1.2.1

```
clear

% help plot
% lookfor plot
% doc
```

1.2.2

```
clear

a = [1 2 3];
b = a.';
c = a * b;
c
```

```
c = 14
```

```
c = a.* a;
c
```

```
c = 1×3
     1     4     9
```

With ";", the output will not be shown on the right side.

1.2.3

```
clear

x = rand(10,1);
[mean,stdev] = stat(x)
```

```
mean = 0.6075
stdev = 0.3262
```

1.3

1.3.1

$$\int_0^{2\pi} (\sin 5t)^2 \mathrm{dt} = \frac{1}{2}\int_0^{2\pi} (\sin 5t)^2 + (\cos 5t)^2 \mathrm{dt} = \pi$$

```
clear

num = 1000
```

```
num = 1000
```

```
x = linspace(0, 2*pi, num);
```

```
y = (sin(5*x)).^2;

dx = x(2) - x(1);
integral_1 = sum(y) * dx
```

```
integral_1 = 3.1416
```

$$\int_0^1 e^t \mathrm{dt} = e - 1$$

```
clear

num = 1000
```

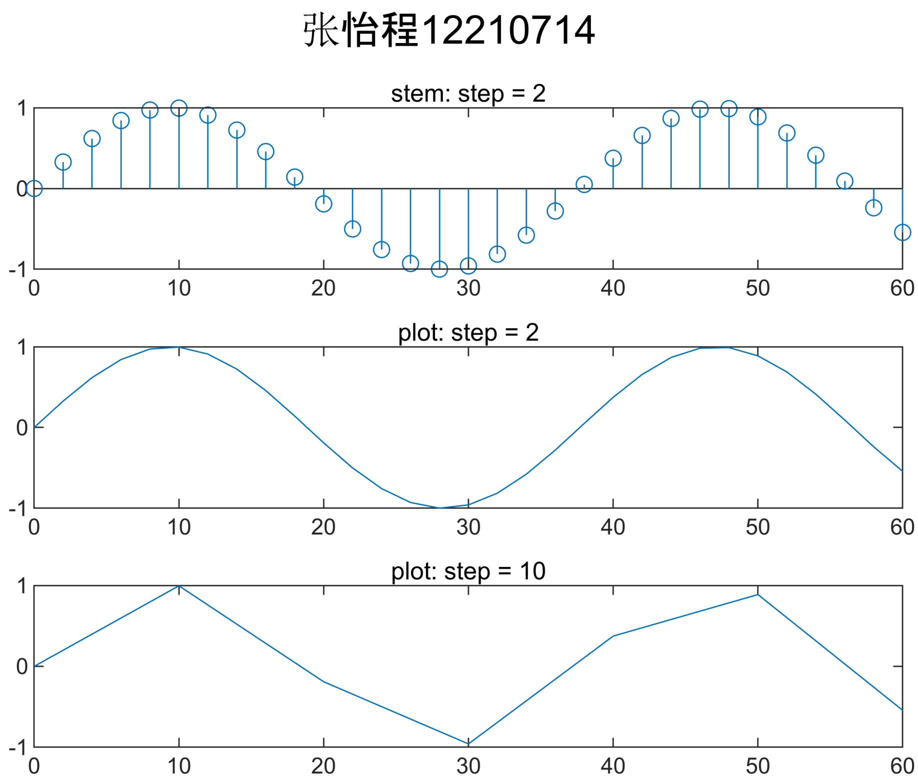
```
num = 1000
```

```
x = linspace(0,1,num);
y = exp(x);
dx = x(2)-x(1);
integral_2 = sum(y)*dx
```

```
integral_2 = 1.7201
```

1.3.2

```
clear

n=0:2:60;
y=sin(n/6);
subplot(311);
sgtitle('张怡程 12210714')
stem(n,y);
title('stem: step = 2')

n1=0:2:60;
z=sin(n1/6);
subplot(312)
plot(n1,z);
title('plot: step = 2')
n2=0:10:60;
w=sin(n2/6);
subplot(313)
plot(n2,w)
title('plot: step = 10')
```



The first plot is a nice reconstruction of the original function, while the second one failed to do it because the samples are too few.

1.3.3

$$\int_0^{2\pi} (\sin 5t)^2 \mathrm{dt}$$

```
clear

I_100 = integ1(100)
```

```
I_100 = 3.1416
```

```
I_50 = integ1(50)
```

```
I_50 = 3.1416
```

```
I_10 = integ1(10)
```

```
I_10 = 2.6856e-30
```

```
I_5 = integ1(5)
```

```
I_5 = 2.2616e-30
```

$$\int_0^1 e^t \mathrm{dt}$$

```
clear

J_100 = integ2(100)
```

```
J_100 = 1.7097
```

```
J_50 = integ2(50)
```

```
J_50 = 1.7012
```

```
J_10 = integ2(10)
```

```
J_10 = 1.6338
```

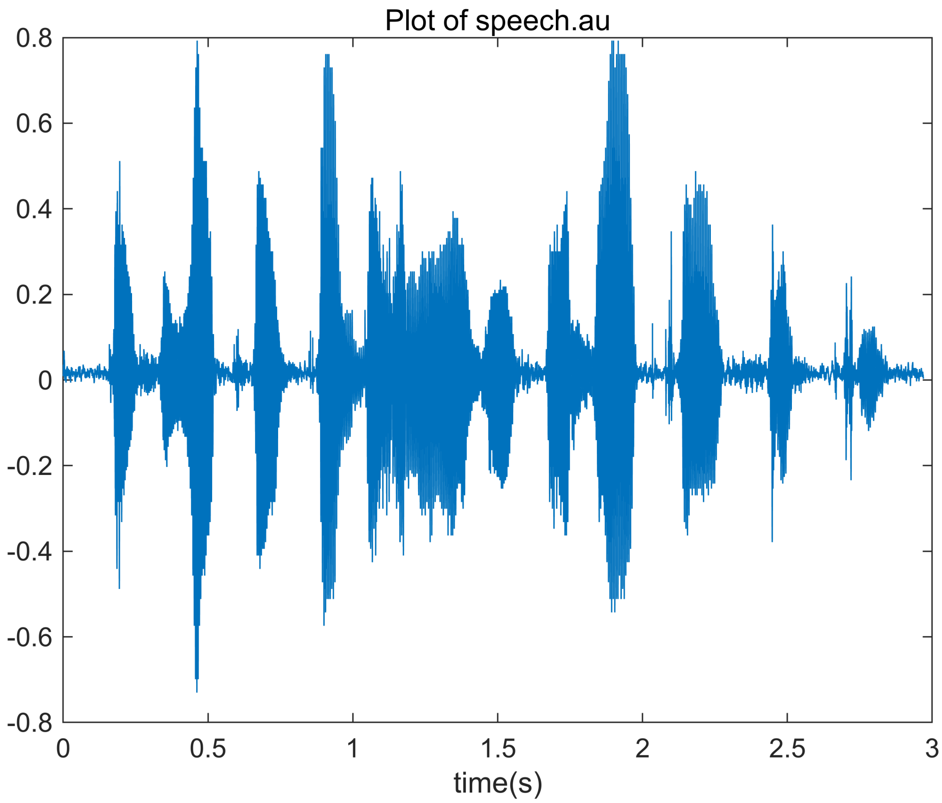
```
J_5 = integ2(5)
```

```
J_5 = 1.5522
```

```
% TODO:fix this
```

1.4

```
clear
figure

[y,fs]=audioread('data/speech.au');
t = (1:length(y))./fs;
plot(t,y)
title('Plot of speech.au')
xlabel('time(s)')
```

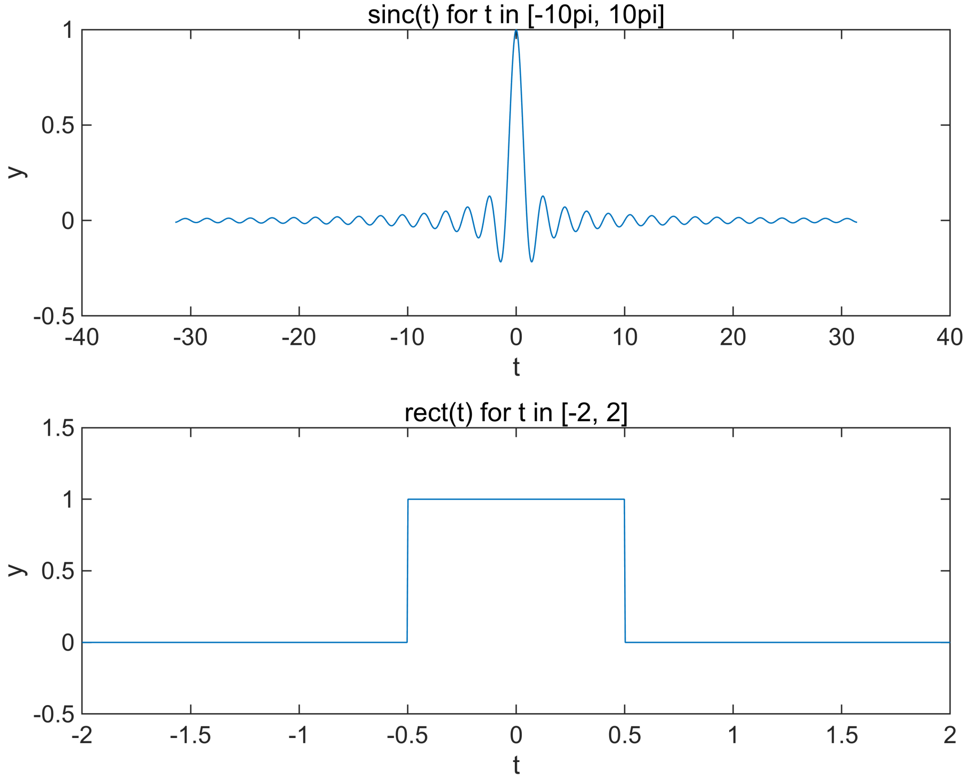



```
% sound(y,fs)
```

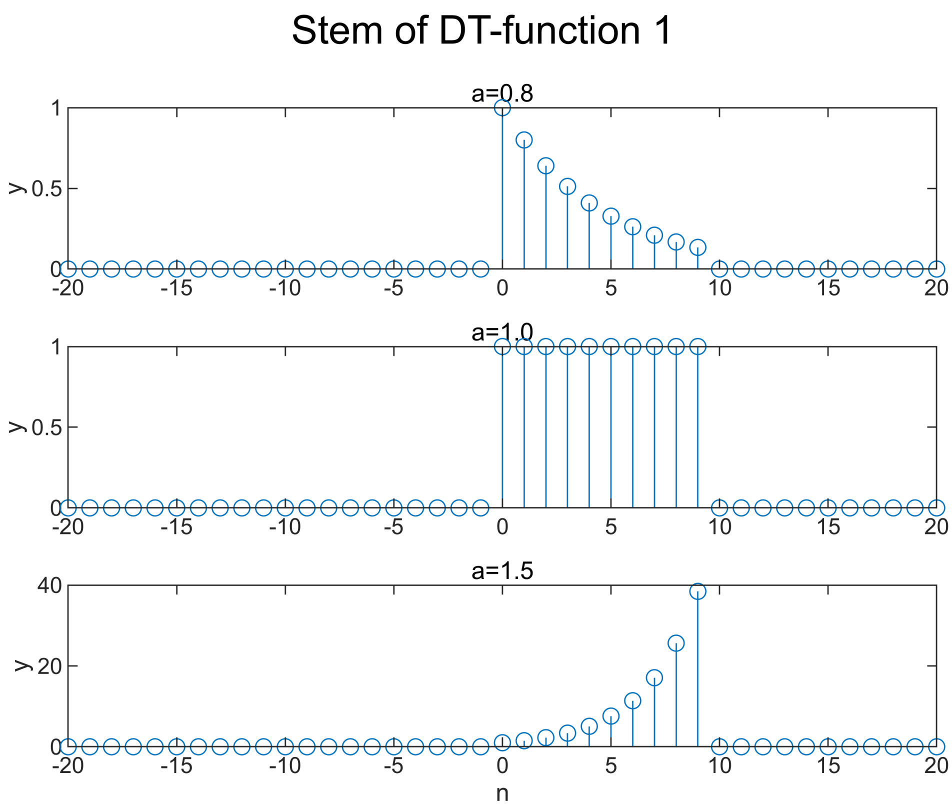
1.5

$$\mathrm{sinc}(x) = \frac{\sin(\pi x)}{\pi x}$$

```
clear
figure

N = 1000;
[t,y] = sinc(N);
subplot(211)
% orient('tall')
plot(t,y)
xlabel('t');ylabel('y')
title('sinc(t) for t in [-10pi, 10pi]')

[t,y]=rect(N);
subplot(212)

plot(t,y)
xlabel('t');ylabel('y')
ylim([-0.5,1.5])
title('rect(t) for t in [-2, 2]')
```

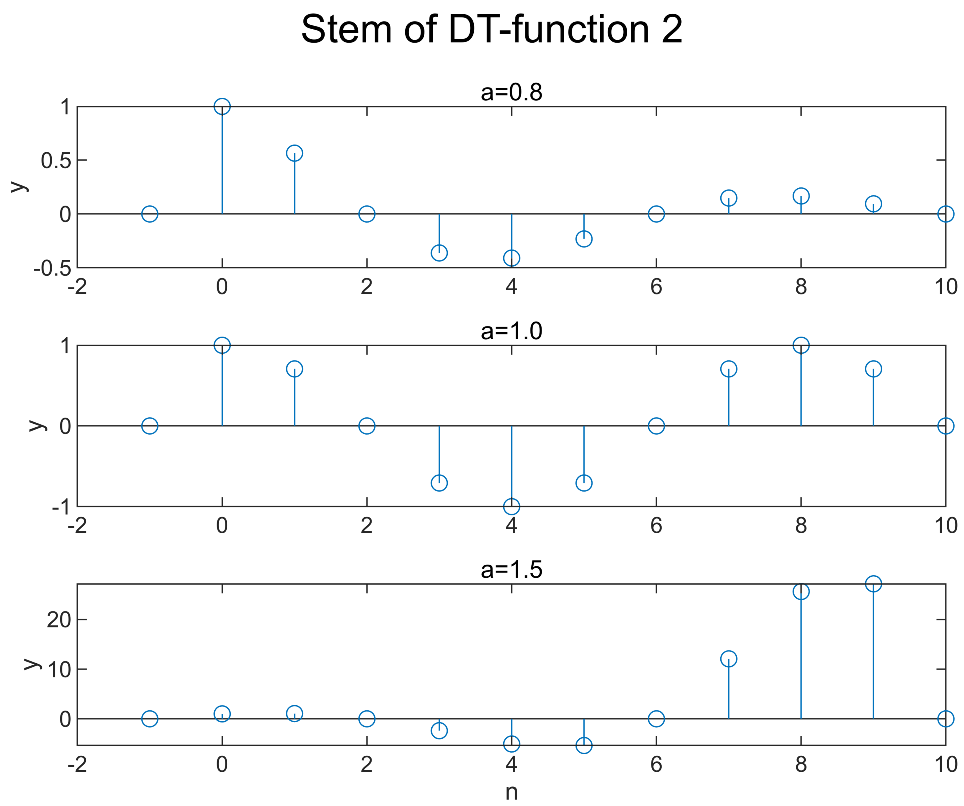



```
clear
figure

[n1,y1]=dtfunc1(0.8);
[n2,y2]=dtfunc1(1.0);
[n3,y3]=dtfunc1(1.5);

subplot(311)
orient('tall')
stem(n1,y1)
title('a=0.8')
ylabel('y')

subplot(312)
stem(n2,y2)
title('a=1.0')
ylabel('y')

subplot(313)
stem(n3,y3)
title('a=1.5')
xlabel('n')
ylabel('y')

sgtitle('Stem of DT-function 1')
```



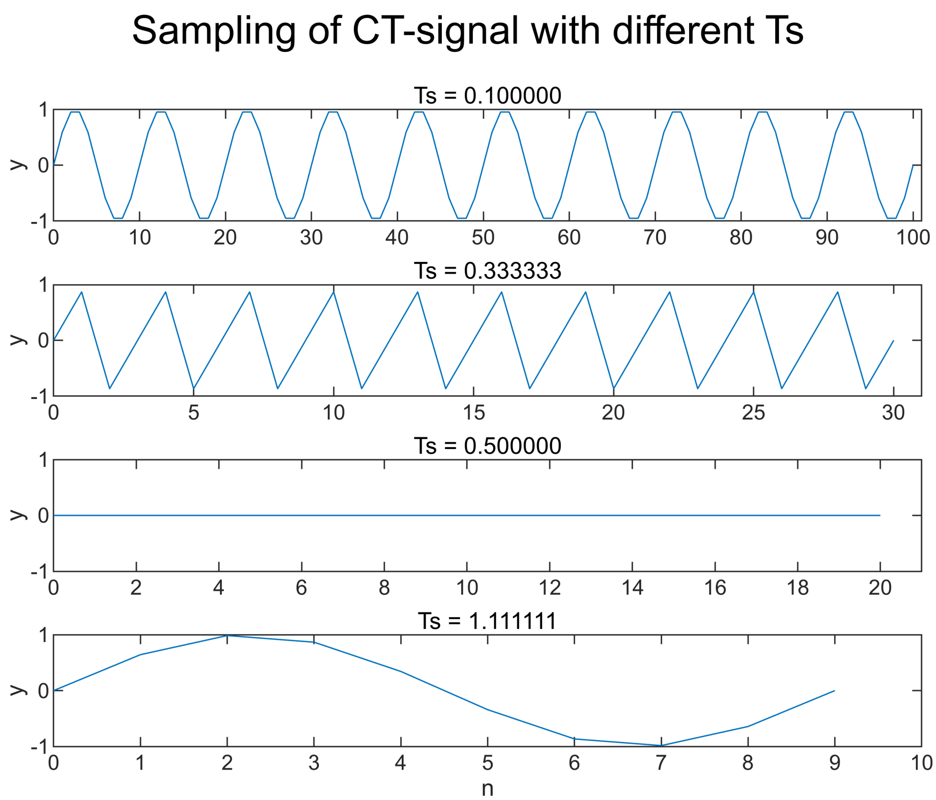

```
clear
figure

[n1,y1]=dtfunc2(0.8);
[n2,y2]=dtfunc2(1.0);
[n3,y3]=dtfunc2(1.5);

subplot(311)
orient('tall')

stem(n1,y1)
title('a=0.8')
ylabel('y')

subplot(312)
stem(n2,y2)
title('a=1.0')
ylabel('y')

subplot(313)
stem(n3,y3)
title('a=1.5')
xlabel('n')
ylabel('y')
```

```
sgtitle('Stem of DT-function 2')
```



1.6

```
clear;figure

subplot(411)
sampfunc(1/10)
subplot(412)
sampfunc(1/3)
subplot(413)
sampfunc(1/2)
subplot(414)
sampfunc(10/9)
xlabel('n')
sgtitle('Sampling of CT-signal with different Ts')
```



Ts = 1/10 performs a good reconstruction of the signal.

Ts = 1/3 fails to reconstruct the sinusoidal appearance. However, the frequency is preserved.

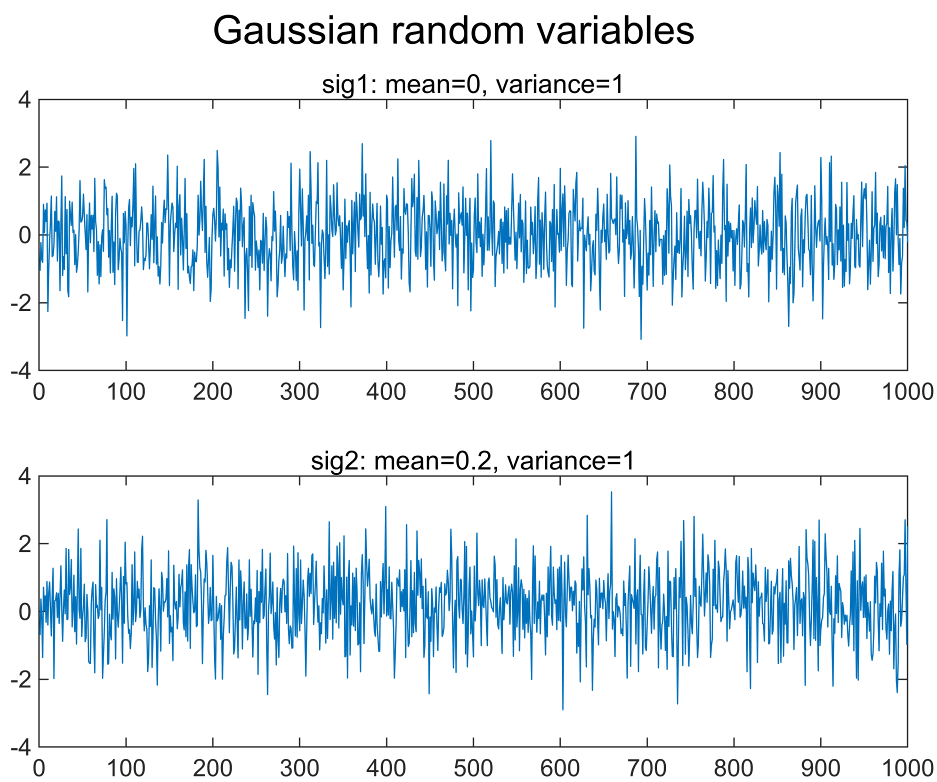
Ts = 1/2 fails to reconstruct the signal. The values happen to be all zero.

Ts = 10/9 undersamples the signal. The reconstructed frequency is lower than the original ones.

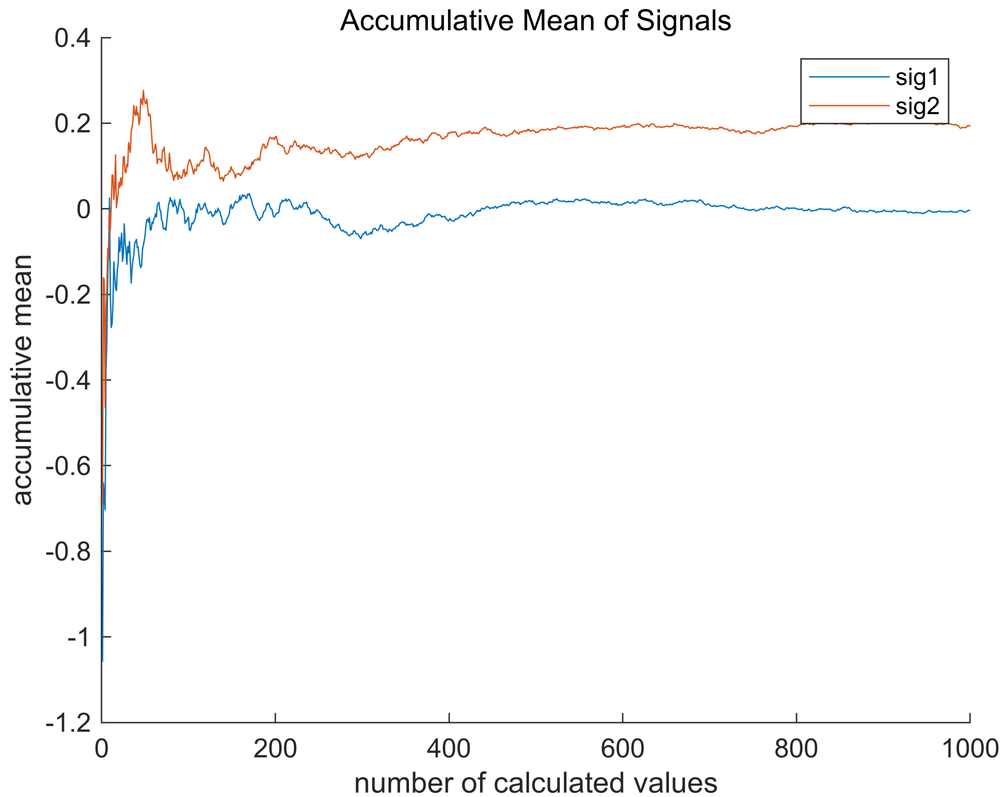
Therefore, to reconstruct the signal, a rather high sampling frequency is needed.

1.7

```
clear;figure

sig1 = randn(1000,1)*1+0;
sig2 = randn(1000,1)*1+0.2;

subplot(211)
plot(sig1)
title('sig1: mean=0, variance=1')
subplot(212)
plot(sig2)
title('sig2: mean=0.2, variance=1')
sgtitle('Gaussian random variables')
```

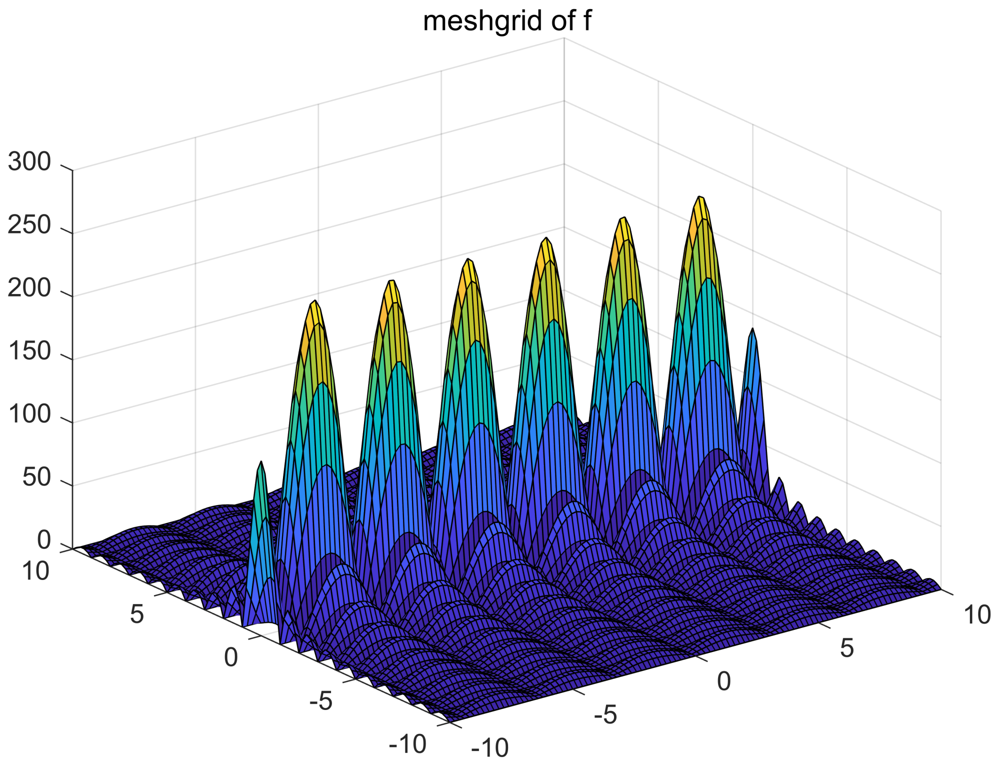



```
figure;hold on
n=1000;
ave1 = ave(sig1(1:n));
ave2 = ave(sig2(1:n));

plot(ave1)
plot(ave2)

legend('sig1', 'sig2')
title('Accumulative Mean of Signals')
xlabel('number of calculated values')
ylabel('accumulative mean')
```

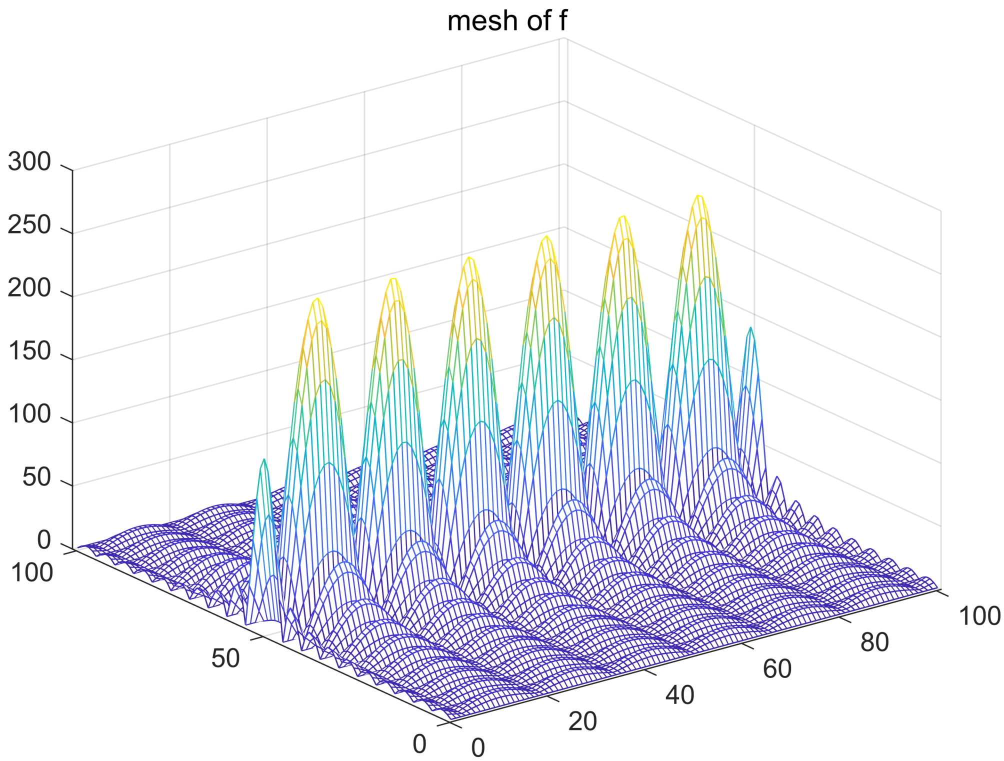


1.8

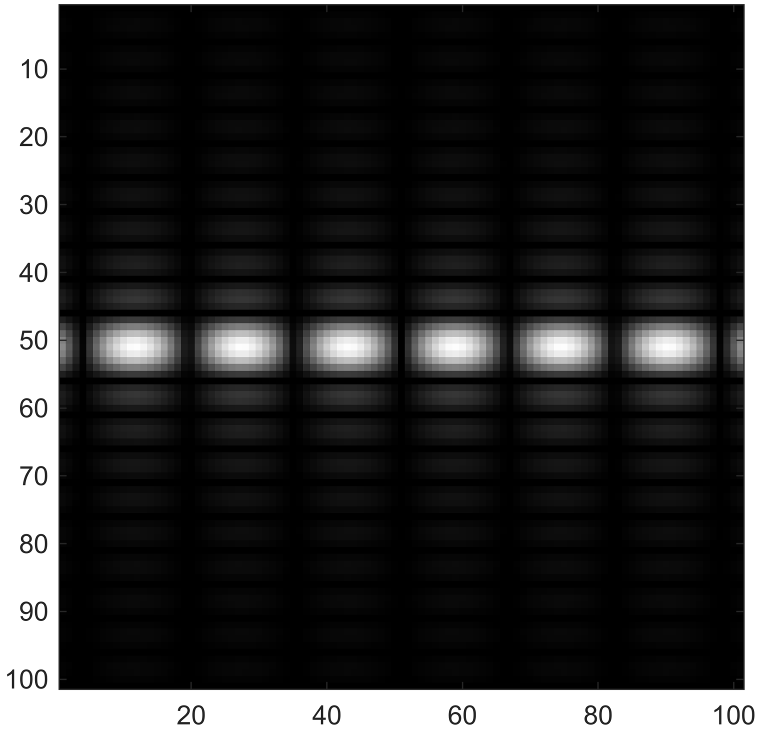
```
clear;figure

f=func2d();
[X, Y]=meshgrid((-50:50)*0.2);
surf(X,Y,f)
title('meshgrid of f')
```




```
figure
mesh(f)
title('mesh of f')
```




```
image(f)
colormap(gray(256))
axis('image')
```


10
20
30
40
50
60
70
80
90
100
20
40
60
80
100