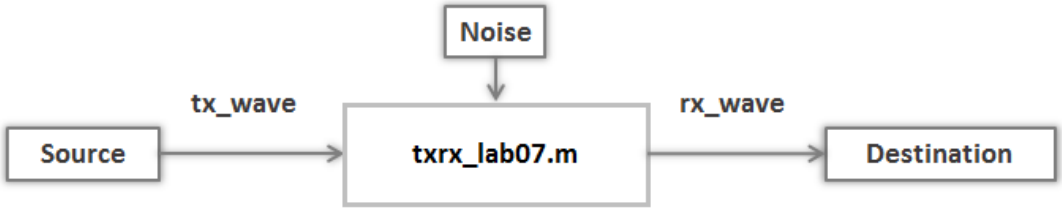
LAB 8 TASK 1 - BER WITH VARYING TRANSMISSION DISTANCE (1/1 point)

In this task, you will study the effect of SNR on BER by adjusting the transmission distance.

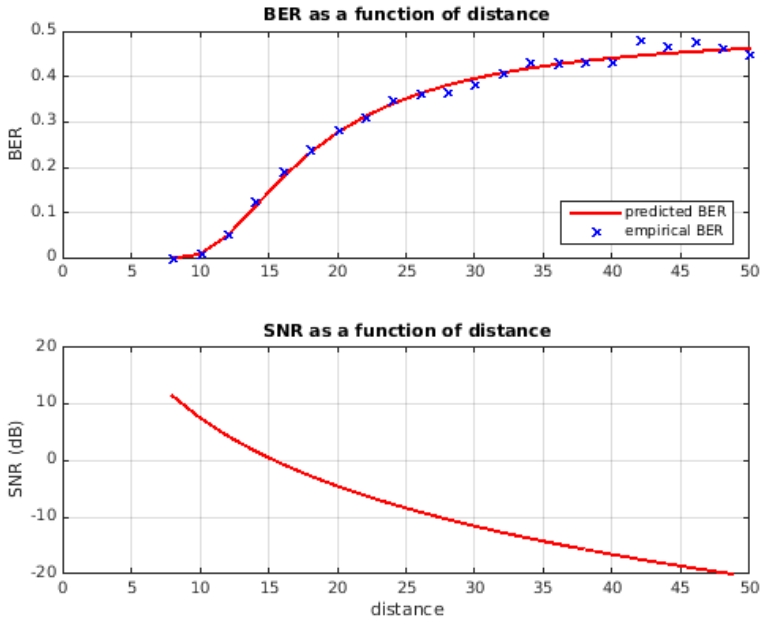



```
SPB = 50;                           % bit time in samples
tx_bs = rand(1,1280)>0.5;           % generate a random bit sequence
tx_wave = format_bitseq(tx_bs,SPB); % create waveform following protocol

distance_list = [8:2:50];           % list of transmission distances
num_dist = length(distance_list);
empirical_BER = zeros(1,num_dist);  % initialize storage arrays
predicted_BER = zeros(1,num_dist);
SNR = zeros(1,num_dist);

% loop over transmission at different distances
for i = 1:num_dist,
    distance = distance_list(i);
    % transmit and receive over noisy channel
    [rx_wave, start_ind, rx_min, rx_max, sigma] = txrx_lab07(tx_wave,distance);
```

Correct

```
predicted_BER(i) = 0.5 * qfunc((thresh-rx_min)/sigma) + 0.5*qfunc((rx_max-thresh)/sigma);
SNR(i) = 10*log10(((rx_max-rx_min)/(2*sigma))^2);
```

Figure 1



SNR =

Columns 1 through 9

11.3773 0 0 0 0 0 0 0 0

Columns 10 through 18

0 0 0 0 0 0 0 0 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 0 0 0 0 0 0 0

Columns 10 through 18

0 0 0 0 0 0 0 0 0

Columns 19 through 22

0 0 0 0

Help

```
SNR =

  Columns 1 through 9

   11.3773    7.5009    4.3337         0         0         0         0         0         0

  Columns 10 through 18

         0         0         0         0         0         0         0         0         0

  Columns 19 through 22

         0         0         0         0


SNR =

  Columns 1 through 9

   11.3773    7.5009    4.3337    1.6558         0         0         0         0         0

  Columns 10 through 18

         0         0         0         0         0         0         0         0         0

  Columns 19 through 22

         0         0         0         0


SNR =

  Columns 1 through 9

   11.3773    7.5009    4.3337    1.6558   -0.6639         0         0         0         0

  Columns 10 through 18

         0         0         0         0         0         0         0         0         0

  Columns 19 through 22

         0         0         0         0


SNR =
```

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 0 0 0

Columns 10 through 18

0 0 0 0 0 0 0 0 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 0 0

Columns 10 through 18

0 0 0 0 0 0 0 0 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 0

Columns 10 through 18

0 0 0 0 0 0 0 0 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

```
    11.3773    7.5009    4.3337    1.6558   -0.6639   -2.7100   -4.5403   -6.1960   -7.7075

  Columns 10 through 18

         0         0         0         0         0         0         0         0         0

  Columns 19 through 22

         0         0         0         0


SNR =

  Columns 1 through 9

    11.3773    7.5009    4.3337    1.6558   -0.6639   -2.7100   -4.5403   -6.1960   -7.7075

  Columns 10 through 18

   -9.0980         0         0         0         0         0         0         0         0

  Columns 19 through 22

         0         0         0         0


SNR =

  Columns 1 through 9

    11.3773    7.5009    4.3337    1.6558   -0.6639   -2.7100   -4.5403   -6.1960   -7.7075

  Columns 10 through 18

   -9.0980  -10.3854         0         0         0         0         0         0         0

  Columns 19 through 22

         0         0         0         0


SNR =

  Columns 1 through 9

    11.3773    7.5009    4.3337    1.6558   -0.6639   -2.7100   -4.5403   -6.1960   -7.7075
```

Columns 10 through 18

-9.0980 -10.3854 -11.5839 0 0 0 0 0 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 0 0 0 0 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 0 0 0 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 -14.7512 0 0 0

Columns 19 through 22

0 0 0 0

Help

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 -14.7512 -15.6904 0 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 -14.7512 -15.6904 -16.5815 0

Columns 19 through 22

0 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 -14.7512 -15.6904 -16.5815 -17.4290

Columns 19 through 22

0 0 0 0

Help

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 -14.7512 -15.6904 -16.5815 -17.4290

Columns 19 through 22

-18.2372 0 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 -14.7512 -15.6904 -16.5815 -17.4290

Columns 19 through 22

-18.2372 -19.0094 0 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 -14.7512 -15.6904 -16.5815 -17.4290

Columns 19 through 22

-18.2372 -19.0094 -19.7487 0

SNR =

Columns 1 through 9

11.3773 7.5009 4.3337 1.6558 -0.6639 -2.7100 -4.5403 -6.1960 -7.7075

Columns 10 through 18

-9.0980 -10.3854 -11.5839 -12.7051 -13.7582 -14.7512 -15.6904 -16.5815 -17.4290

Columns 19 through 22

-18.2372 -19.0094 -19.7487 -20.4579

Check Reset Save Hide Answer *You have used 3 of 10 submissions*

INSTRUCTIONS

Step 1: Run the code as presented

Click on the **Run Code** button to execute the MATLAB code in the window. The code will return the measured BER calculated by the function **compute_BER**. However, the SNR value and the predicted BER values are not correct. Your job is to modify the code line to obtain the correct SNR and the predicted BER.

Step 2: Modify the code to compute SNR and BER

Put your code under the comment starting with % Add your code below that calculates the SNR *in dB* for each distance and stores it in the vector **SNR** and calculates the predicted BER at each distance and stores it in the vector **predicted_BER**.

Note the following assumptions for calculating the predicted BER:

(1) Input bits are equally likely to be 0 and 1.

(2) The noise-free value of the channel output when IN=0 is **rx_min** returned by the function **txrx_lab07(tx_wave)**.

(3) The noise-free value of the channel output when IN=1 is **rx_max** returned by the function **txrx_lab07(tx_wave)**.

(4) The noise is Gaussian distributed with standard deviation **sigma**, returned by the function **txrx_lab07(tx_wave)**.

(5) The decision threshold is **thresh** calculated in the code.

For this part, you may find the function **Y = qfunc(X)** useful. This function returns the value of the Q function at **X**. This is not a standard MATLAB function, but it was built from the standard MATLAB function **erfc**, which is related.

Remember that the values of SNR must be computed in dB.

Step 3: Submit your work

Once you have completed your work, click on the **Check** button to submit your answer.

Help

LAB 8 TASK 2 - QUESTION 1 (1/1 point)

As the transmission distance increases, the bit error rate (BER) _____?

Please select the correct answer.

- (•) Increases ✔
- ( ) Decreases
- ( ) Remains constant
- ( ) Increases first and then decreases
- ( ) Decreases first and then increases

EXPLANATION

A larger transmission distance will cause a lower received signal power, and thus a smaller SNR value. As a result, the value of the BER will increase.

Final Check | Save | Hide Answer *You have used 1 of 2 submissions*

EdX offers interactive online classes and MOOCs from the world's best universities. Online courses from MITx, HarvardX, BerkeleyX, UTx and many other universities. Topics include biology, business, chemistry, computer science, economics, finance, electronics, engineering, food and nutrition, history, humanities, law, literature, math, medicine, music, philosophy, physics, science, statistics and more. EdX is a non-profit online

About & Company Info

About

News

Contact

FAQ

edX Blog

initiative created by founding partners Harvard and MIT.

© 2014 edX, some rights reserved.

Terms of Service and Honor Code

Privacy Policy (Revised 4/16/2014)

Help

Donate to edX

Jobs at edX

Follow Us

Twitter

Facebook

Meetup

LinkedIn

Google+