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**Assignment 9**

***Part 1***

*Matlab Code*

sigma = 0.1;

alpha1 = -0.5;

alpha2 = 0.5;

mu1 = sqrt(sigma)\*randn;

mu2 = sqrt(sigma)\*randn;

mu3 = sqrt(sigma)\*randn;

n = 200;

Y = zeros(2,n);

z = zeros(1,n);

for t = 2:n

Y(2,t) = Y(1,t-1) + mu1;

Y(1,t) = alpha1\*Y(1,t-1) + alpha2\*Y(2,t-1) + mu2;

z(t) = Y(1,t) + mu3;

end

t = 1:n;

hold on;

plot(t,Y(1,:));

plot(t,Y(2,:));

hold off;



***Part 2***

*Matlab Code*

beta = 0.1;

sigma = 0.1;

mu1 = sqrt(sigma)\*randn;

mu2 = sqrt(sigma)\*randn;

mu3 = sqrt(sigma)\*randn;

n = 200;

Y = zeros(2,n+1);

z = zeros(1,n+1);

alpha\_1 = [-0.5 1 0.5];

alpha\_2 = [0.5 -1 -0.5];

mode = randi(3);

for t = 2:n+1

alpha1 = alpha\_1(mode);

alpha2 = alpha\_2(mode);

Y(2,t) = Y(1,t-1) + mu1;

Y(1,t) = alpha1\*Y(1,t-1) + alpha2\*Y(2,t-1) + mu2;

z(t) = Y(1,t) + mu3;

redraw = binornd(1,beta);

mode = mode\*(1-redraw) + randi(3)\*redraw;

end

t = 1:n+1;

hold on;

plot(t,Y(1,:));

plot(t,Y(2,:));

xlabel('t');

legend('y(1)','y(2)');

hold off;



*Graphical Representation*

Y2(t-1)

Y1(t-1)

Y1(t)

Y2(t)

z(t)

μ1

μ2

μ3

m(t-1)

(α1, α2)

m(t)

(α1,α2)

β β

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**Transition table for P(m(t) | m(t-1)) , β = 0.1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Mode at t | 1 | 2 | 3 |
| Mode at t-1 |  |  |  |  |
| 1 |  | 0.933333333 | 0.0333333333 | 0.0333333333 |
| 2 |  | 0.0333333333 | 0.933333333 | 0.0333333333 |
| 3 |  | 0.0333333333 | 0.0333333333 | 0.933333333 |