AMERICAN INTERNATIONAL UNIVERSITY- BANGLADESH

Laboratory Report

Report Title:	Study of Nyquist bit rate and Shannon capacity using MATLAB		
Lab Report No:	04	**Date of Submission:**	16-06-2022
Submitted by:	Samira Kabir Rima	**ID:**	20-42406-1
Semester:	Summer 21-22	**Program:**	BSc. CSE
Course Code:	COE3103	**Course Title:**	Data Communication
Course Instructor:	Afsah Sharmin	**Section:**	B

Problem:

Performance Task for Lab Report: (your ID = AB-CDEFG-H)

**Generate a composite signal using two simple signals as,

$x = A_1 \sin(2\pi(C*100)t) + A_2 \cos(2\pi(G*100)t) + s*randn(size(t));$

(a) Select the value of the amplitudes as follows: let A_1 = AB, A_2 = AF and s=AH

(b) Calculate the SNR value of the composite signal.

(c) Find the bandwidth of the signal and calculate the maximum capacity of the channel.

(d) What will be the signal level to achieve the data rate?

Solution:

	MATLAB Code	Output

a	%A)
	%20-42406-1
	%AB-CDEFG-H
	%A1=AB;A2=AF;s=AH
	A1=20
	A2=20
	s=21
	C=4
	G=6
	fs = 8000;
	f = 400;
	t = 0:1/fs:1-1/fs;
	A = 3.0;
	x = A1*sin(2*3.1416*(C*100)*t) +
	A2*cos(2*3.1416*(G*100)*t) + s*randn(size(t));
		A1 = 20
		A2 = 20
		s = 21
		C = 4
		G = 6

b	%B)
	A1=20;
	A2=20;
	s=21;
	fs=40000;
	t = 0:1/fs:1-1/fs;
	powfund=(A1^2)/2+(A2^2)/2;
	varnoise=s^2;
	C=4;
	G=6;
	x =
	A1*sin(2*pi*(C*100)*t)+A2*cos(2*pi*(G*100)*t)+
	s*randn(size(t));
	noise= s*randn(size(t));
	SNR=powfund/varnoise
	dfSNR=10*log10(powfund/varnoise)
		SNR = 0.9070
		dfSNR = -0.4238

c	%C)
	A1=20;
	A2=20;
	s=21;
	fs=40000;
	t = 0:1/fs:1-1/fs;
	powfund=(A1^2)/2+(A2^2)/2;
	varnoise=s^2;
	C=4;
	G=6;
		bandwidth = 500
		capacity1 = 465.6636
		capacity2 = -397.6617

	x =
	A1*sin(2*pi*(C*100)*t)+A2*cos(2*pi*(G*100)*t)+
	s*randn(size(t));
	noise= s*randn(size(t));
	SNR=powfund/varnoise;
	dfSNR=10*log10(powfund/varnoise);
	bandwidth = 900-400
	capacity1=bandwidth*log2(1+SNR)
	capacity2=bandwidth*log2(1+dfSNR)
	apprxDataRate1=floor(bandwidth*log2(1+SNR));
	apprxDataRate2=floor(bandwidth*log2(1+dfSNR));	

d	%D)
	A1=20;
	A2=20;
	s=21;
	fs=40000;
	t = 0:1/fs:1-1/fs;
	powfund=(A1^2)/2+(A2^2)/2;
	varnoise=s^2;
	C=4;
	G=6;
	x =
	A1*sin(2*pi*(C*100)*t)+A2*cos(2*pi*(G*100)*t)+
	s*randn(size(t));
	noise= s*randn(size(t));
	SNR=powfund/varnoise
	dfSNR=10*log10(powfund/varnoise);
	bandwidth = 900-400
	capacity1=bandwidth*log2(1+SNR)
	capacity2=bandwidth*log2(1+dfSNR)
	apprxDataRate1=floor(bandwidth*log2(1+SNR))
	apprxDataRate2=floor(bandwidth*log2(1+dfSNR))
	level1=floor(2^(apprxDataRate1/(2*bandwidth)))
	level2=floor(2^(apprxDataRate2/(2*bandwidth)))
		SNR = 0.9070
		
		bandwidth = 500
		capacity1 = 465.6636
		capacity2 = -397.6617
		apprxDataRate1 = 465
		apprxDataRate2 = -398
		level1 = 1
		level2 = 0