Marwadi University	**Marwari University** **Faculty of Technology** **Department of Information and Communication Technology**	
Subject: Digital Signal and Image Processing(01CT0513)	**Aim:** Simulate Cross Correlation and Auto correlation on Discrete Time Signals.	
Experiment No: 03	**Date: 02-09-2024**	**Enrollment No: 92200133030**

Aim: Simulate Cross-Correlation and Autocorrelation on Discrete Time Signals.

Theory:-

- Cross-correlation and autocorrelation are mathematical operations used to measure the similarity or correlation between two signals. They are widely used in various applications, such as signal processing, image processing, and pattern recognition.
- Cross-correlation measures the similarity between two signals at different time shifts. It computes the dot product of one signal with a time-shifted version of the other signal. The resulting cross-correlation signal
- indicates the similarity between the two signals at different time lags.
- Autocorrelation, on the other hand, measures the similarity of a signal with a time-shifted version of itself. It computes the cross-correlation of a signal with itself. The autocorrelation signal shows how the signal is correlated with itself at different time Signals.

Programm:-

```
import matplotlib.pyplot as plt
import numpy as np


def cross_correlation(signal1, signal2):
    # Compute the cross-correlation
    cross_corr = np.correlate(signal1, signal2, mode='full')
    return cross_corr


def autocorrelation(signal):
    # Compute the autocorrelation
    auto_corr = np.correlate(signal, signal, mode='full')
    return auto_corr


# Define the discrete-time signals
signal1 = np.array([1, 2, 3, 4, 5])
signal2 = np.array([2, 4, 6, 8, 10])

# Compute the cross-correlation
cross_corr = cross_correlation(signal1, signal2)

# Compute the autocorrelation
auto_corr = autocorrelation(signal1)
```

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```
# Create the time lags for plotting
lags_cross = np.arange(-len(signal1) + 1, len(signal2))
lags_auto = np.arange(-len(signal1) + 1, len(signal1))

# Plot the cross-correlation and autocorrelation signals
plt.figure(figsize=(10, 6))

plt.subplot(2, 1, 1)
plt.stem(lags_cross, cross_corr)
plt.title('Cross-correlation')
plt.xlabel('Time Lag')
plt.ylabel('Magnitude')

plt.subplot(2, 1, 2)
plt.stem(lags_auto, auto_corr)
plt.title('Autocorrelation')
plt.xlabel('Time Lag')
plt.ylabel('Magnitude')

plt.tight_layout()
plt.savefig("./Corelation.png")
plt.show()
```

Output :-