```
close all;

figure;
%% I.1) Dhmiourgia tyxaias diergasias
N = 10000;
b=[1]; a = [1.0000 -1.1214 0.6500];
nn = 0:N-1;
x = randn(1,N) * 5 + 0;
u = filter(b,a,x);
subplot(411); plot(nn,u);
title('Random Variable');

%% I.2) Ypologismos meshs timhs kai typikhs apoklishs
a = mean(u);
sigma = std(u);

%% I.3) Ypologismos auto-sysxetishs
ac = xcorr(u); k = -N+1:N-1;
subplot(412); plot(k,ac);
title('Auto-correlation');

%% I.4) Ypologismos ths Cumulative Distribution Function
gmin = min(min(u));
gmax = max(max(u));
%Theloume 50 deigmata
number_of_samples = 50;
g = linspace(gmin,gmax,number_of_samples);
Fg = zeros(size(g));
for ii = 1:number_of_samples,
thisg = g(ii);
Fg(ii) = sum(u < thisg) / N;
end

subplot(413); plot (g,Fg);
title('Cumulative Distribution Function');

%% I.5) Ypologismos ths Probability Distribution Function
deltag = g(2) - g(1);
pg = hist(u,g) / N / deltag;
% Theoritikh Gaussian katanomh
pggaus=1/sqrt(2*pi)/sigma * exp(-(g - a).^2./(2*sigma.^2));
subplot(414); plot (g,pg,g,pggaus);
title('Probability Distribution Function');


%% II.1) Dhmiourgia AM kai envelope
Ac = 1; Am = 1; fc = 100; fm = 2;
t = [0:0.001:1];
s=sin(2*pi*fm*t);

e = (Ac + Am*s);         %DSB-AM envelop
```

```
x1 = (Ac + Am*s).*cos(2*pi*fc*t); %DSB-AM

%% II.2) Ektyposh envelope kai tou diamorfomenou shmatos
figure;
subplot(411); plot(t,x1,t,e,'r',t,-e,'r');
title('Amplitude modulated signal plus envelope');
xlabel('Time'); ylabel('x1(t)');

%% II.3) Diamorfwsh me thn ammod
fs=400; %Fs>2(fc+fm)
x2 = ammod(s,fc,fs);
subplot(412); plot(t,x2);
title('Amplitude modulated signal with ammod()');
xlabel('Time'); ylabel('x2(t)');

%% II.4) Apodiamorfwsh twn dx1 kai dx2
dx1 = abs(x1);
dx2 = amdemod(x2,fc,fs);

%% II.5) Lowpass filtro
Fs=400; %Prepei na isxyei Fs>2(fc+fm)
order=10;
cutoff=5; %Filtrarisma syxtotitwn panw apo ta 5Hz
fr=cutoff/(Fs/2);
[C,D]=butter(order,0.025);
dc=filter(C,D,dx1);

%% II.6) Ektypwseis apodiamorfwmenwn shmatwn
subplot(413); plot(t,dc);
title('Demodulated signal');
subplot(414); plot(t,dx2);
title('Demodulated signal with amdemod()');

%% III.1) FM diamorfwsh kai apodiamorfwsh
dev = 20; % Frequency deviation sto modulated signal
Fs=2.2*(fc+fm+dev); %Gia FM prepei na einai Fs>2(fc+fm+dev)
y = fmmod(s,fc,Fs,dev); % Modulate
z = fmdemod(y,fc,Fs,dev); % Demodulate

%% III.2) Ektypwseis
figure;
subplot(311); plot(t,s); title('Baseband signal');
subplot(312); plot(t,y); title('Frequency modulated signal with fmmod()');
subplot(313); plot(t,z); title('Demodulated signal with fmdemod()');
```