Table of Contents

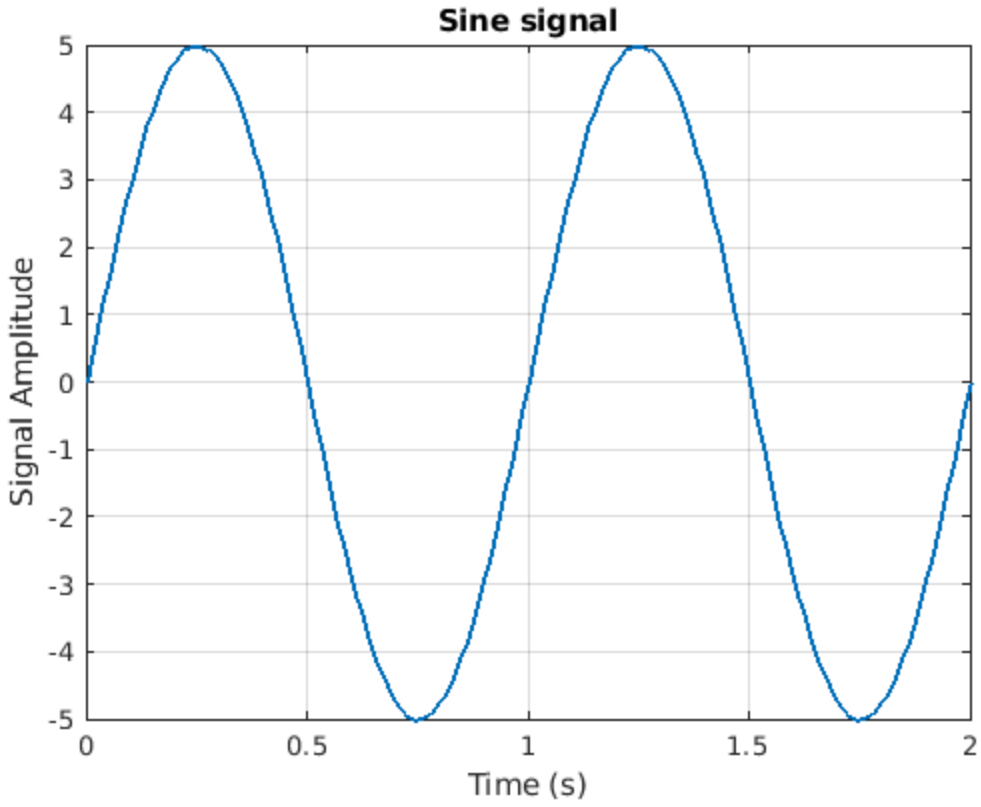
..... 1
part 1 1
part 2 3
part 3 4
part 4 5
part 5 7

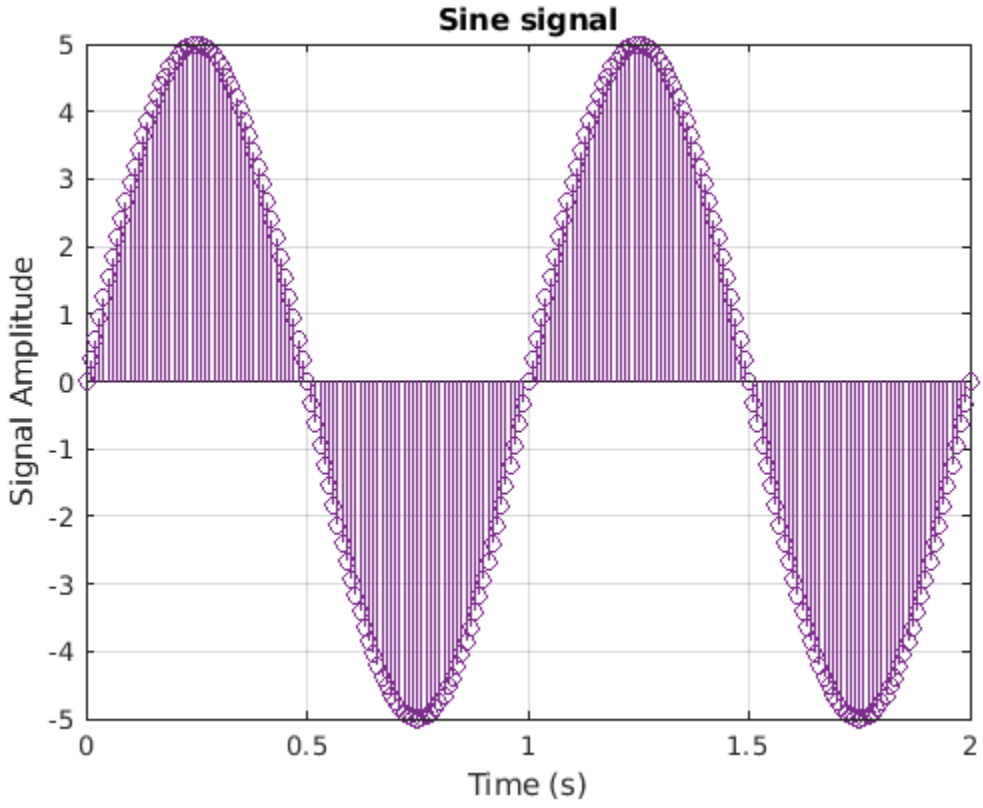

```
close all;
clear;
clc;
```

part 1

part 1.1

```
t = 0:0.01:2;        % Define time axis
A = 5;               % Amplitude
f = 1;               % Frequency
y = A*sin(2*pi*f*t); % Sine function

% Plotting signals
figure('Name', 'Sine signal (Plot)');
plot(t, y, 'LineWidth', 1.5);
xlabel('Time (s)');
ylabel('Signal Amplitude');
title('Sine signal');
grid on;

figure('Name', 'Sine signal (Stem)');
stem(t, y,'color', '#7E2F8E', 'LineWidth', 0.5);
xlabel('Time (s)');
ylabel('Signal Amplitude');
title('Sine signal');
grid on;
```

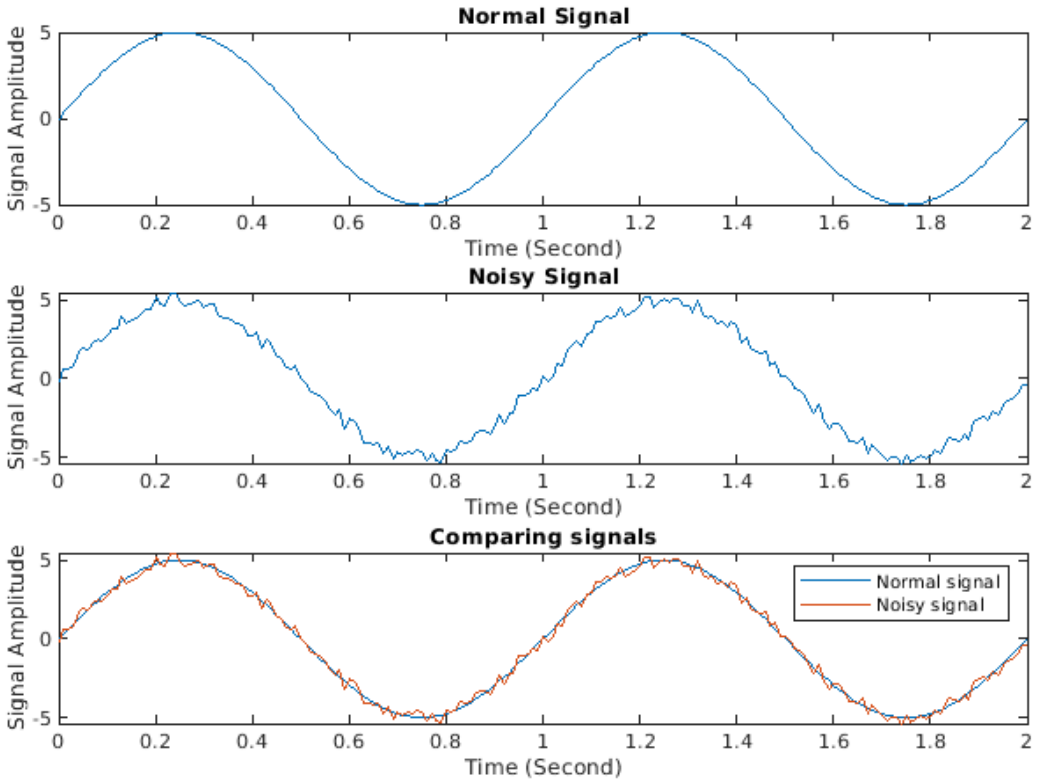

Sine signal
Signal Amplitude
Time (s)
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
0.5
1
1.5
2


Sine signal
Signal Amplitude
Time (s)
5
4
3
2
1
0
-1
-2
-3
-4
-5
0
0.5
1
1.5
2

part 2

part 1.2

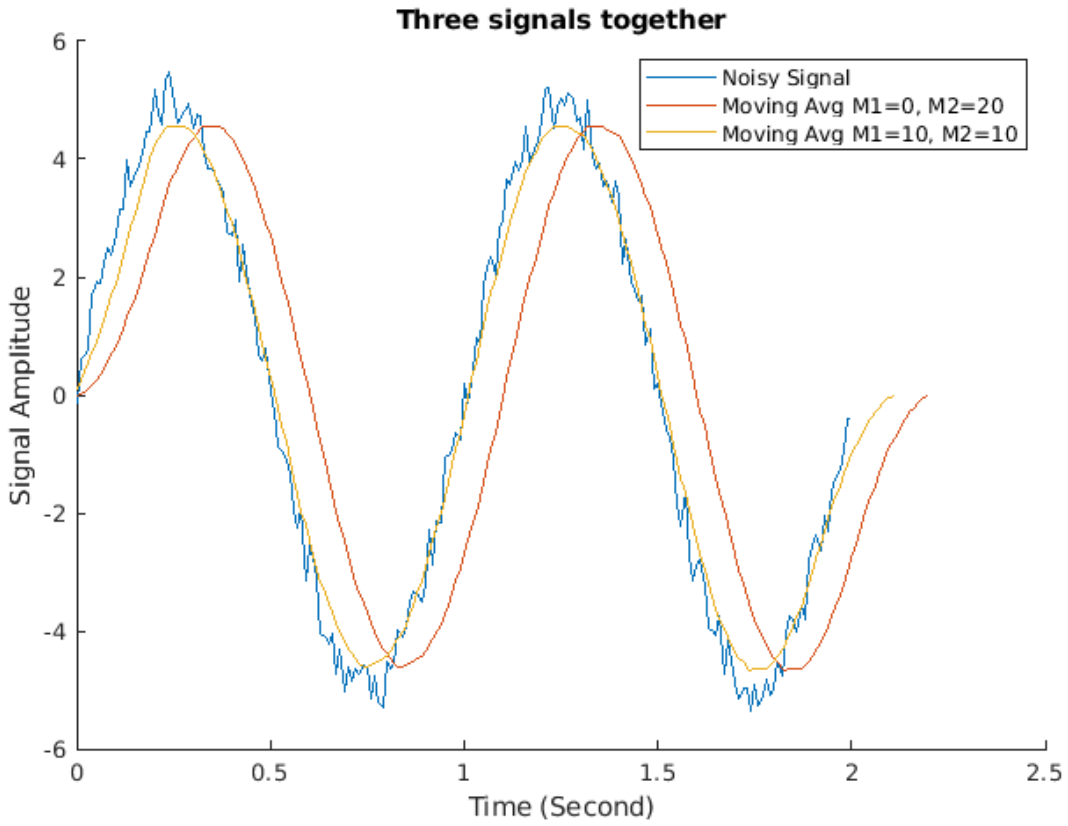
```
r = rand(1, length(y)) - 0.5; % Noise
noised_signal = y + r;        % Add noise to sine, y defined in section 1.1

% Plotting signals
figure('Name', 'Normal Sine signal VS Noisy Sine Signal', 'Position', [300 200
 700 500]);
subplot(3,1,1);               % Plotting normal signal without noise
plot(t,y)
title('Normal Signal');xlabel('Time (Second)');ylabel('Signal Amplitude');
subplot(3,1,2);               % Plotting noisy signal
plot(t,noised_signal)
title('Noisy Signal');xlabel('Time (Second)');ylabel('Signal Amplitude');
%hold on;
subplot(3,1,3);               % Plotting both signal together for comparing
 them
plot(t,y, t, noised_signal)
hold on;
title('Comparing signals');xlabel('Time (Second)');ylabel('Signal Amplitude');
legend('Normal signal', 'Noisy signal');
hold off;
```



part 3

part 1.3: A moving average filter introduces a delay because it computes the average of past data points, which inherently involves looking back in time, causing the output to lag behind the input signal.

```
M1 = 0;
M2 = 20;
len = M2 + M1 + 1; % Window length

window = ones(1, len) / len; % Moving average window

y2 = conv(noised_signal, window);   % Noised signal defined in section 1.2,
 Line 30
t2 = 0:0.01:(0.01 * (length(y2) - 1));

% Plotting section 1.3.1
figure('Name', 'Moving Avg signals', 'Position', [300 200 700 500]);
hold on;
plot(t,noised_signal);              % Noise signal
plot(t2, y2);                       % Moving Avg M1=0, M2=20

% part 1.3.2:
M1 = 10;
M2 = 10;
len = M2 + M1 + 1; % Window length

window = ones(1, len) / len; % Moving average window

y3 = conv(noised_signal(M1:end), window);
t3 = 0:0.01:(0.01 * (length(y3) - 1));

plot(t3, y3);                       % Moving Avg M1=0, M2=20
hold off;
title('Three signals together'); xlabel('Time (Second)'); ylabel('Signal
 Amplitude');
legend("Noisy Signal", "Moving Avg M1=0, M2=20", "Moving Avg M1=10, M2=10");
```

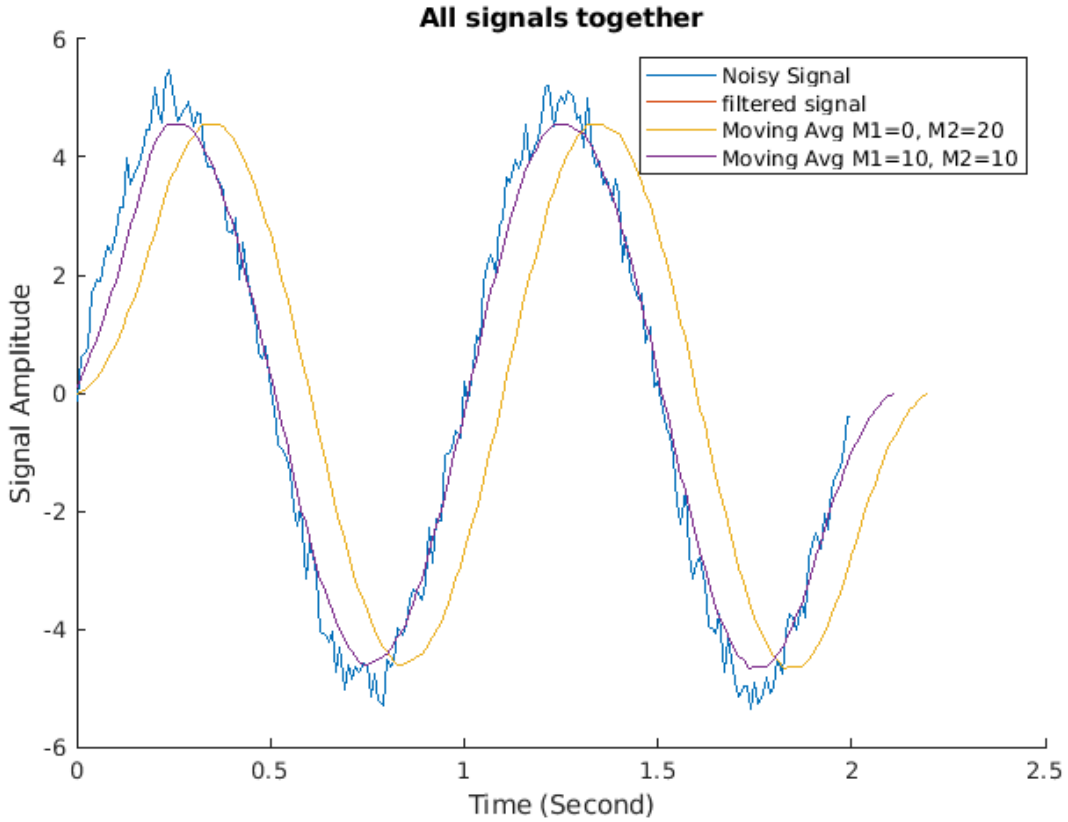


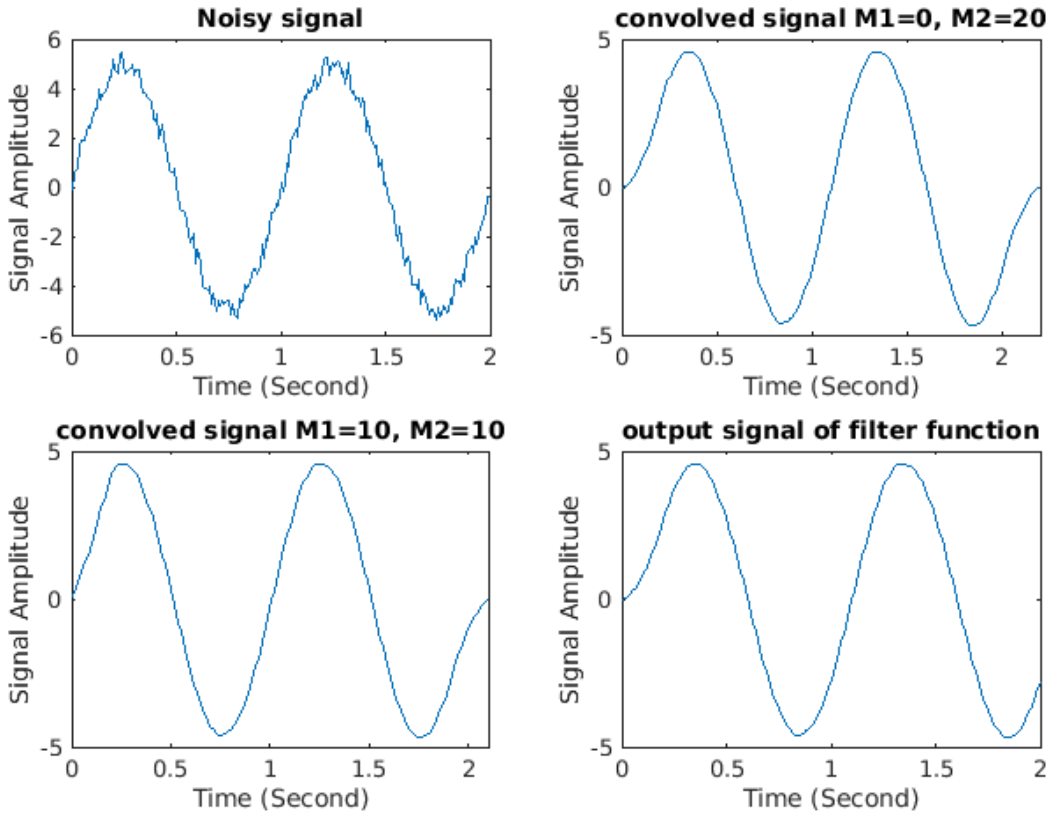
part 4

part 1.4.1

```
M1 = 0;
M2 = 20;
len = M2 + M1 + 1; % Window length

b = ones(1,len)/len;
a = 1;
y4_1 = filter(b, a, noised_signal);
t4_1 = 0:0.01:(0.01 * (length(y4_1) - 1));

% Plotting section 1.4
figure('Name', 'Moving Avg signals by using filter function', 'Position', [300
 200 700 500]);
hold on;
plot(t,noised_signal);              % Noise signal
plot(t4_1, y4_1);                   % filtered signal
plot(t2,y2);                        % Plotting convolved signal M1=0, M2=20
plot(t3,y3);                        % Plotting convolved signal M1=10, M2=10
title('All signals together'); xlabel('Time (Second)'); ylabel('Signal
 Amplitude');
legend("Noisy Signal", "filtered signal", "Moving Avg M1=0, M2=20", "Moving
 Avg M1=10, M2=10");
```

```
hold off;

% Plotting section 1.3
figure('Name', 'plotting in seperated subplots', 'Position', [300 200 700
 500]);
subplot(2,2,1);               % Plotting noisy signal
plot(t,noised_signal)
title('Noisy signal');xlabel('Time (Second)');ylabel('Signal Amplitude');
subplot(2,2,2);               % Plotting convolved signal M1=0, M2=20
plot(t2,y2)
title('convolved signal M1=0, M2=20');xlabel('Time (Second)');ylabel('Signal
 Amplitude');
subplot(2,2,3);               % Plotting convolved signal M1=10, M2=10
plot(t3,y3)
title('convolved signal M1=10, M2=10');xlabel('Time (Second)');ylabel('Signal
 Amplitude');
subplot(2,2,4);               % filtered signal
plot(t4_1,y4_1)
title('output signal of filter function');xlabel('Time
 (Second)');ylabel('Signal Amplitude');
```

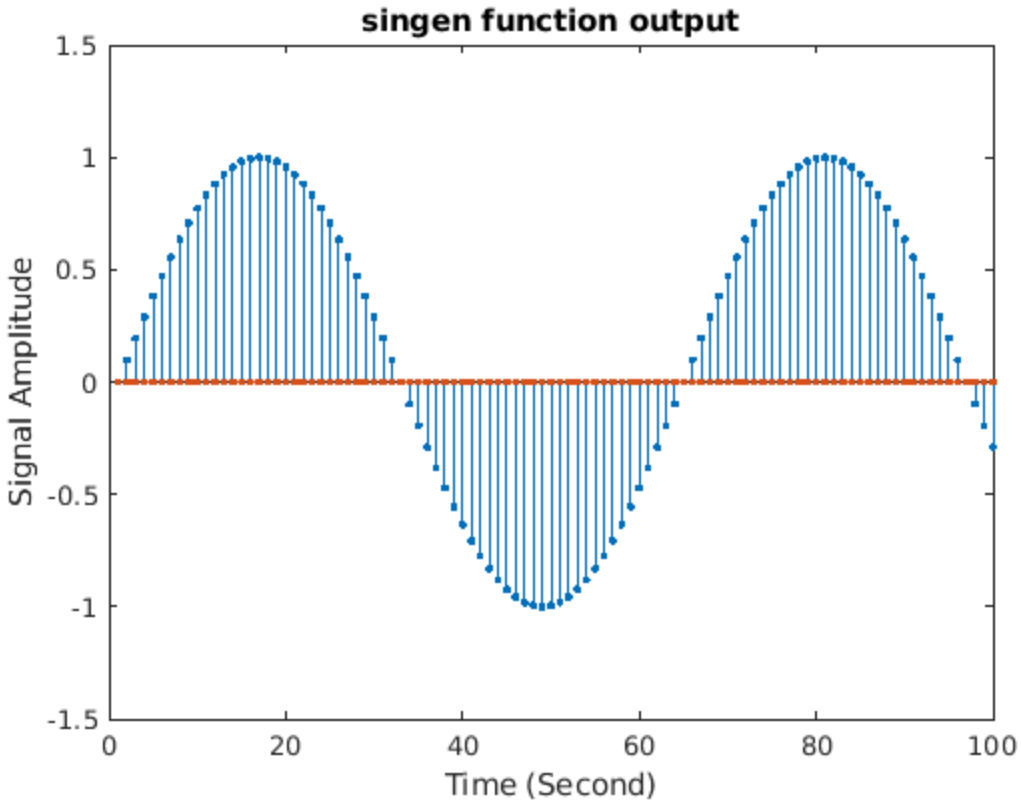




part 5

part 1.5

```
w0 = pi/32; n = 100;
[y5,t5] = singen(w0,n);     %singen function is defined in singen.m
figure('Name', 'singen');
stem(t5,y5, '.')
title('singen function output');xlabel('Time (Second)');ylabel('Signal
 Amplitude');
```



Published with MATLAB® R2023a