520.137 – Introduction to Electrical and Computer Engineering

Laboratory Session 6 – Signal-to-Noise Ratio

Name: _____ **Name:**_____ **Name:**_____

Introduction:

In this experiment you will quantify the effect of signal-to-noise ratio (SNR) on the probability of getting errors in a simple binary transmission line.

1. Open up the "Matlab/Simulink" simulation environment.

2. Download the "Lab6.mdl" simulation from the course web page.

3. Open this file by typing "Lab6" inside Matlab.

4. In this program, a binary signal is created. The encoding used is +1 for a "1" and –1 for a "0"

    What is the average signal power:

    $$\sigma_s^2 = \frac{1}{T}\int_0^T s^2(t)\,dt$$

    for this signal encoding?

5. This signal is then corrupted by white noise of varying amplitude. This simulates the effect of ambient noise that is acquired during transmission. The noise signal has been selected so that the average noise power is $\sigma_n^2 = A$. **Compute a formula for the SNR in decibels:**
    _____

6. Select a value of *A* inside Matlab. Start with low noise; say *A*=0.01. You can do this by typing:

    >> A=0.01;

7. The simulation will compute *N* binary signals. Choose a small number for *N*, say 100, inside Matlab. Simply type:
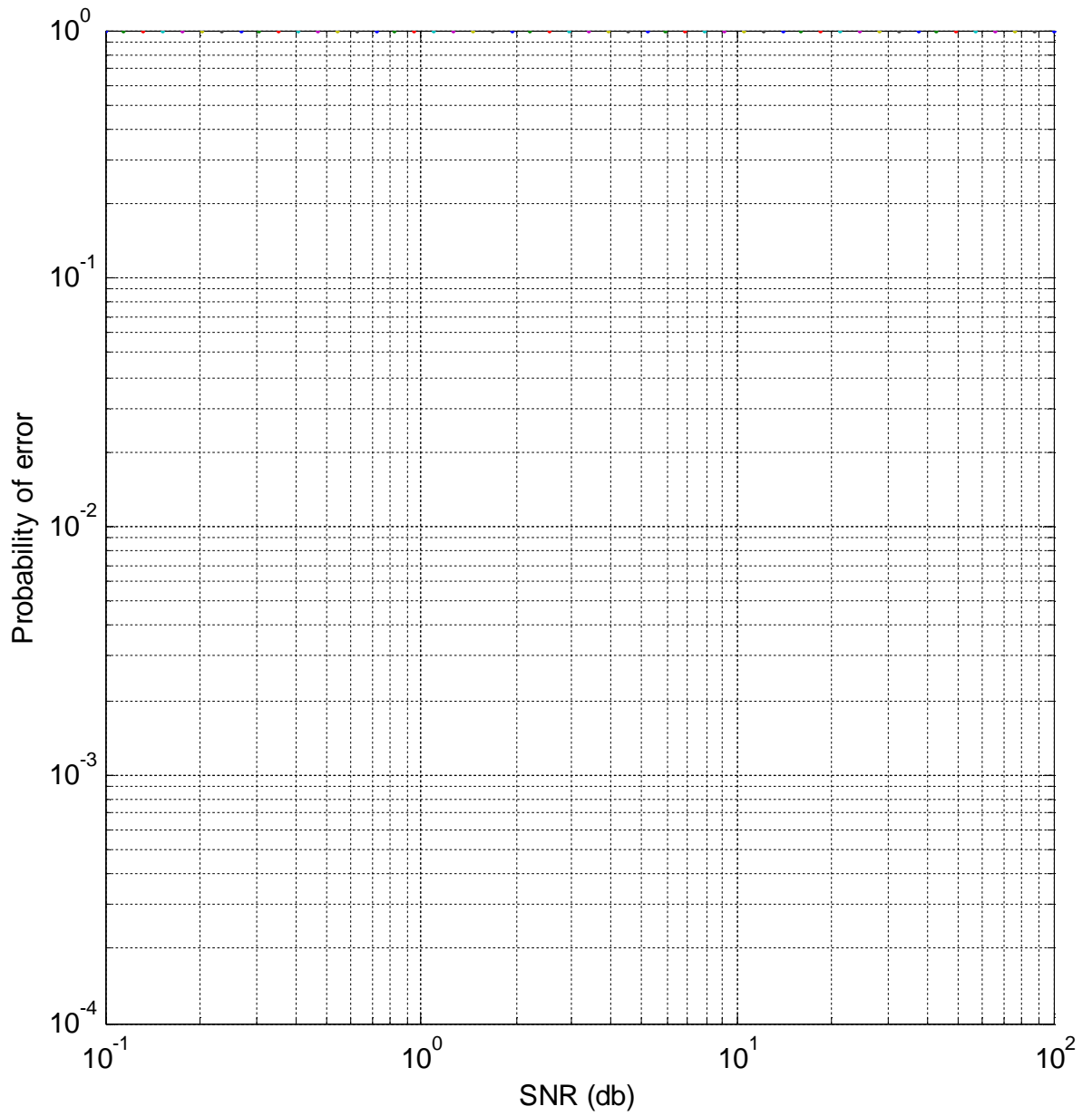
    >> N=100;

8. To detect the original signal, the corrupted signal is sent through a threshold detector. **What is the correct value for this threshold?** _____ .

    The number of errors is then computed by comparing the original signal with the detected signal. The counter will let you know how many. By running the simulation and double clicking on each of the "virtual" Scopes, make sure that you understand what each of the blocks is doing. You will need to pick a random "seed" in Matlab. (Just type >> seed= <your number>, for example: seed = 1) By adjusting the value of *A* in Matlab, complete the following table.

A	SNR (db)	# of errors	N	Effective Prob of Error
0.01				
1				
5.0				

9. Use the data from the table to complete the following graph.

Instructor's initials:_____