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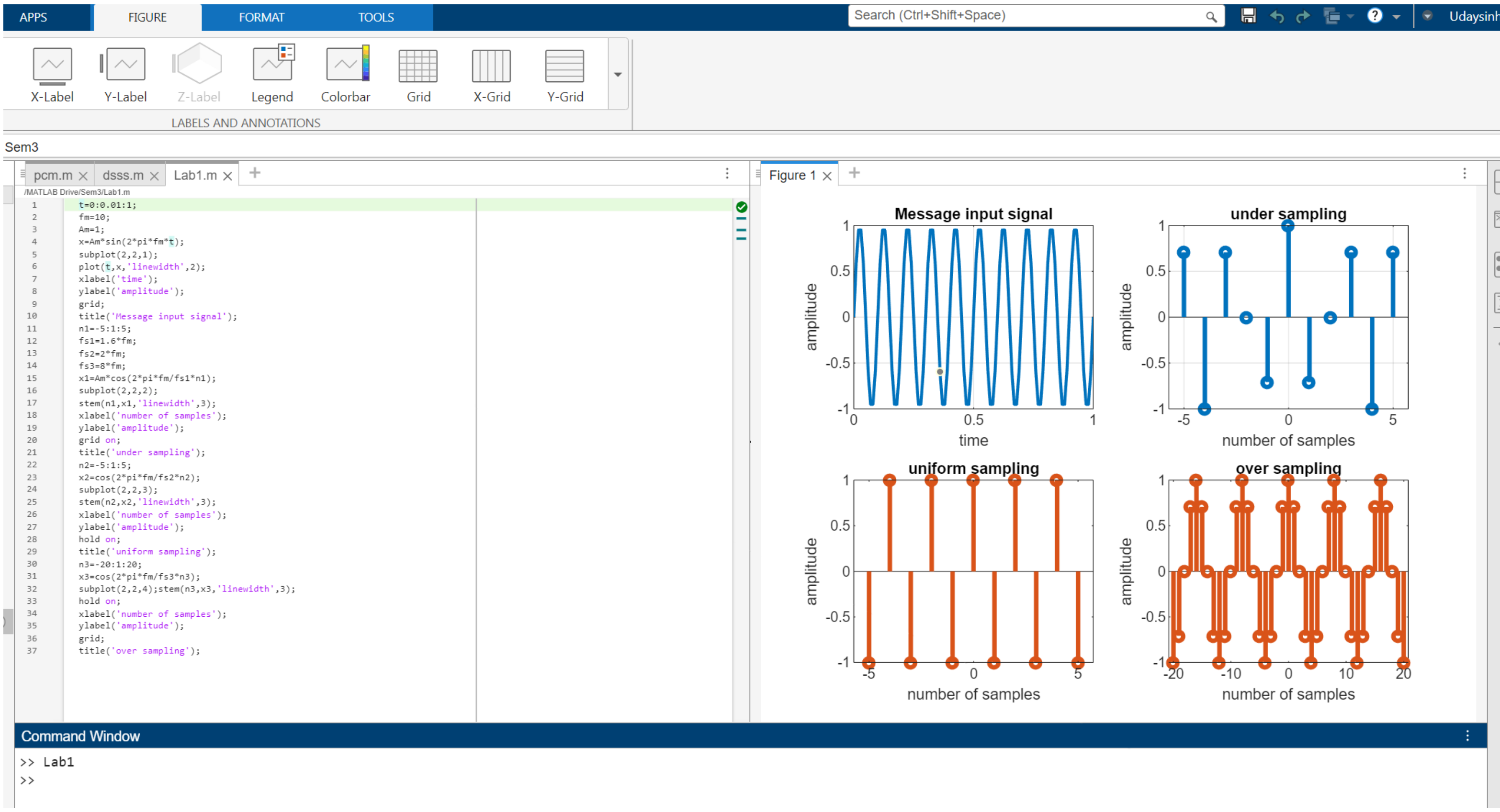
EXP 1: To know the Principles of sampling and quantization

Aim: To know the principles of sampling and quantization

Apparatus: Matlab

Theory: Sampling and quantization are foundational principles in digital signal processing. Together, they enable the conversion of analog signals into a digital form that can be processed, stored, and transmitted by digital systems. Understanding these principles is key in applications like audio processing, image encoding, telecommunications, and data compression

MATLAB Code:



Conclusion: **sampling and quantization are the cornerstone of digitizing analog signals for digital processing. Sampling ensures that the continuous signal is captured at discrete intervals, while quantization provides a digital representation of the signal's amplitude. Both processes introduce certain errors—sampling error due to undersampling (if the sampling rate is too low) and quantization error due to finite resolution. However, with careful design and adherence to principles like the Nyquist criterion and appropriate bit-depth for quantization, these errors can be minimized, allowing for high-quality digital representations of analog signals.**

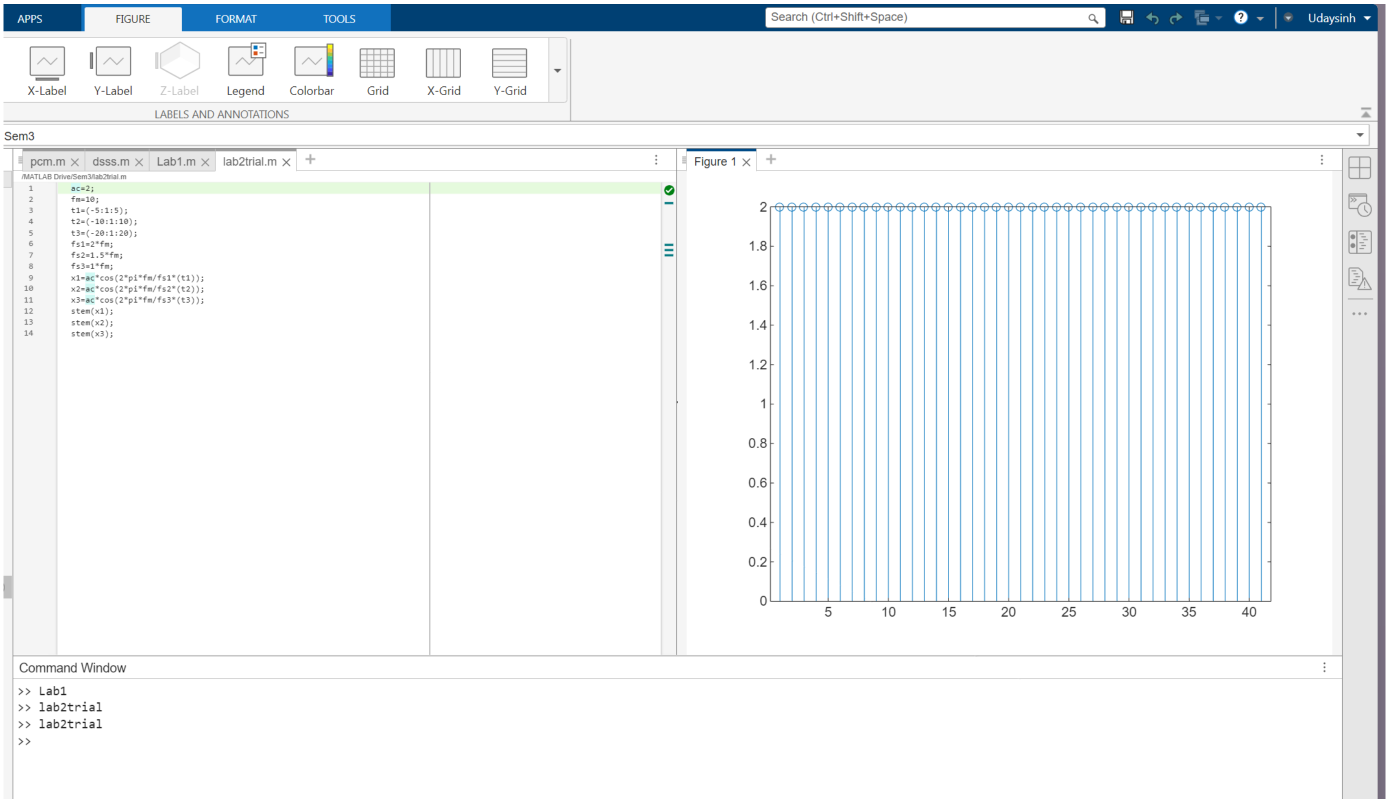
EXP 2: To know the Amplitude Key shifting

Aim: To know the Amplitude Key Shifting

Apparatus: Matlab

Theory: Amplitude Shift Keying (ASK) is a type of digital modulation technique in which the amplitude of a carrier wave is varied in proportion to a digital signal, typically in the form of binary data. ASK is widely used in communication systems, particularly for transmitting digital information over radio frequencies.

MATLAB Code:



Conclusion: ASK is a straightforward and effective digital modulation technique that represents binary data by changing the amplitude of a carrier signal. Its ease of implementation and efficient bandwidth usage make it suitable for various applications, such as RFID and optical communication. However, ASK's sensitivity to noise and interference limits its reliability in noisy environments compared to other modulation techniques. Despite these limitations, ASK remains a valuable method for simple, low-cost digital communication where conditions are controlled or noise is minimal.

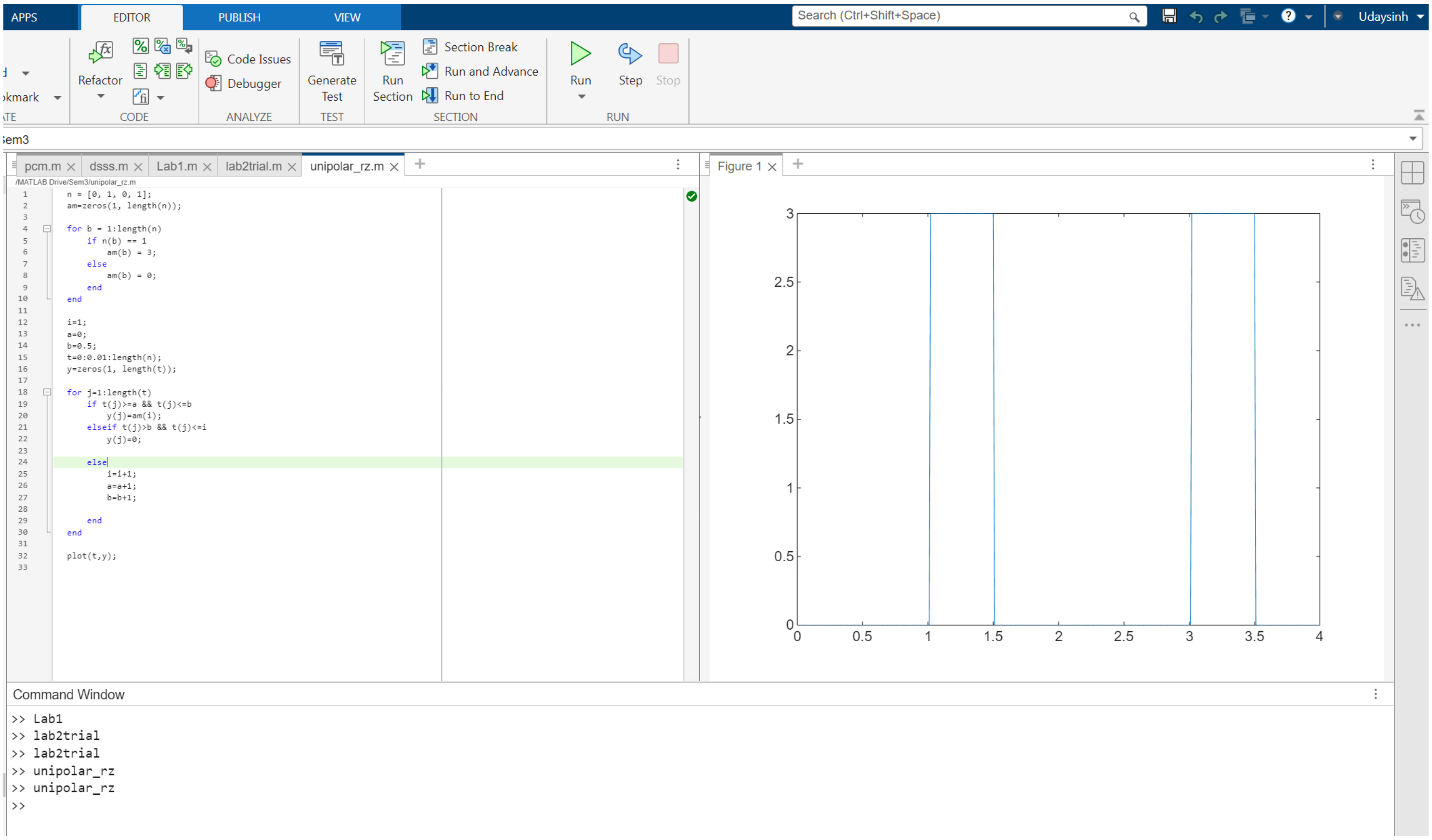
EXP3: To know the Principles Line coding

Aim: To know the principles of line coding

Apparatus: Matlab

Theory: Line coding is a process of converting digital data into a format suitable for transmission over a communication channel. It is a type of digital baseband modulation that converts binary data into electrical pulses or voltage levels, allowing the data to be sent across physical media, such as cables or fiber optics. Line coding is crucial in digital communication systems as it ensures signal integrity, helps with synchronization, and minimizes bandwidth usage.

MATLAB Code:



<u>Conclusion</u>: line coding is a critical process in digital communication that converts binary data into a suitable waveform for transmission across a physical medium. By selecting an appropriate line coding scheme, systems can achieve efficient bandwidth usage, maintain signal integrity, facilitate synchronization, and reduce errors. From simple unipolar and polar coding to advanced methods like Manchester and 4B/5B encoding, each line coding technique offers specific benefits suited to different communication needs. Overall, line coding enhances the reliability and efficiency of digital transmission in applications ranging from telecommunications to data storage.

EXP 4: To know the Principles BASK, BPSK, BFSK

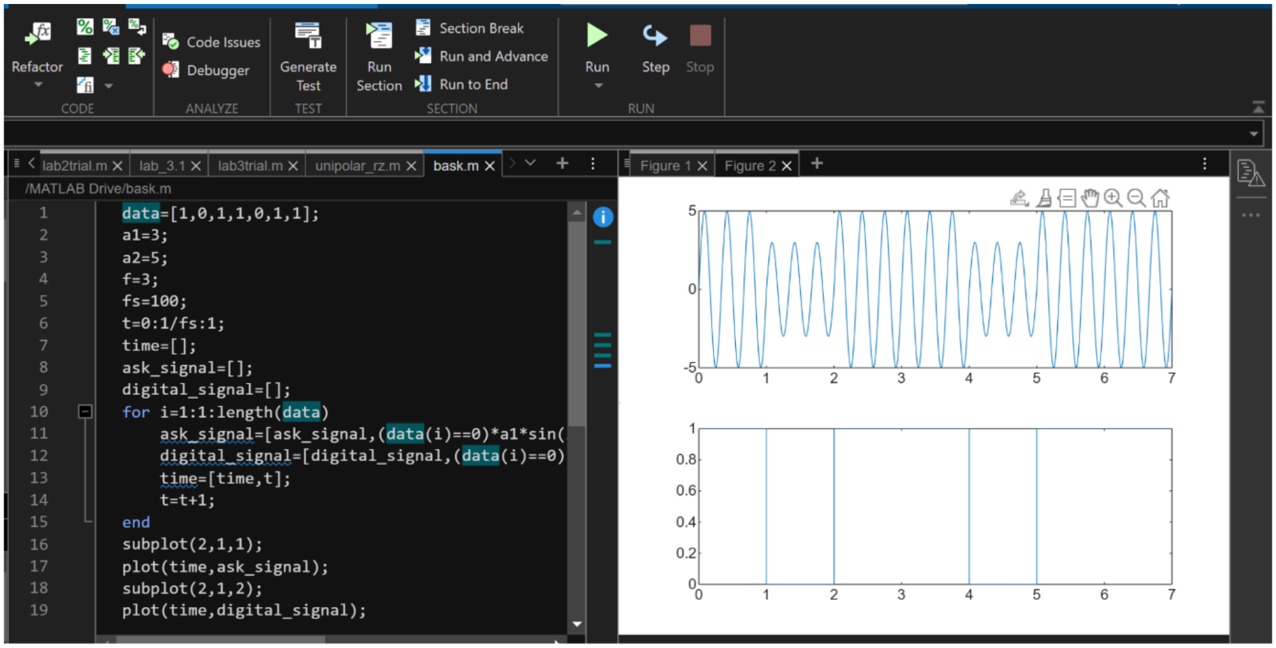
Aim: To know the principles of BPSK, BASK, BFSK

Apparatus: Matlab

Theory: Binary Phase Shift Keying (BPSK), Binary Amplitude Shift Keying (BASK), and Binary Frequency Shift Keying (BFSK) are fundamental digital modulation techniques used in communication systems to transmit binary data over a carrier signal. Each technique modulates a specific property of the carrier signal—phase, amplitude, or frequency—making it possible to encode binary information for transmission.

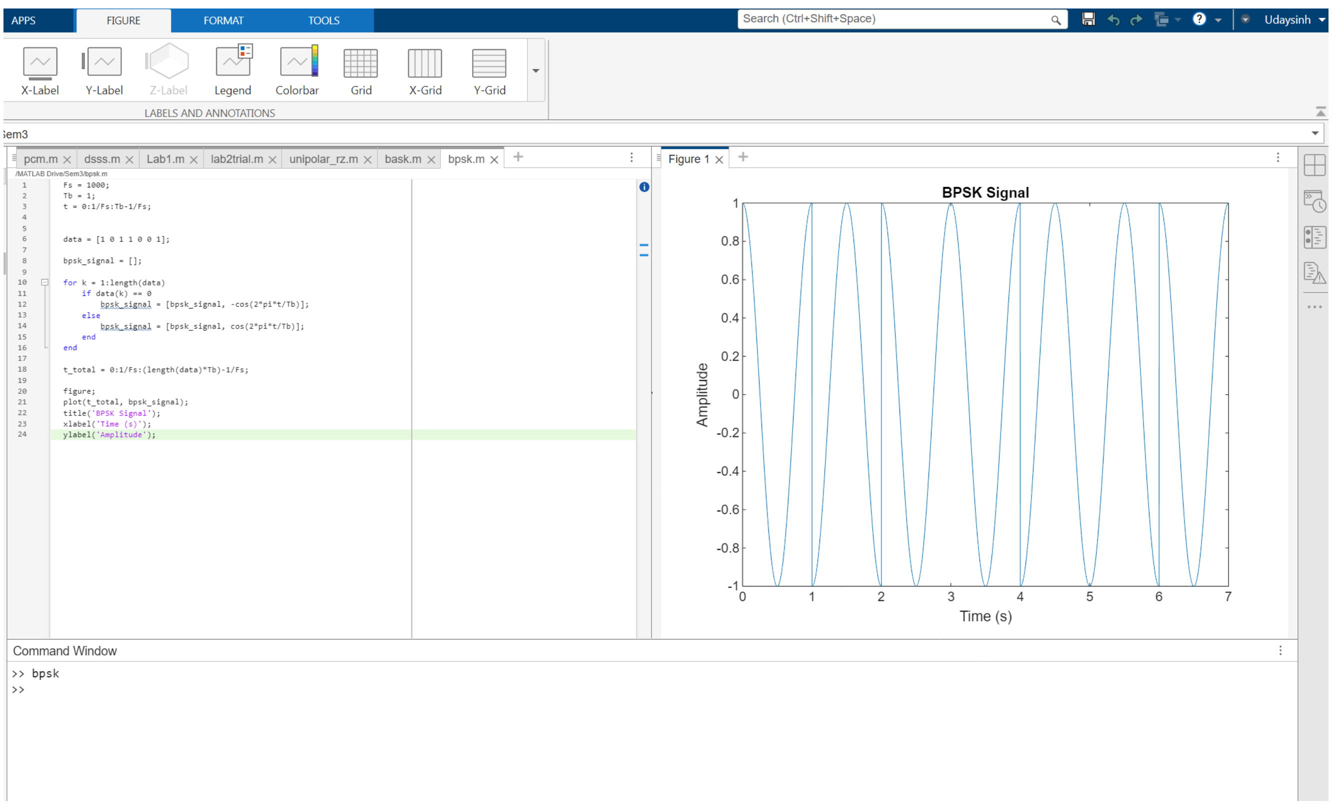
MATLAB Code:

BASK:



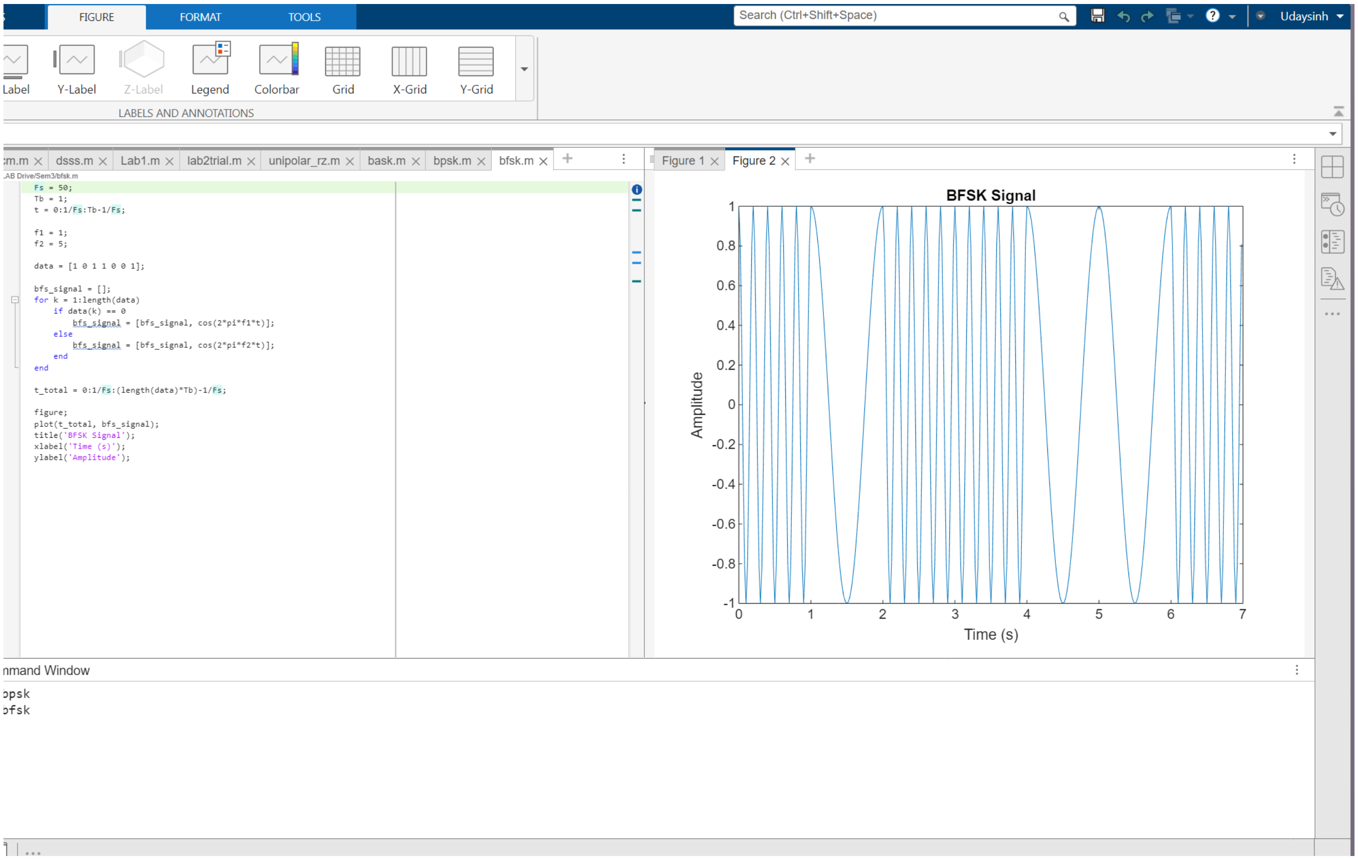
/MATLAB Drive/bask.m
data=[1,0,1,1,0,1,1];
a1=3;
a2=5;
f=3;
fs=100;
t=0:1/fs:1;
time=[];
ask_signal=[];
digital_signal=[];
for i=1:1:length(data)
ask_signal=[ask_signal,(data(i)==0)*a1*sin(
digital_signal=[digital_signal,(data(i)==0)
time=[time,t];
t=t+1;
end
subplot(2,1,1);
plot(time,ask_signal);
subplot(2,1,2);
plot(time,digital_signal);
Figure 1
Figure 2

BPSK:



/MATLAB Drive/Sem3/bpsk.m
Fs = 1000;
Tb = 1;
t = 0:1/Fs:Tb-1/Fs;
data = [1 0 1 1 0 0 1];
bpsk_signal = [];
for k = 1:length(data)
if data(k) == 0
bpsk_signal = [bpsk_signal, -cos(2*pi*t/Tb)];
else
bpsk_signal = [bpsk_signal, cos(2*pi*t/Tb)];
end
end
t_total = 0:1/Fs:(length(data)*Tb)-1/Fs;
figure;
plot(t_total, bpsk_signal);
title('BPSK Signal');
xlabel('Time (s)');
ylabel('Amplitude');
BPSK Signal
Amplitude
Time (s)
Command Window
>> bpsk

BFSK:



Conclusion: These are essential binary modulation techniques in digital communication, each with unique strengths suited to different applications. BPSK offers high noise resistance and bandwidth efficiency, making it ideal for environments with high noise, like satellite and deep-space communication. BASK is straightforward and bandwidth-efficient, though sensitive to noise, and works well in short-range systems like RFID. BFSK balances simplicity with moderate noise resistance, though it requires more bandwidth, making it suitable for reliable, low-data-rate radio-frequency systems. Selecting the appropriate technique depends on the requirements for noise immunity, bandwidth, and system complexity, with each technique catering to specific communication needs.

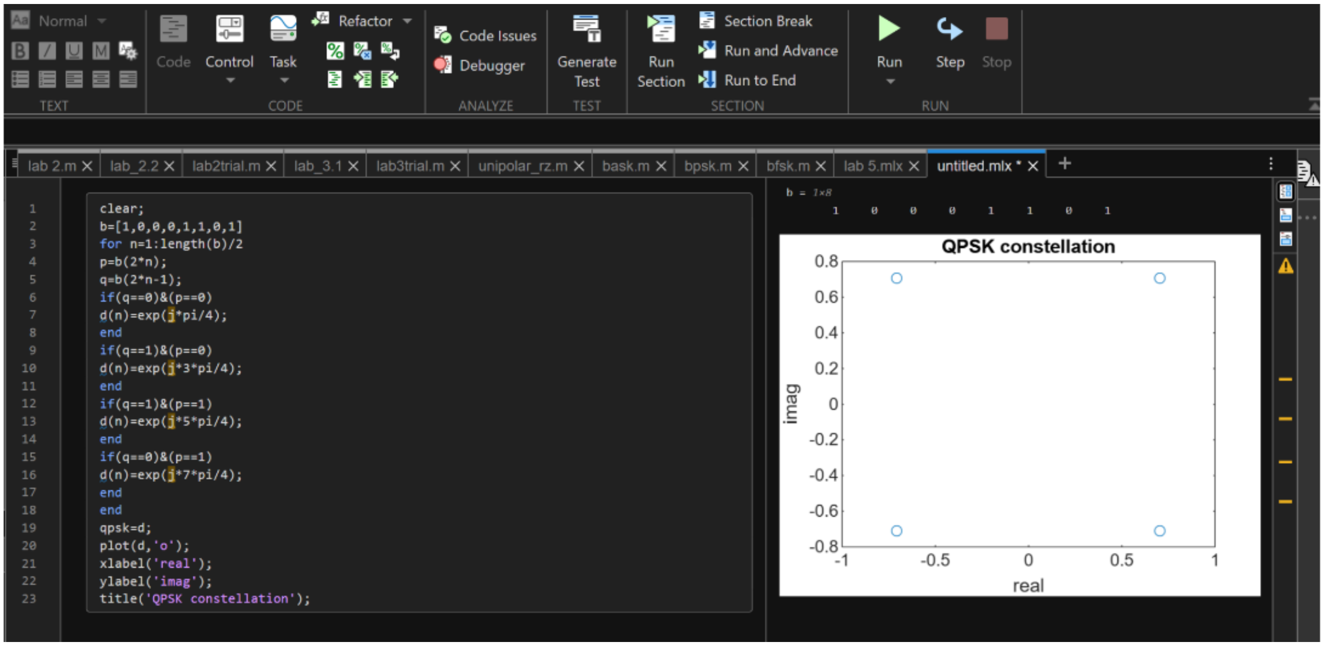
EXP 5: To know the QPSK

Aim: To know the principles of QPSK

Apparatus: Matlab

Theory: Quadrature Phase Shift Keying (QPSK) is a widely-used digital modulation technique that encodes two bits of binary data per symbol, achieving efficient bandwidth usage and improved data rates compared to simpler modulation schemes like BPSK (Binary Phase Shift Keying). QPSK is commonly used in applications like wireless communications, satellite links, and digital TV due to its robust performance in noisy environments.

MATLAB Code:



Conclusion: highly efficient digital modulation technique that enables high data rates by encoding two bits per symbol through four distinct phase shifts. This efficient use of bandwidth and strong resistance to noise make QPSK suitable for a wide range of high-speed communication applications, including wireless networks, satellite communications, and digital broadcasting. While it is more complex than simpler modulation schemes, QPSK's advantages in spectral efficiency and data rate make it a valuable choice for modern, bandwidth-limited digital communication systems.

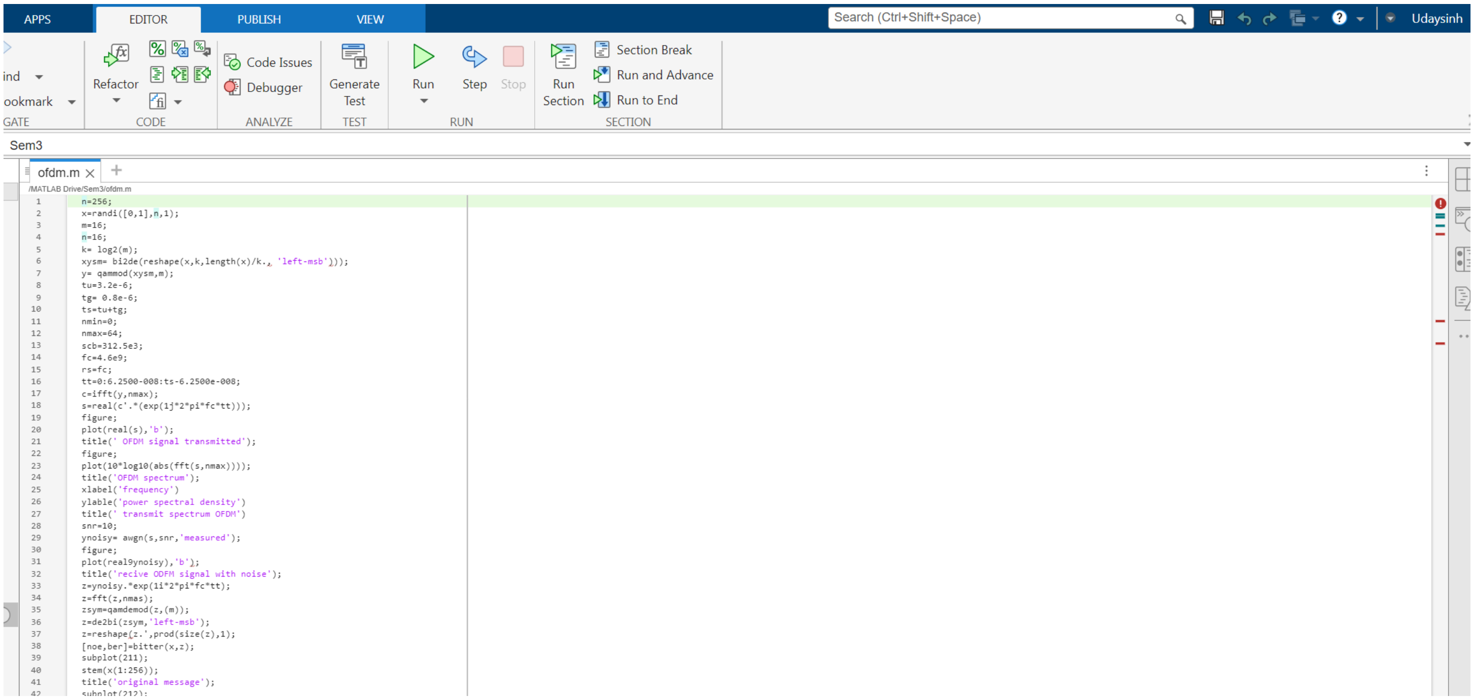
EMP 6: To know the Principles of OFDM

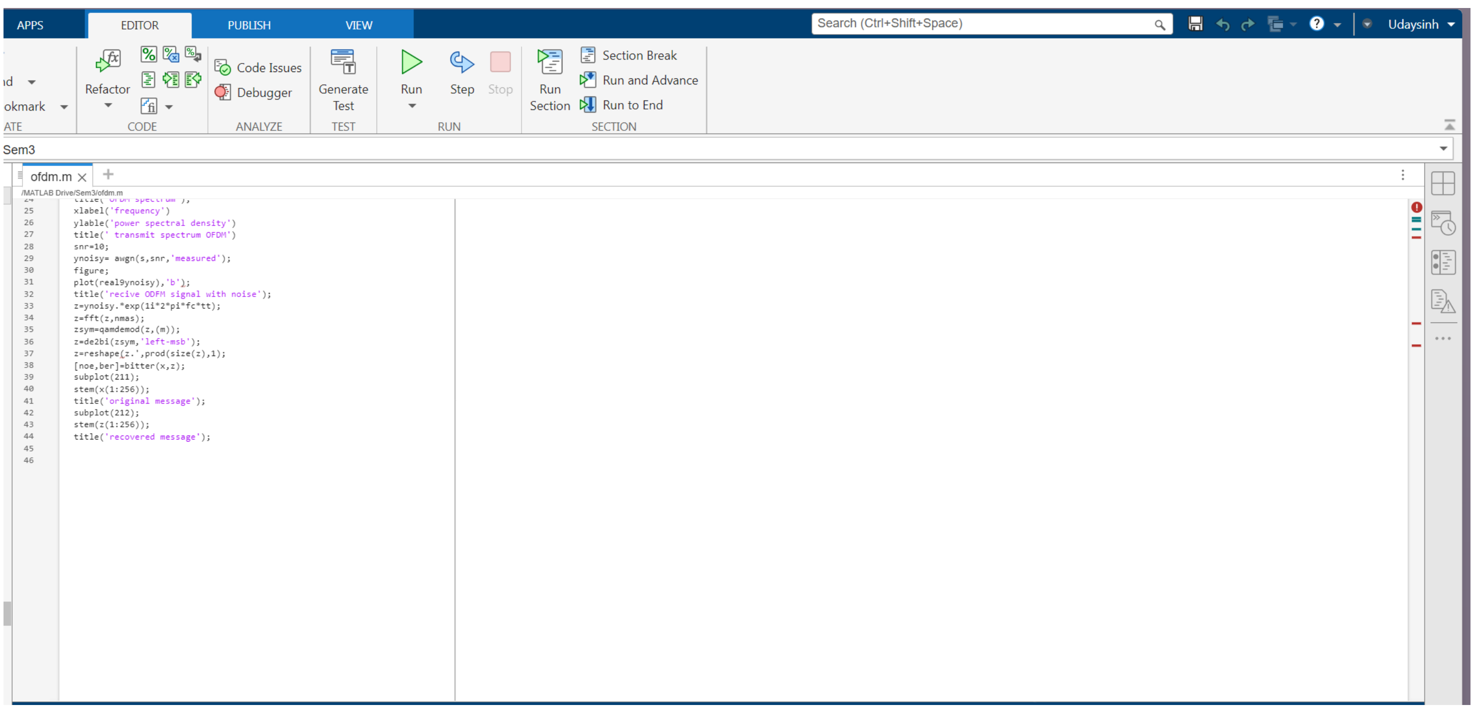
Aim: To know the principles of OFDM

Apparatus: Matlab

Theory: Orthogonal Frequency Division Multiplexing (OFDM) is a highly efficient modulation technique used in modern digital communication systems. It is designed to mitigate the effects of multipath fading, interference, and frequency-selective channels, making it ideal for high-speed wireless communication, such as Wi-Fi, LTE, 5G, digital TV broadcasting, and more.

MATLAB Code:





Conclusion:

Orthogonal Frequency Division Multiplexing (OFDM) is a powerful and widely used digital modulation technique that enables high-speed data transmission in challenging environments, especially where multipath fading and interference are concerns. By

dividing a wideband channel into multiple narrow subcarriers, OFDM ensures efficient bandwidth utilization, high spectral efficiency, and robustness against multipath distortion, which makes it highly suitable for applications such as wireless communications (Wi-Fi, LTE, 5G), digital TV broadcasting, and broadband networking.

EXP 7: To know the Principles of sampling and quantization

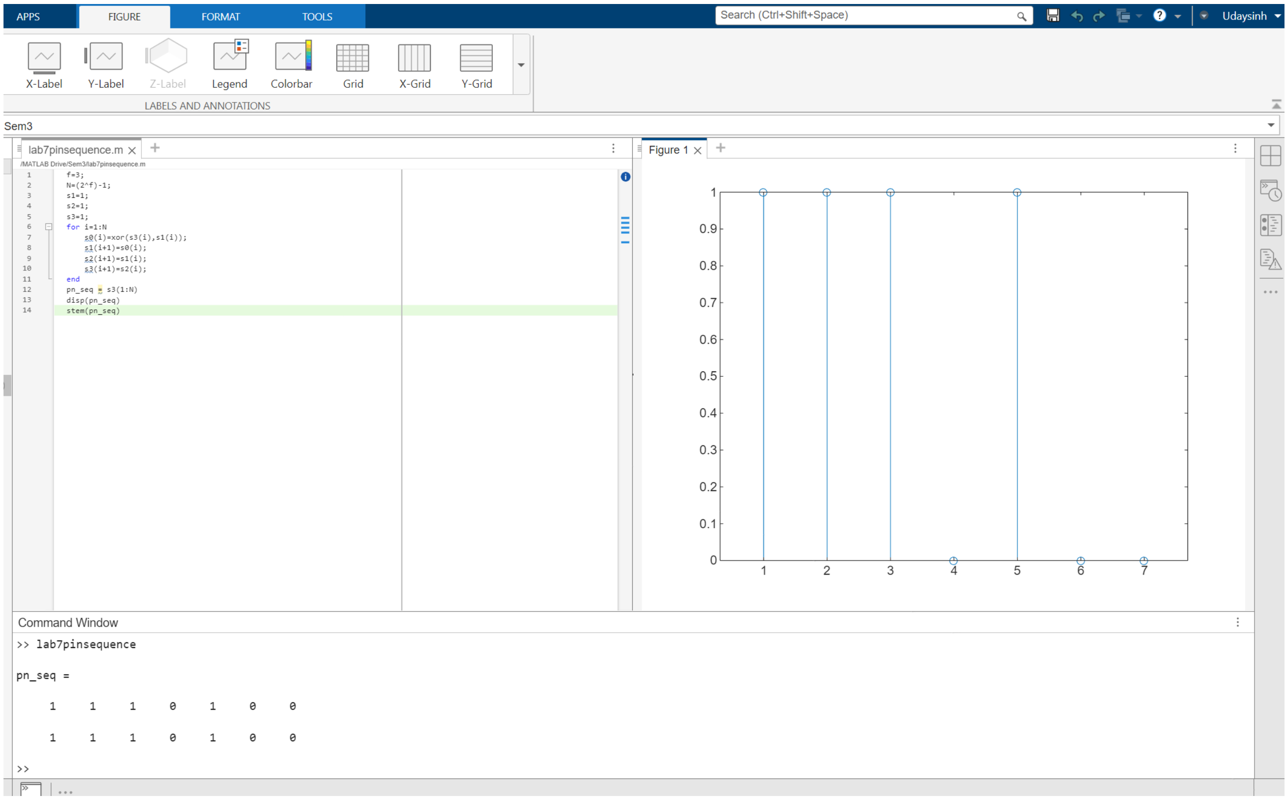
Aim: To know the principles of sampling and quantization

Apparatus: Matlab

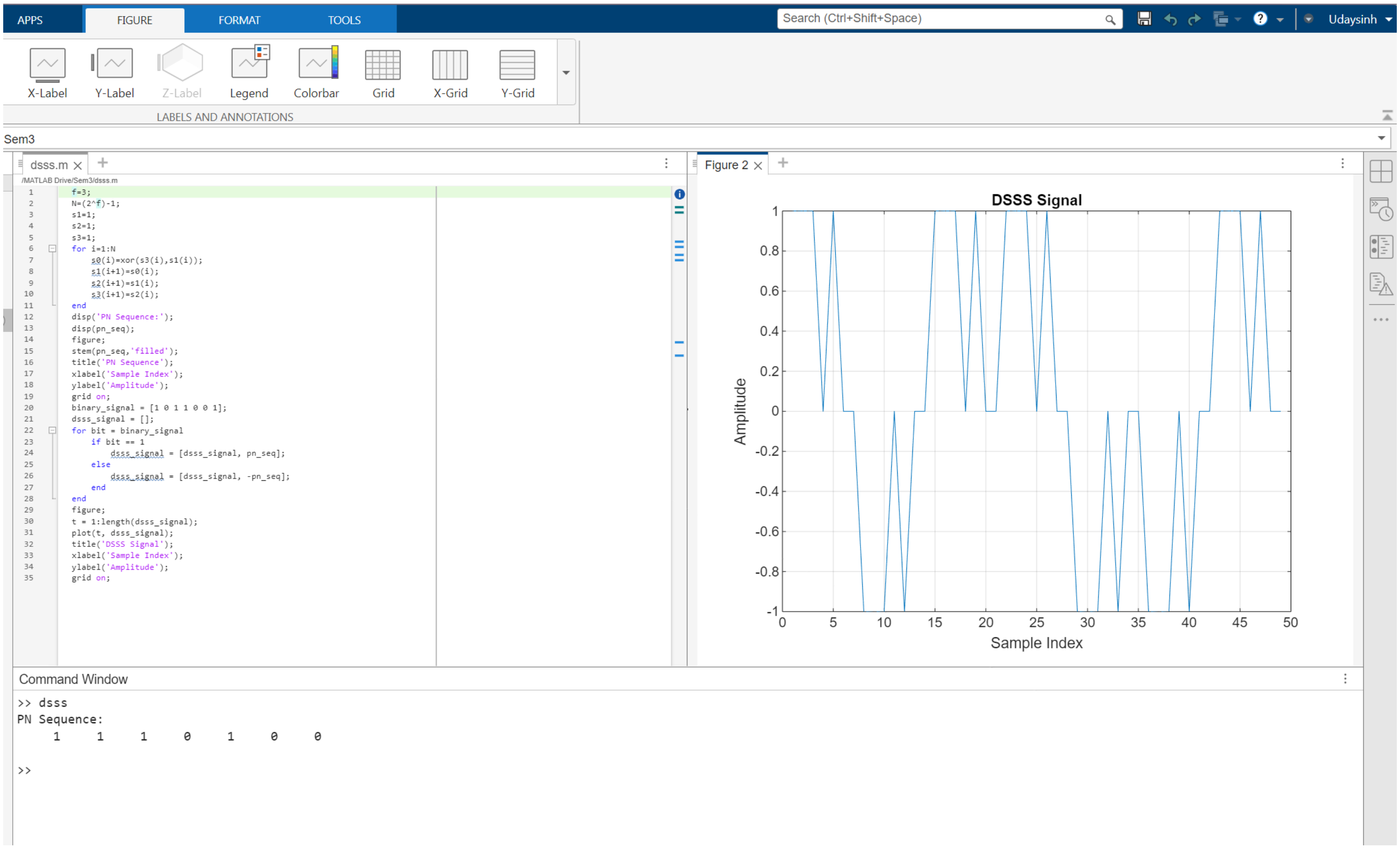
Theory: A Pseudo-Noise (PN) sequence is a sequence of binary digits (0s and 1s) that appears random but is actually deterministic and generated by a specific algorithm or mathematical process. The key feature of a PN sequence is that it has a long period (i.e., it repeats after a large number of bits) and exhibits statistical properties similar to random noise, making it useful for various communication applications, especially in spread spectrum systems.

MATLAB Code:

PN Sequence:



DSSS:



Conclusion: **PN sequences are fundamental to Direct Sequence Spread Spectrum (DSSS) systems, where they play a key role in spreading the signal across a wide frequency range. This spreading provides several benefits, including increased resistance to interference, better security through signal encryption, and improved capacity for multiple users through Code Division Multiple Access (CDMA). DSSS has widespread applications in military, GPS, and wireless communication systems. Despite some drawbacks such as bandwidth consumption and power requirements, DSSS remains a robust and reliable method for communication in noisy and congested environments.**