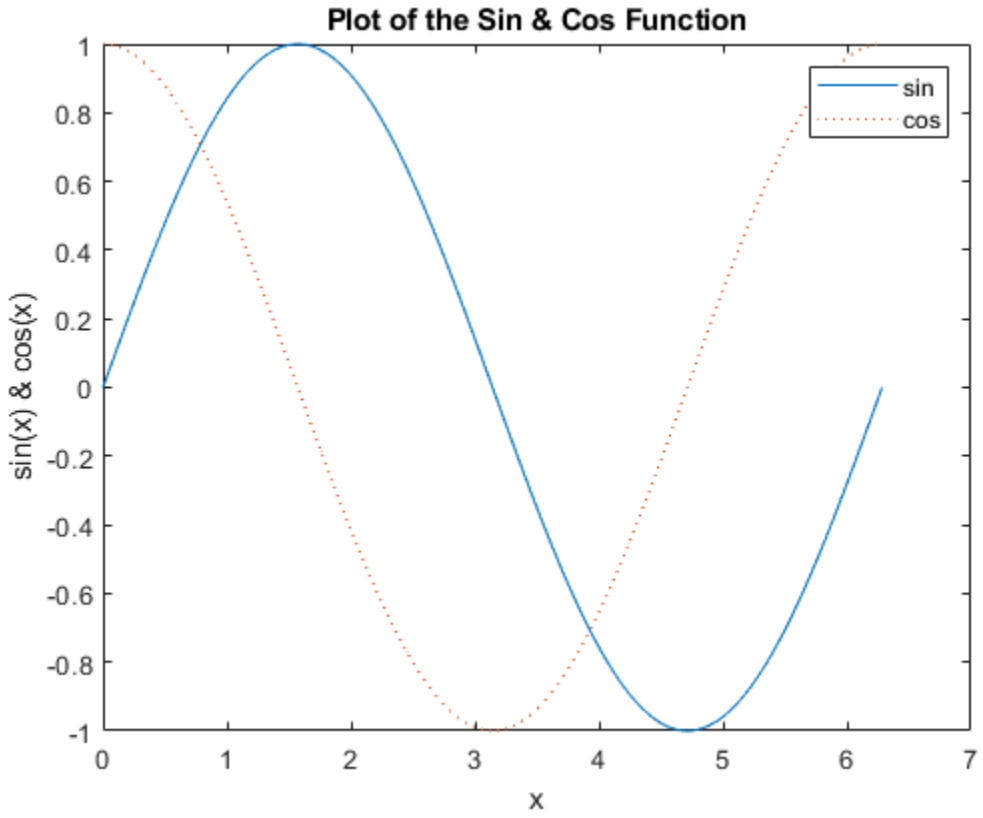
ACTIVITY 1

Steps 13 - 15:



ACTIVITY 2

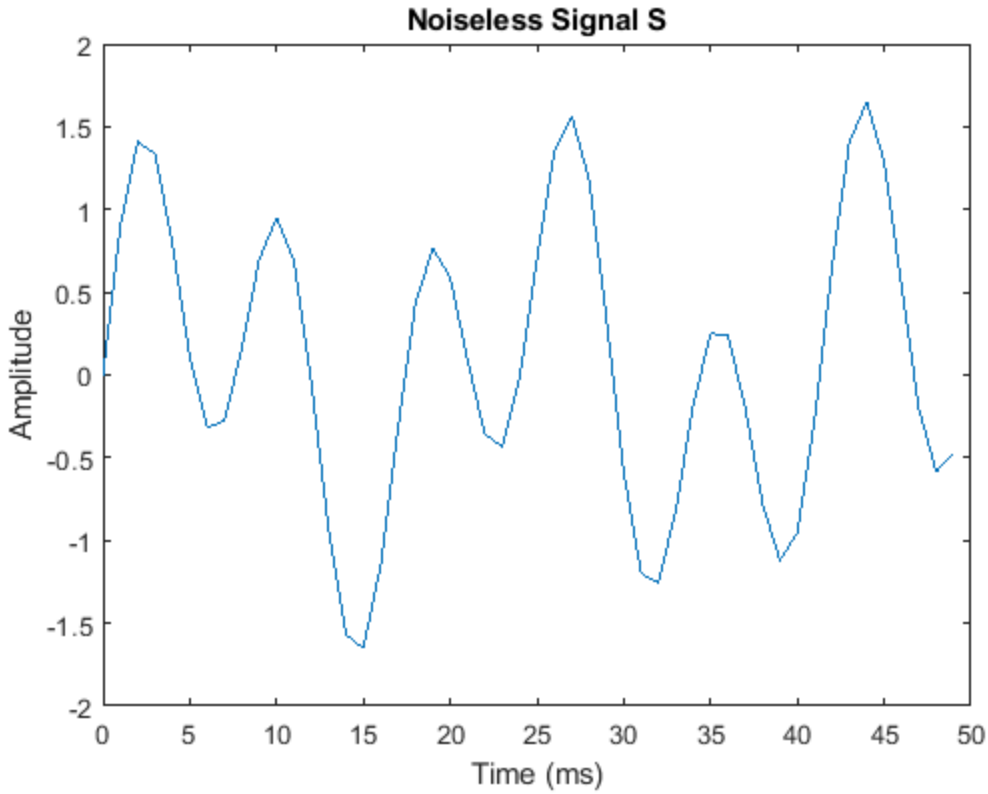
Q1 Ans:

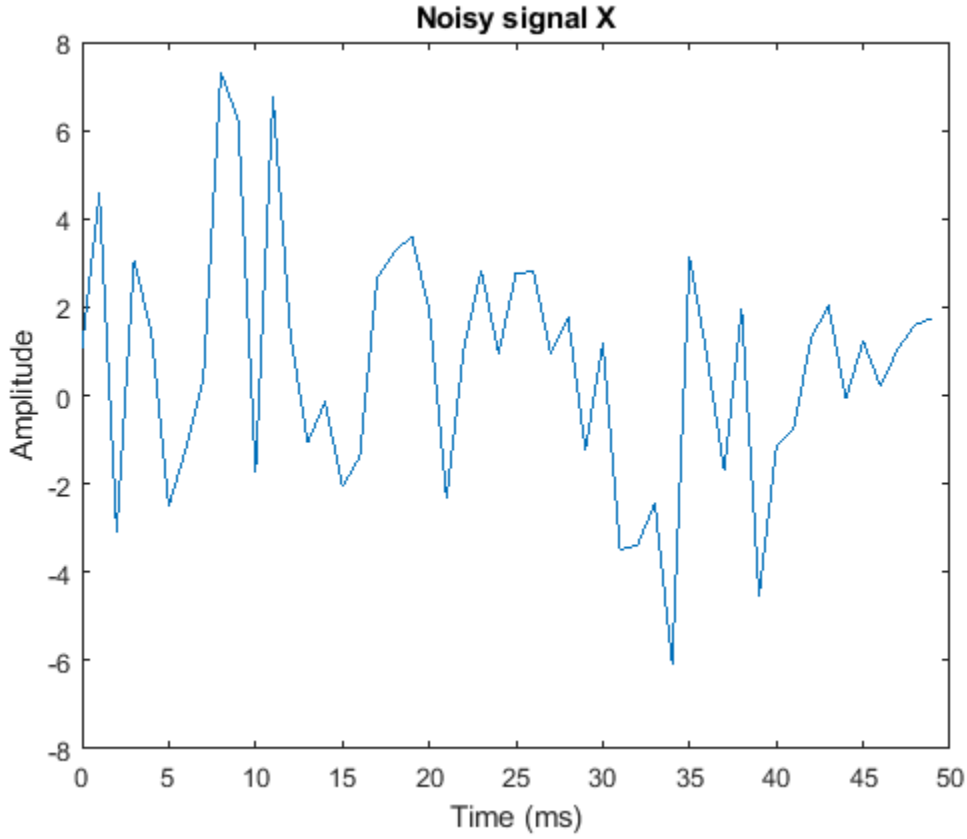
v(t) = A*sin(2*pi*f*t + φ)
A:maximum amplitude
φ:phase
f: frequency (in Hz)
T: time period (in seconds)
fs: sampling rate for digital processing
T_s: sampling interval for digital processing

S = 0.7*sin(2*pi*50*t) + sin(2*pi*120*t)

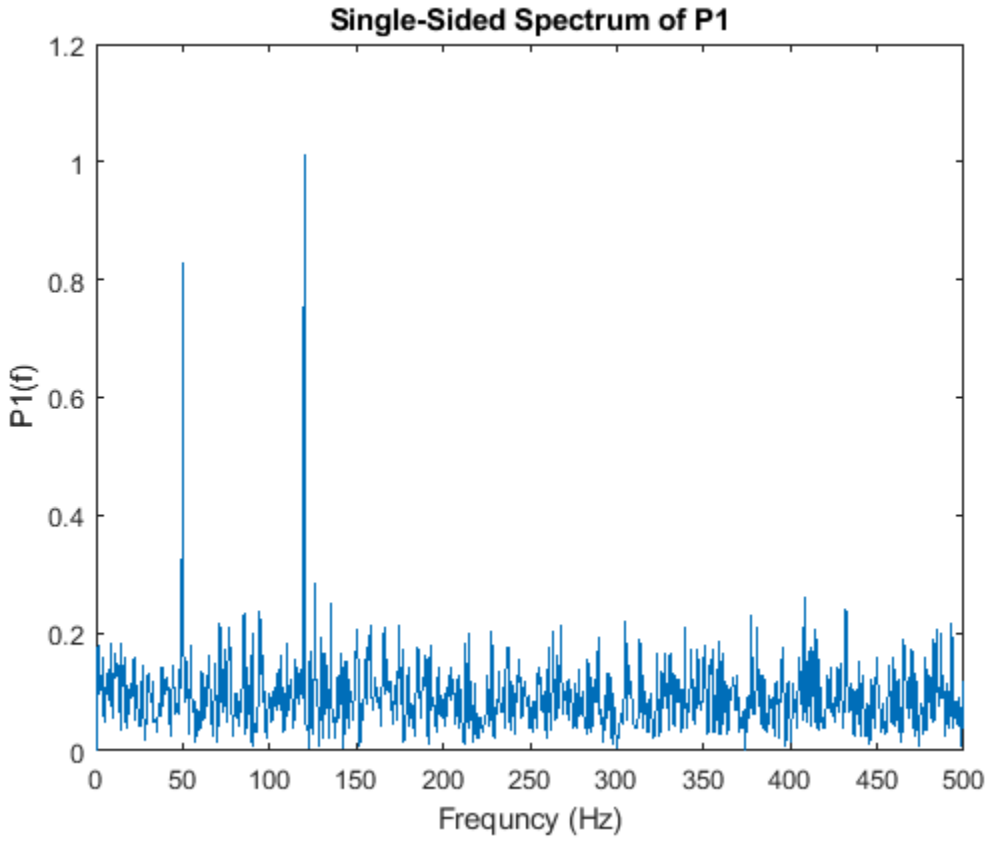
The two sinusoidal components or frequency components are sin(2*pi*50*t) and sin(2*pi*120*t). The amplitude of the first component is 0.7 with the frequency of 50. The amplitude of the second component is 1 with the frequency of 120. The Bandwidth is the difference between highest frequency and the lowest frequency. Therefore, the bandwidth is 70Hz, which is 120Hz - 50Hz.

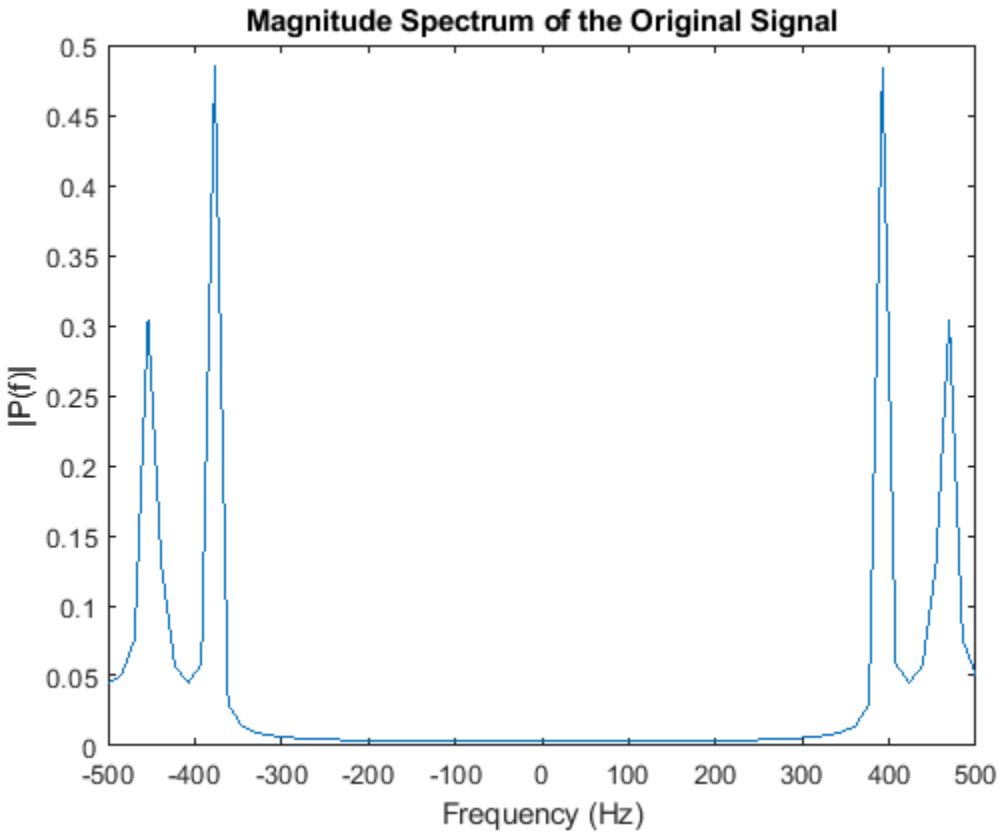
Step 3:


Noiseless Signal S
Amplitude
Time (ms)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
5
10
15
20
25
30
35
40
45
50


Noisy signal X
Amplitude
Time (ms)
8
6
4
2
0
-2
-4
-6
-8
0
5
10
15
20
25
30
35
40
45
50

Step 5:

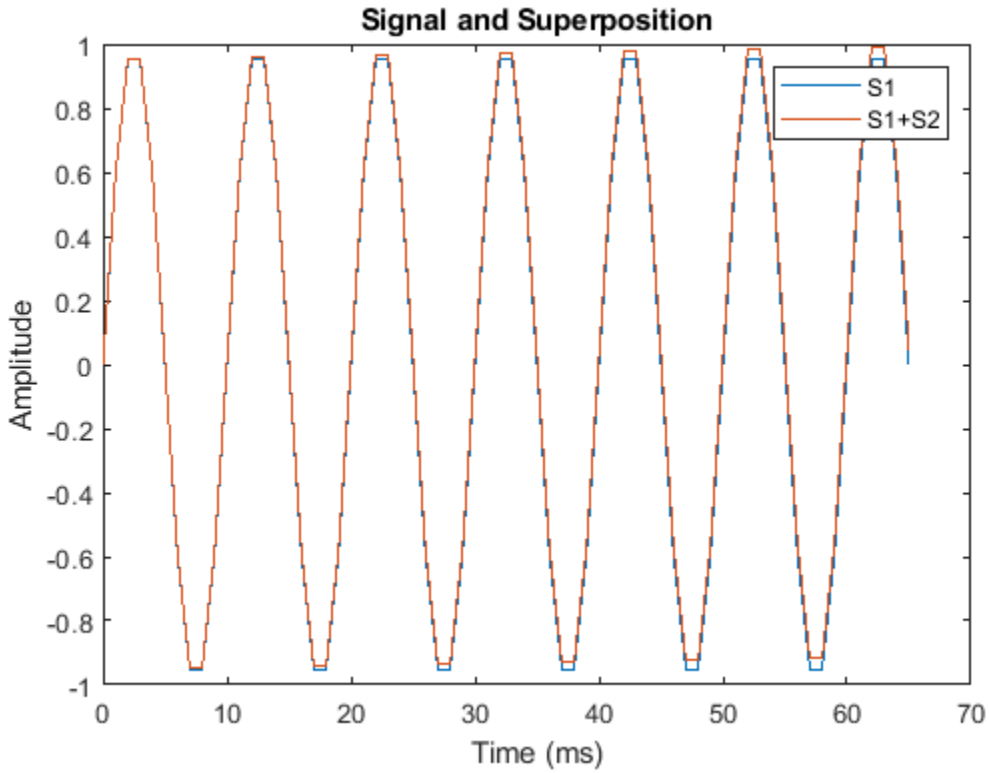

Single-Sided Spectrum of P1
P1(f)
Frequncy (Hz)
0
0.2
0.4
0.6
0.8
1
1.2
0
50
100
150
200
250
300
350
400
450
500


Magnitude Spectrum of the Original Signal
|P(f)|
Frequency (Hz)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
-500
-400
-300
-200
-100
0
100
200
300
400
500

Q2 Ans:

- The higher the frequency, the more oscillations the signal has in a given time interval, and thus the sharper the variations. In your example,the three signals have different frequencies: 50 Hz, 150 Hz, and 300 Hz. The signal with the highest frequency is x3, which corresponds to the third row wave. Therefore, x3 has the sharpest variations in the time domain with the frequency of 300Hz.

ACTIVITY 3



Q3 Ans:

S1 has a frequency of 100Hz

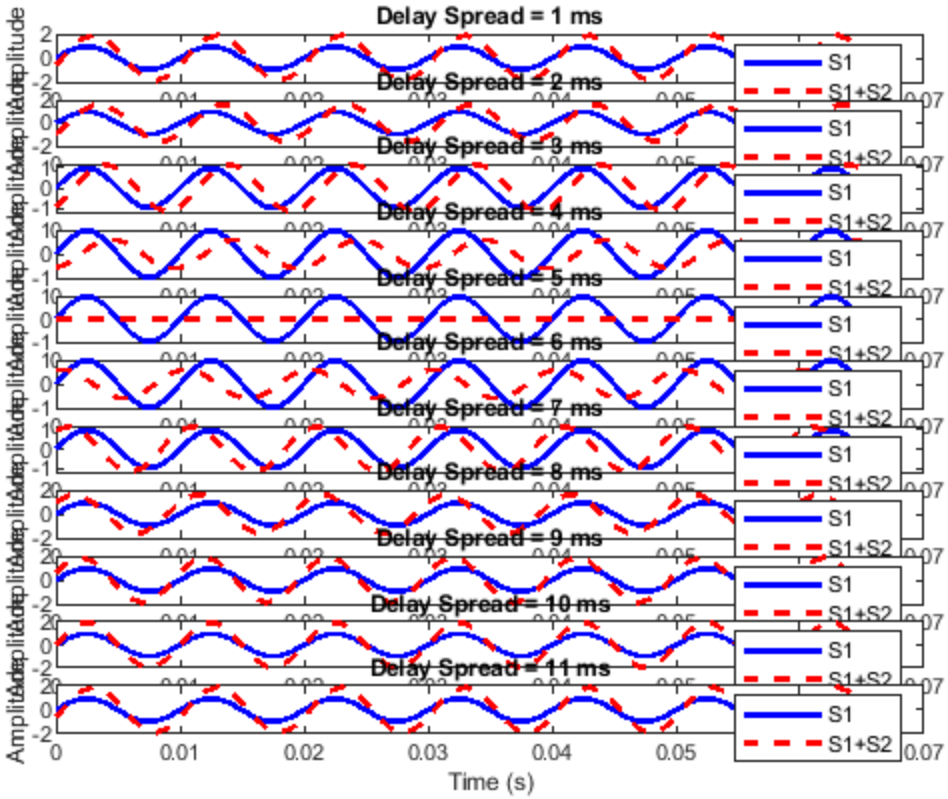
So,

Period = (1/100) * 1000 = 10 ms

Q4 Ans:

- The superposition has the same frequency and wavelength as S1, but a larger amplitude. It is also in phase with S1. It is a constructive superposition.

Q5 Ans:



- I would say according to the graph above, when the time delay is 4 ms, it still looks similar to S1.

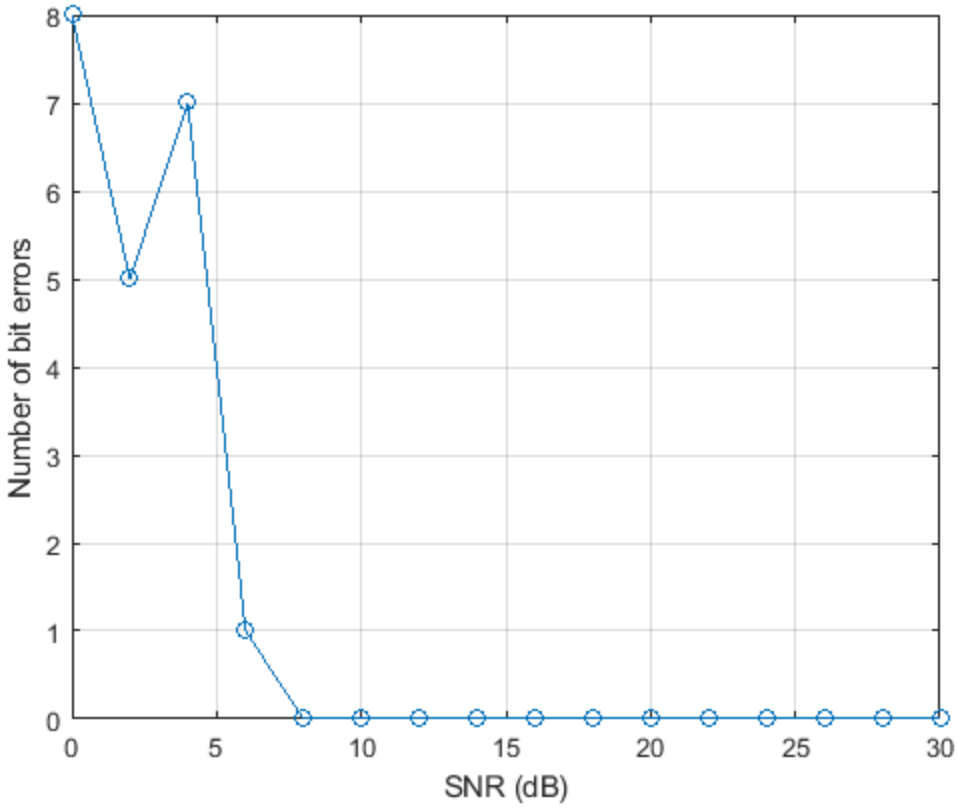
Q6 Ans:

- The connection between Q3 and Q5 is that the delay spread is smaller than the period to avoid interference.

ACTIVITY 4

- Number of bit errors after demodulation is 0

Q7 ANS:



Well according to the diagram above there is a bit error from SNR value of 0 - 8