Digital Signal Processing
Report 2 MATLAB

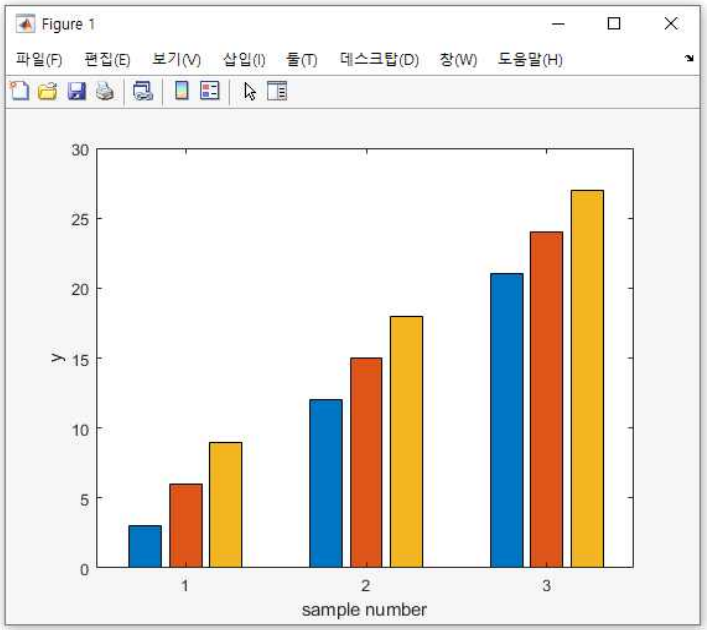
단국대학교
Dankook University

학번 : 32151648
소속 : 소프트웨어학과
이름 : 박동학

1. 행렬을 선언, 연산 후 plot()

명령 창

```
>> a = [ 1 2 3
4 5 6
7 8 9 ]

a =

     1     2     3
     4     5     6
     7     8     9

>> b = a*2

b =

     2     4     6
     8    10    12
    14    16    18

>> c = a+b

c =

     3     6     9
    12    15    18
    21    24    27

>> plot(c)
>> grid on
>> bar(c)
>> xlabel("sample number")
>> ylabel("y")
>>
```

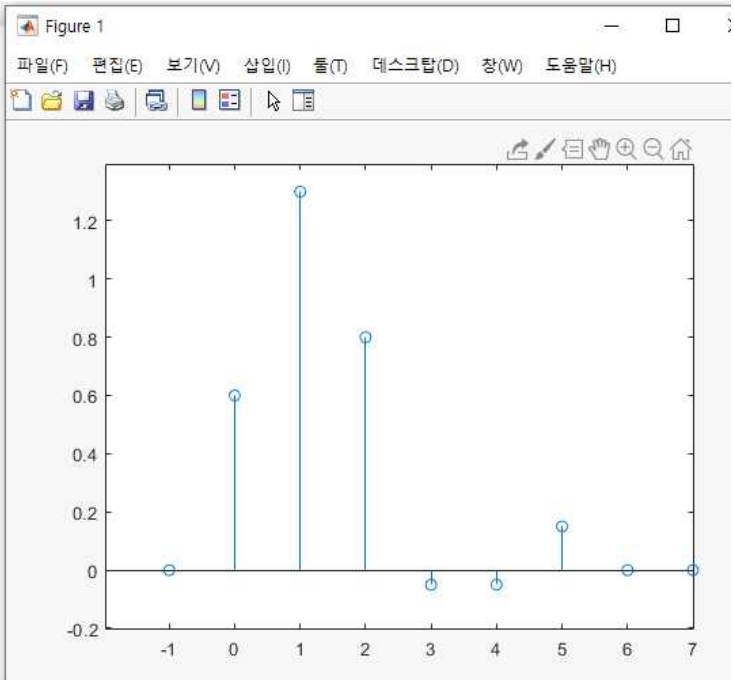



```
>> A = [ 1 2 0; 2 5 -1; 4 10 -1]

A =

     1     2     0
     2     5    -1
     4    10    -1

>> B = A'

B =

     1     2     4
     2     5    10
     0    -1    -1

>> C = A*B

C =

     5    12    24
    12    30    59
    24    59   117

>> D = A.*B

D =

     1     4     0
     4    25   -10
     0   -10     1
```

```
>> x = inv(D)

x =

    0.8242    0.0440    0.4396
    0.0440   -0.0110   -0.1099
    0.4396   -0.1099   -0.0989

>> i = inv(A)*B.*C

i =

          45         264        1008
         -48        -300       -1121
         -96        -649       -2457
```

2. Convolution 연산 후 stem()

```
명령 창
>> x = [2 1 -1 0.5];
>> h = [1 0.7 0.3];
>> y =  conv(h,x);
>> z = [zeros(1,2), y, zeros(1,2)];
>> n = -2:1:7;
>> stem(n,z);
>> title("convolution output");
>>  h = [0.3 0.5 0.3]

h =

    0.3000    0.5000    0.3000

>> y = conv(h,x);
>> z = [zeros(1,2), y, zeros(1,2)];
>> n = -2:1:7;
>> stem(n,z);
fx >>
```



3. 프로그램을 .m 파일로 저장하고 이를 실행

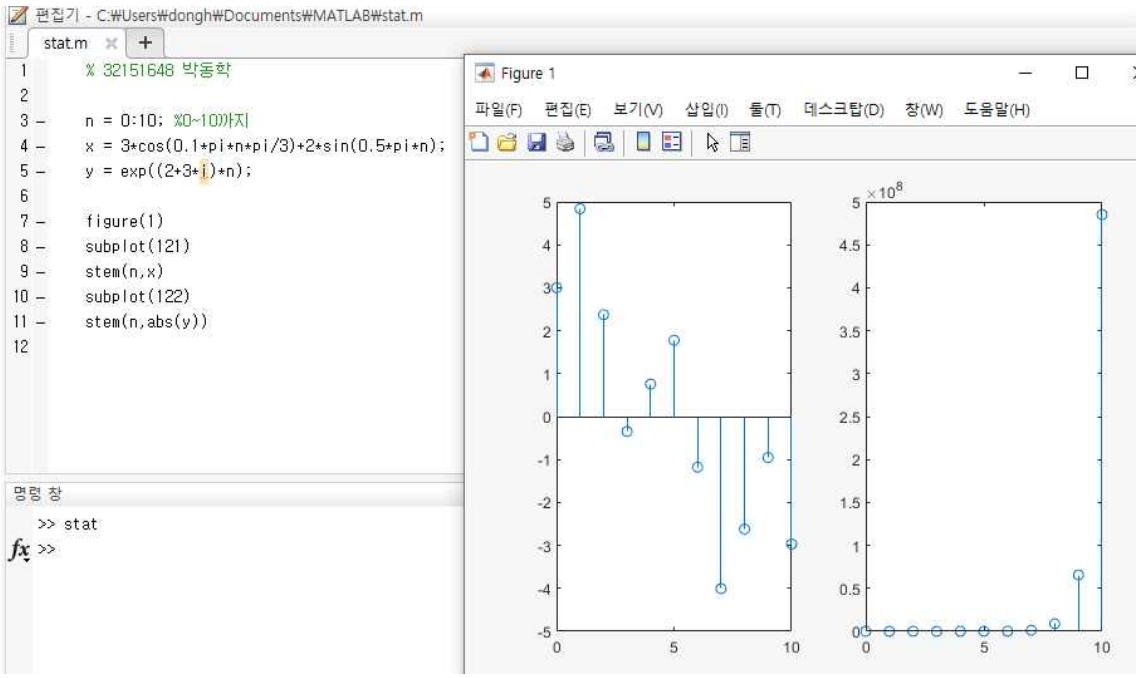
편집기 - C:₩Users₩donghw₩Documents₩MATLAB₩stat.m

stat.m

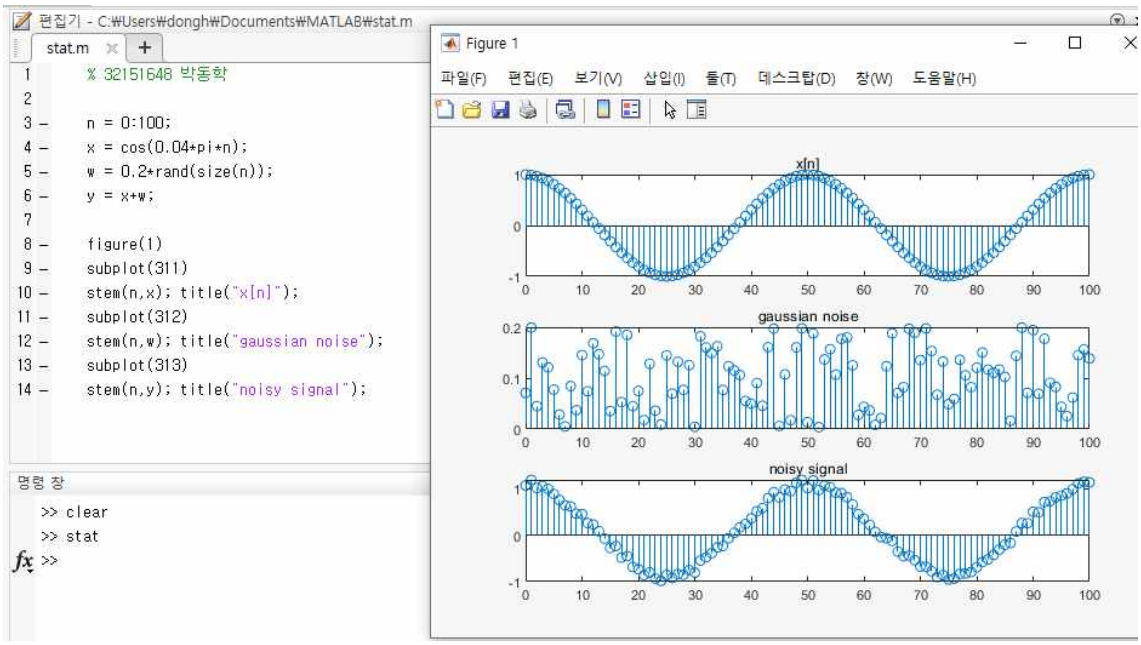
```
1    function [mean, stdev] = stat(x)
2
3 -    [m n] = size(x);
4 -    mean = sum(x)/n;
5 -    stdev = sqrt(sum(x.^2)/m - mean.^2);
6
```

```
명령 창
>> a = [ 1 2 3 4 5 6 7 8 9 10 9 8 7 6 5 4 3 2 1]

a =

     1     2     3     4     5     6     7     8     9    10     9     8     7     6     5     4     3     2     1

>> [zm, zstd] = stat(a)

zm =

    5.2632


zstd =

   25.3436

fx >>
```

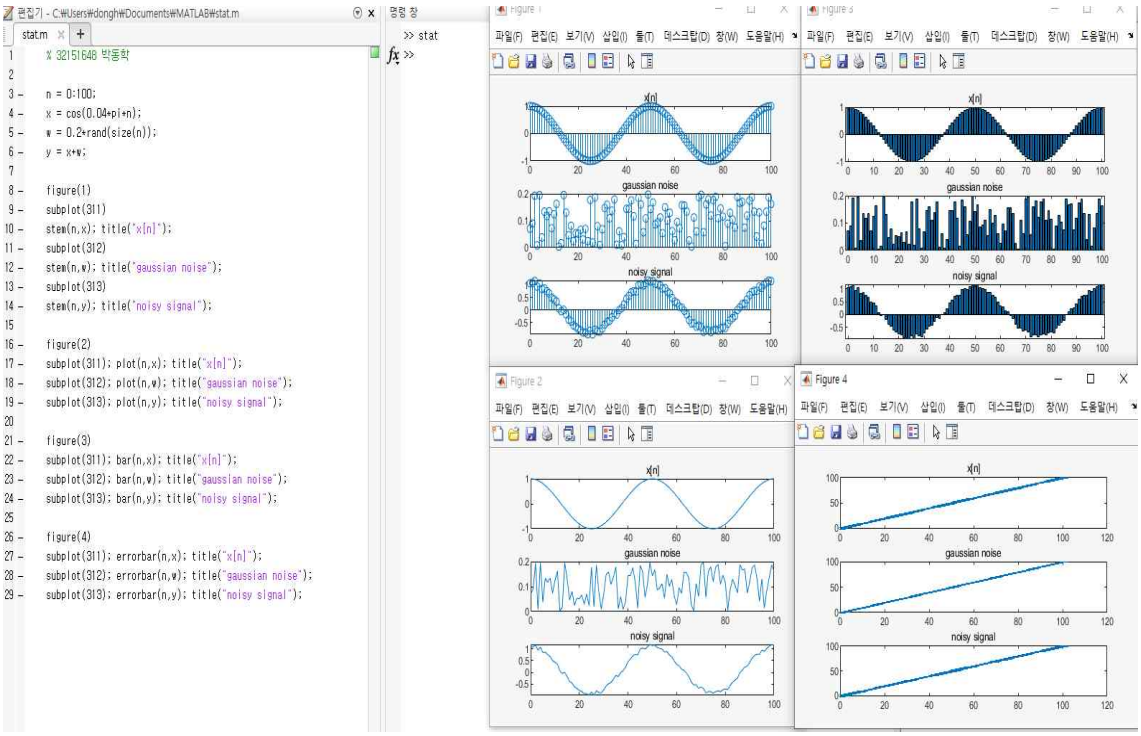
4. 삼각 함수, subplot



5. Gaussian Noise, subplot



5. Gaussian Noise (다양한 형대로 그려보기)



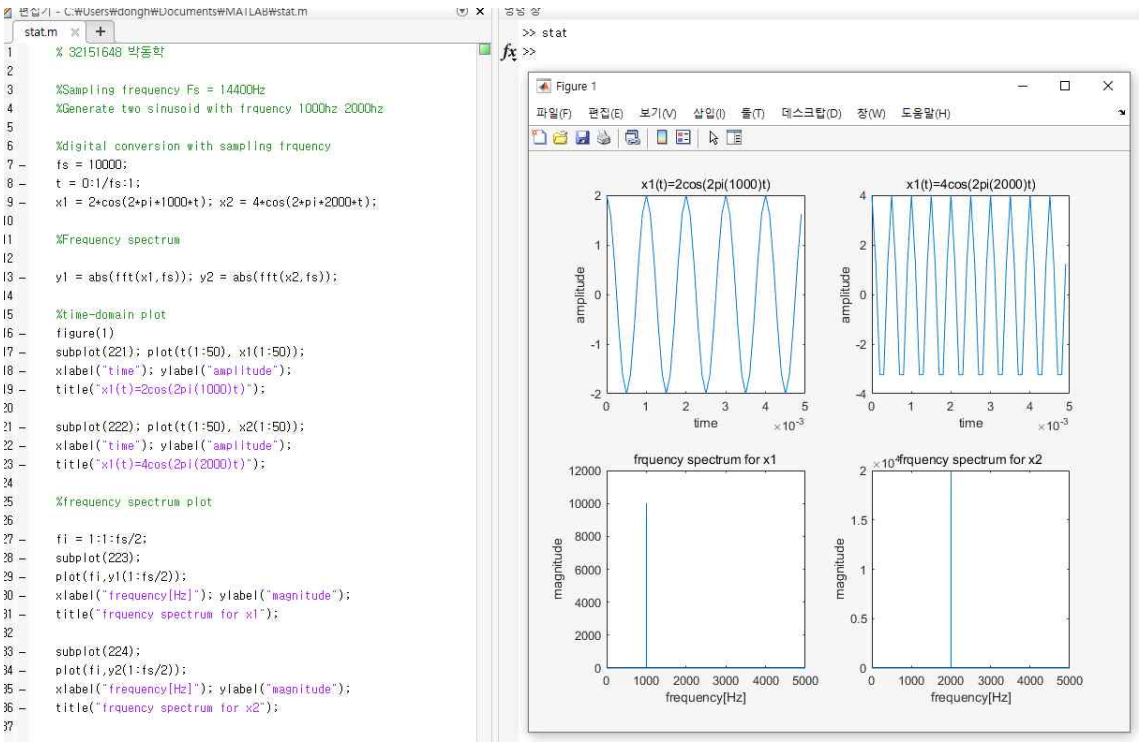
```
% 32151648 박동학

n = 0:100;
x = cos(0.04*pi*n);
w = 0.2*rand(size(n));
y = x+w;

figure(1)
subplot(311)
stem(n,x); title('x[n]');
subplot(312)
stem(n,w); title('gaussian noise');
subplot(313)
stem(n,y); title('noisy signal');

figure(2)
subplot(311); plot(n,x); title('x[n]');
subplot(312); plot(n,w); title('gaussian noise');
subplot(313); plot(n,y); title('noisy signal');

figure(3)
subplot(311); bar(n,x); title('x[n]');
subplot(312); bar(n,w); title('gaussian noise');
subplot(313); bar(n,y); title('noisy signal');

figure(4)
subplot(311); errorbar(n,x); title('x[n]');
subplot(312); errorbar(n,w); title('gaussian noise');
subplot(313); errorbar(n,y); title('noisy signal');
```

6. 시간 측정

```
% 32151648 박동학

x = [2 1 -1 0.5 1 2 4 5];
h = [1 0.7 0.3];

tic
y = conv(h,x);
toc

t = cputime

z = conv(h,x);

cputime-t
```

```
경과 시간은 0.000187초입니다.

t =

   151.7188


ans =

     0

fx >>
```

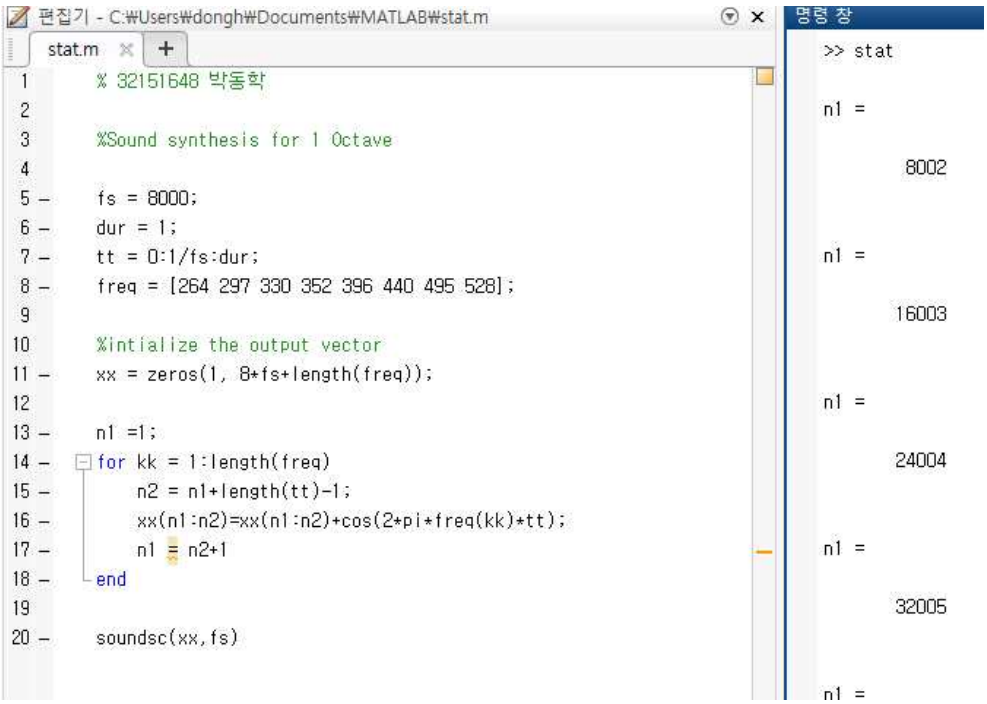
7. fs가 10000인 함수를 그려보고 time-domain / frquency-spectrum보기



```
% 32151648 박동학

%Sampling frequency Fs = 14400Hz
%Generate two sinusoid with frquency 1000hz 2000hz

%digital conversion with sampling frquency
fs = 10000;
t = 0:1/fs:1;
x1 = 2*cos(2*pi*1000*t); x2 = 4*cos(2*pi*2000*t);

%Frequency spectrum

y1 = abs(fft(x1,fs)); y2 = abs(fft(x2,fs));

%time-domain plot
figure(1)
subplot(221); plot(t(1:50), x1(1:50));
xlabel("time"); ylabel("amplitude");
title("x1(t)=2cos(2pi(1000)t)");

subplot(222); plot(t(1:50), x2(1:50));
xlabel("time"); ylabel("amplitude");
title("x1(t)=4cos(2pi(2000)t)");

%frequency spectrum plot

fi = 1:1:fs/2;
subplot(223);
plot(fi,y1(1:fs/2));
xlabel("frequency[Hz]"); ylabel("magnitude");
title("frquency spectrum for x1");

subplot(224);
plot(fi,y2(1:fs/2));
xlabel("frequency[Hz]"); ylabel("magnitude");
title("frquency spectrum for x2");
```

```
>> stat
fx >>
```


8. 사운드



```
% 32151648 박동학

%Sound synthesis for 1 Octave

fs = 8000;
dur = 1;
tt = 0:1/fs:dur;
freq = [264 297 330 352 396 440 495 528];

%intialize the output vector
xx = zeros(1, 8*fs+length(freq));

n1 =1;
for kk = 1:length(freq)
    n2 = n1+length(tt)-1;
    xx(n1:n2)=xx(n1:n2)+cos(2*pi*freq(kk)*tt);
    n1 = n2+1
end

soundsc(xx,fs)
```

```
>> stat

n1 =

        8002

n1 =

       16003

n1 =

       24004

n1 =

       32005

n1 =
```

9. 이미지 색상 다루기

```
stat.m
1   % 32151648 박동학
2
3   %R,G,B separation
4 - myimage = imread('image_2.jpg');
5
6   %read each R,G,B as an array
7 - red = myimage(:,:,1);
8 - blue = myimage(:,:,2);
9 - green = myimage(:,:,3);
10
11  %Display
12 - figure(1)
13 - subplot(221); imshow(myimage); title("Original Image"
14 - subplot(222); imshow(red); title("red component");
15 - subplot(223); imshow(blue); title("blue conponent");
16 - subplot(224); imshow(green); title("green component")
17
```