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```
clear;clc;close all
```

Problem 5

```matlab
freq = 1;
t = -1 : 0.001 : 1;
func = sin(2*pi*freq*t);

[aCorr,shift] = autoCorr(func);
[aCorr_norm,shift_norm] = autoCorr(func,"normalized");

figure
subplot(3,1,1)
plot(t,func)
title("1 Hz Sine Wave")
grid on
xlabel("Time (sec)")
xlim([-1 1])
ylabel("Amplitude")
subplot(3,1,2)
plot(shift,aCorr)
title("Autocorrelation of 1 Hz Sine Wave")
grid on
xlabel("Shift")
xlim([shift(1) shift(end)])
ylabel("Correlation")
subplot(3,1,3)
plot(shift,aCorr_norm)
title("Autocorrelation of 1 Hz Sine Wave (Normalized)")
grid on
xlabel("Shift")
xlim([shift(1) shift(end)])
ylabel("Correlation")

function [aCorr,shift] = autoCorr(seq,type)

    if nargin < 2
        type = "";
    end

    n = length(seq);
    m = 2*n-1;
    for i = 1 : n
        aCorr(i) = sum(seq(n-i+1:n) .* seq(1:i));
        aCorr(m+1-i) = aCorr(i); % autocorrelation is symmetric
```
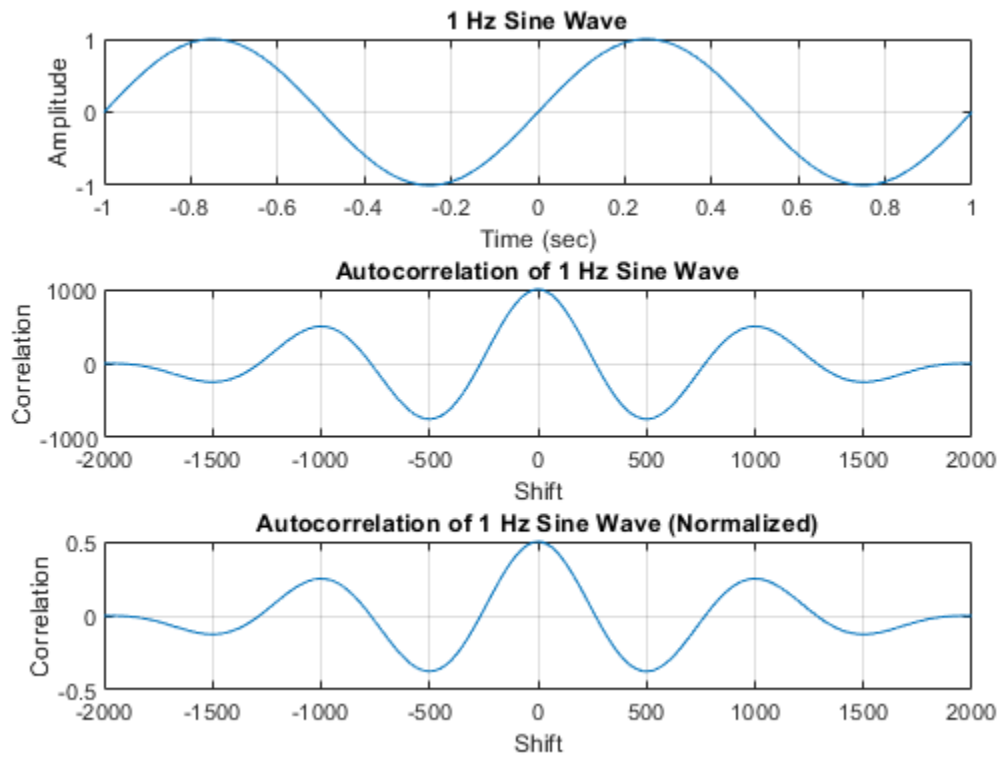
```
    end

    if type == "normalized"
        aCorr = aCorr/n;
    end

    shift = [-n+1:n-1];
end
```

1 Hz Sine Wave

Autocorrelation of 1 Hz Sine Wave

Autocorrelation of 1 Hz Sine Wave (Normalized)

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