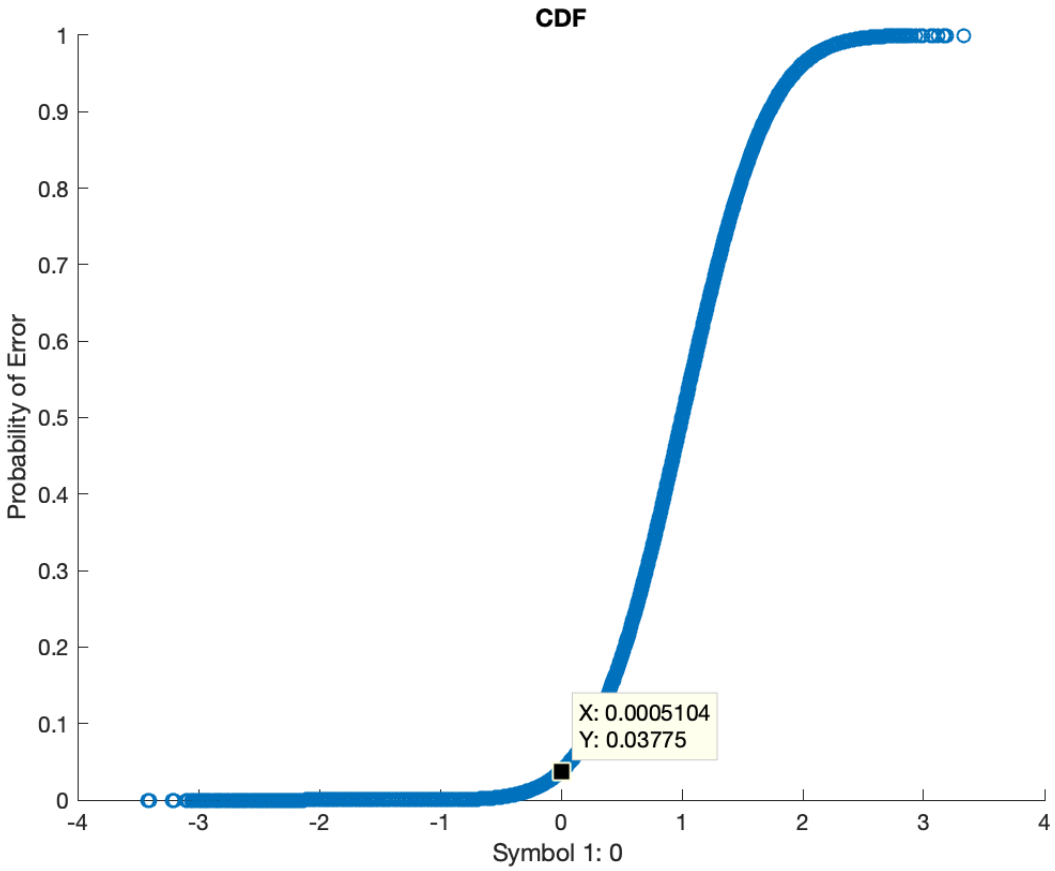
Von Kaukeano
TUID: 915596703
Practicum #2

1.

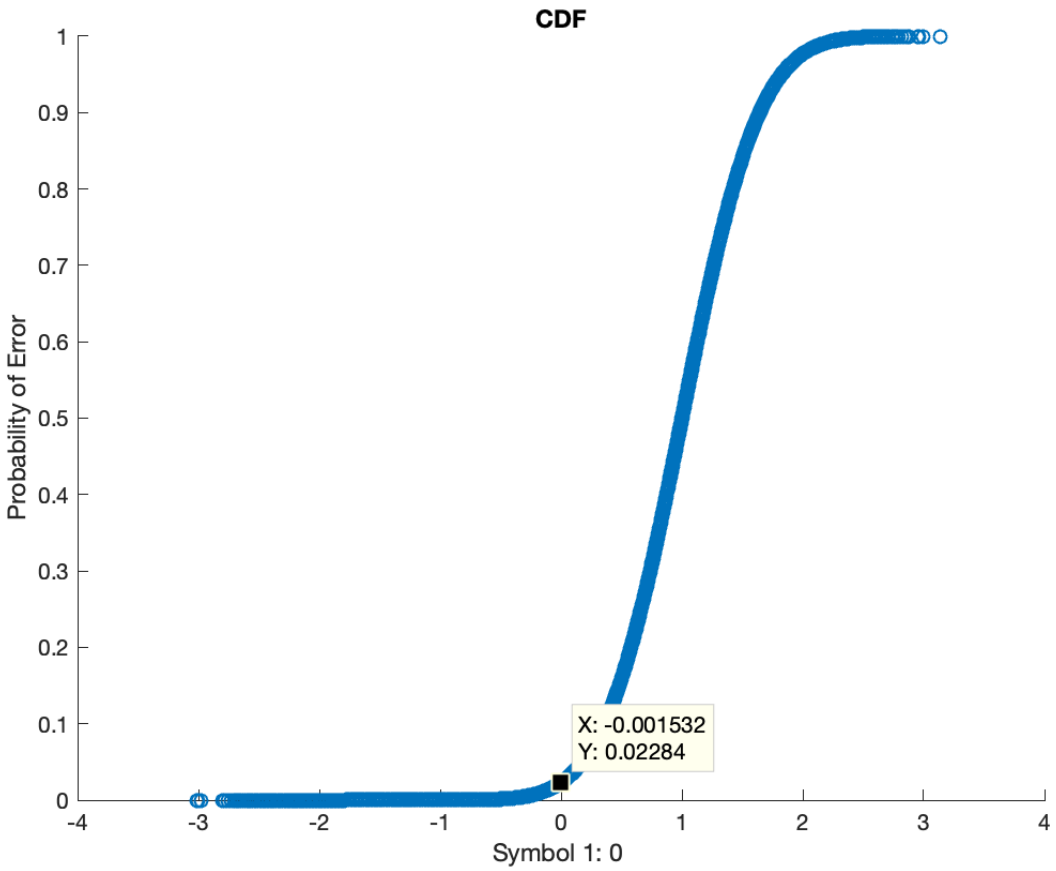


The theoretical BER ratio for 100,000 bits is .03775 by selecting the data point that was closest to zero since there was not a point exactly at zero.

2.

The average BER after 100 trials of 100,000 bits 0.037802. The theoretical value is extremely close because of many trials. If selected the point at exactly zero in the plot, then the values may possibly be even closer.

3.



The theoretical BER of 100,000 bits at 6 SNR is .02284.
The average BER after 100 trials of 100,000 bits at 6 SNR is 0.023029. The probability reduces approximately by a factor of ten. This is reason since the formula for decibels are 10 *log of the ratio.

Appendix

```
%% Von Kaukeano
% Practicum 2
% 915596703

% #1

clear
clc

N = 100000;

SNR = 6;

signal = randi([0 1], N, 1);    % bit stream with 0's & 1's

noise = randn(N,1);          % additive Gaussian noise

received = (signal*2-1) + noise * 10^(-SNR/20);

P = normcdf(received,1,10^(-SNR/20));

scatter(received, P);

ylabel('Probability of Error');
xlabel('Symbol 1: 0 ');
title('CDF');

%% #2

average_BER = 0;

for ii = 1:100

signal = randi([0 1], N, 1);

noise = randn(N,1);

received = (signal*2-1) + noise * 10^(-SNR/20);

detect = (received > 0);

[number,ratio] = biterr(detect,signal);

average_BER = average_BER + ratio;

end

average_BER= average_BER / ii;
```

Citation

https://www.mathworks.com/help/comm/ref/biterr.html

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