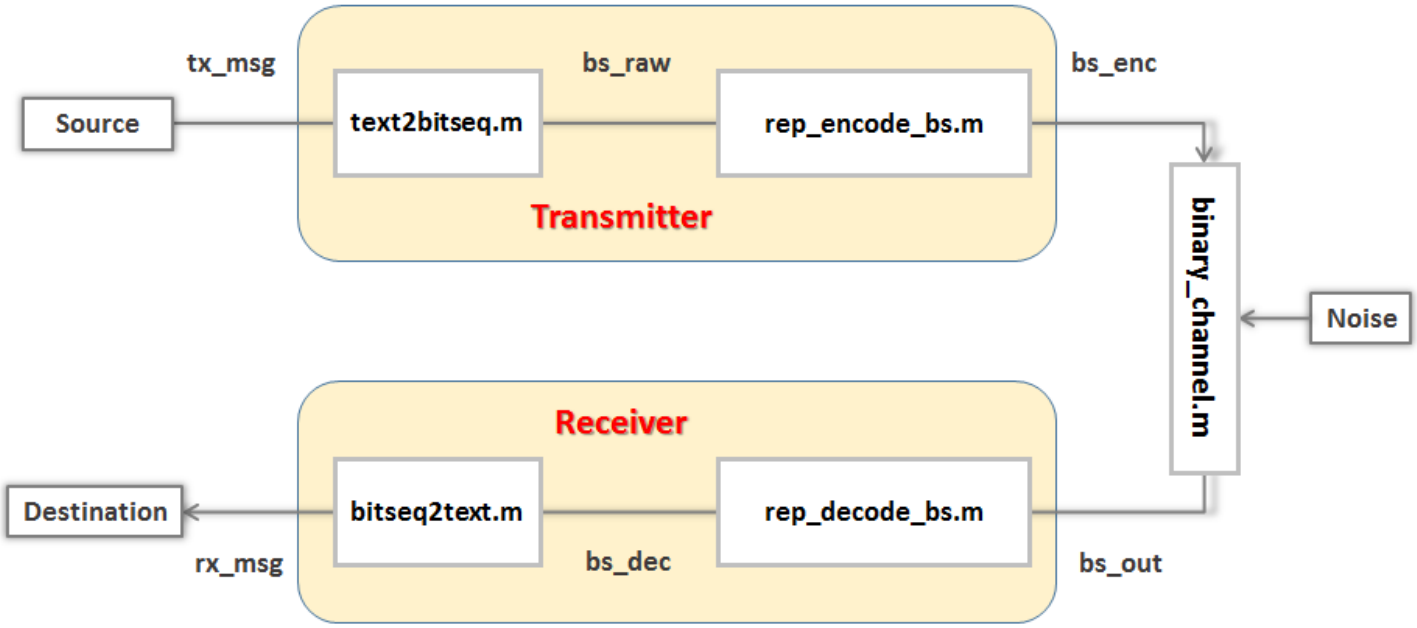
LAB 9 TASK 3 - ERROR CORRECTION CAPABILITY (1/1 point)

In this task, you will investigate the error correction capability of the (3,1,3) repetition code by comparing its BER performance to that without using error correction code.




```
num_bits=20000;
bs_raw = rand(1,num_bits)>0.5;    % generate a random bit sequence

% loop over different transmission distances
distance_list = [1:50];           % list of transmission distances
num_dist = length(distance_list);
BER_no_ecc = zeros(1,num_dist);   % initialize storage arrays
BER_ecc = zeros(1,num_dist);

for i = 1:num_dist,
    distance = distance_list(i);

    % compute BER without error correction
    bs_out = binary_channel(bs_raw,distance);   % simulate the transmission
    BER_no_ecc(i) = compute_BER(bs_raw,bs_out); % compute bit error rate
```

Correct

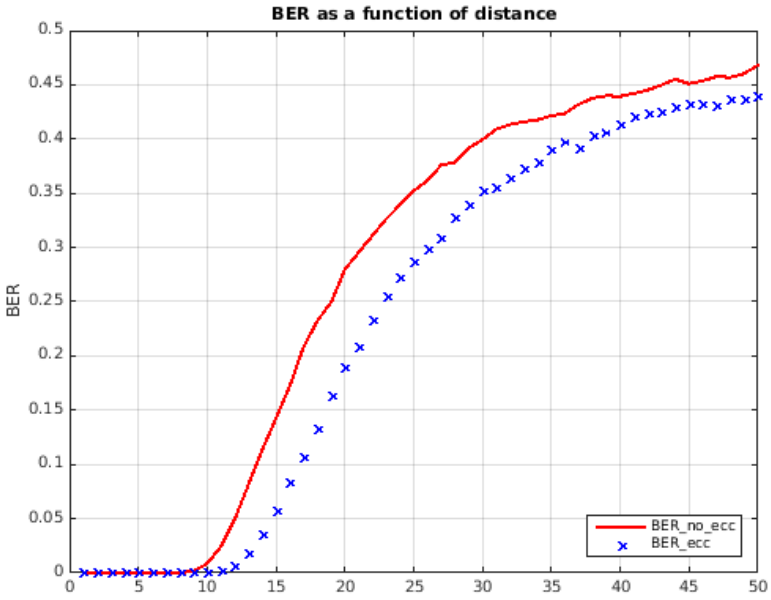
Help

```
% encode data with (3,1,3) repetition encoder
bs_enc = ones(3,1)*bs_raw;
bs_enc = bs_enc(:)';

% do not change this line
bs_out = binary_channel(bs_enc,distance); % transmit over noisy channel

% decode with error correcton
codewords = reshape(bs_out,3,num_bits);
bs_dec = sum(codewords,1) > 1.5;
```

Figure 1



Check Reset Save Hide Answer *You have used 1 of 10 submissions*

INSTRUCTIONS

The available code in the above window calculates the empirical BER performance without error correction for transmission at the distances contained in the vector **distance_list**, and returns the results in the vector **BER_no_ecc**. It also plots the bit error rate as a function of distance. The code first creates a random bit stream, then transmits it over a noisy binary channel using the function

bs_out = binary_channel(bs_raw,distance);

which simulates the transmission of the binary sequence **bs_raw** over a binary channel and generates the output **bs_out** with errors, where the bit error rate depends on distance in the same way as in previous labs. It compares the input and output bit streams to compute the bit error rate.

Your job is to calculate the empirical BER with repetition code and plot it in the same figure for comparison.

Step 1: Run the given code

After you click on the **Run Code** button, the code will generate a figure with two curves representing the BER performance without error correction and with error correction using the repetition code. The curve showing BER without error correction is correct. However, the curve showing BER with error correction is not. It will be very similar to that without error correction. Your job is to use your code from Tasks 1 and 2 to add channel coding and error correction, and see how this affects the BER.

Help

Step 2: Modify the code to add error correcting channel coding in the transmitter and error correction in the receiver

Your job is to modify the code after the comments starting with

```
% Modify the code below
```

Your code should first encode the bitstream in **bs_raw** using the (3,1,3) repetition encoder and store it in **bs_enc**.

The existing code transmits **bs_enc** over a noisy binary channel with the code:

bs_out = binary_channel(bs_enc,distance); % simulate the transmission

Do NOT change this line.

Your code should then decode **bs_out** by performing error correction, and store the result in **bs_dec**.

Step 3: Submit your work

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