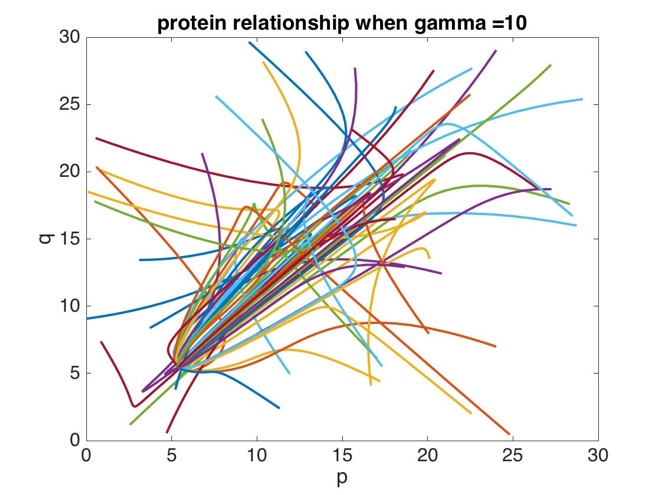
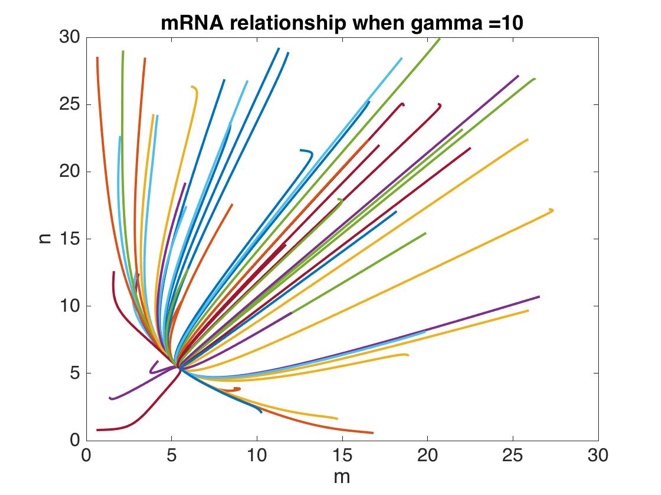
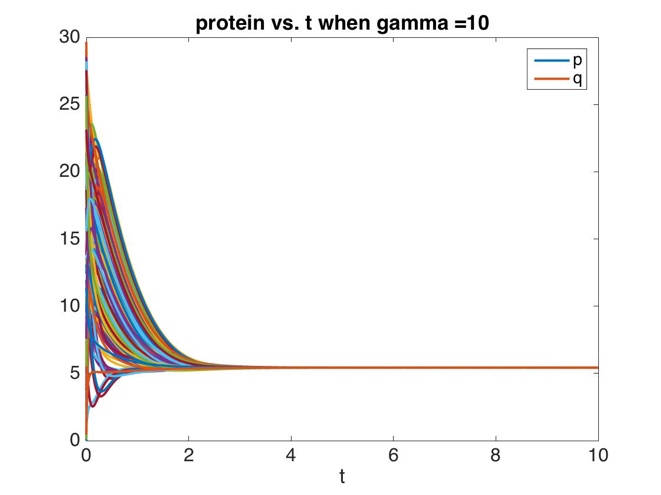
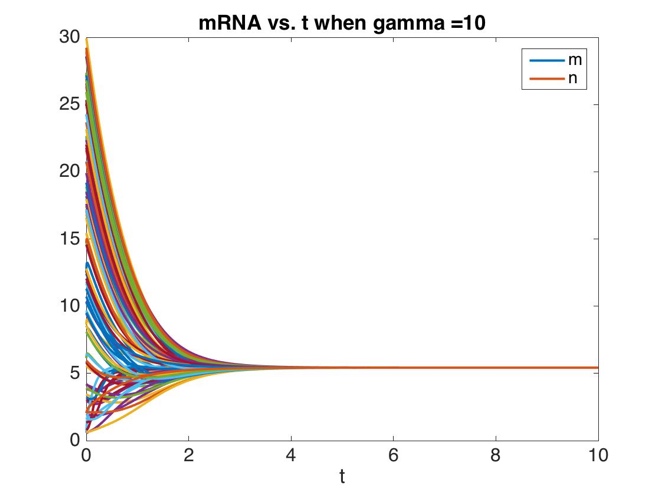
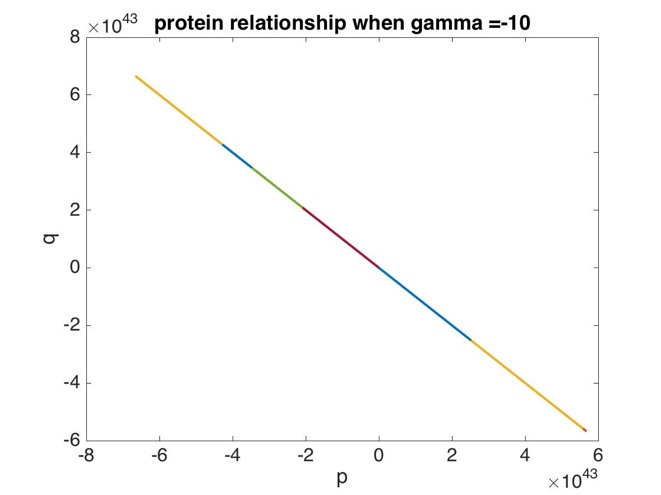
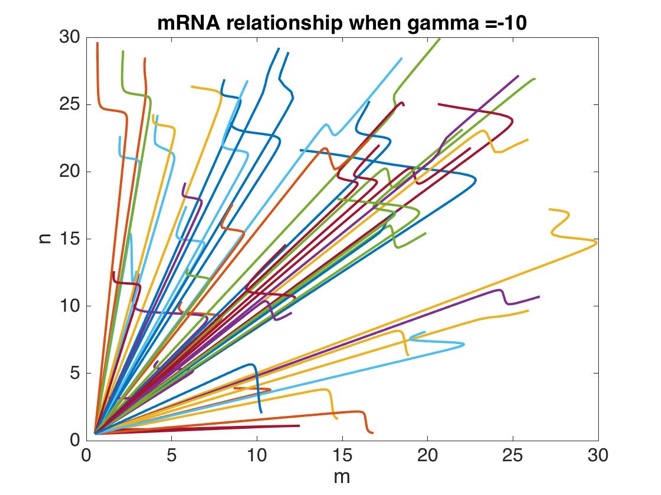
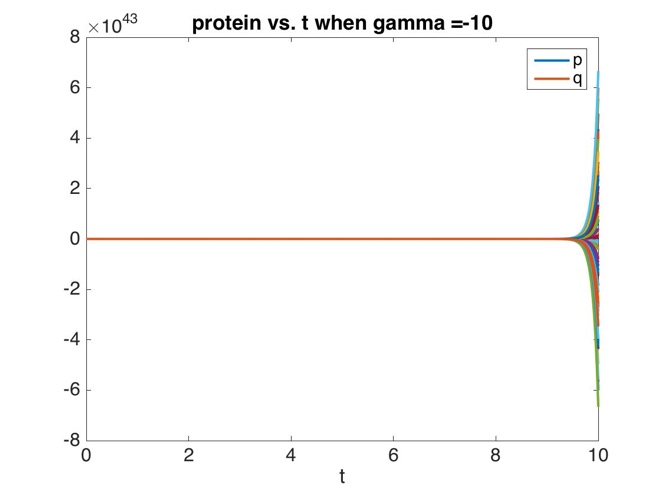
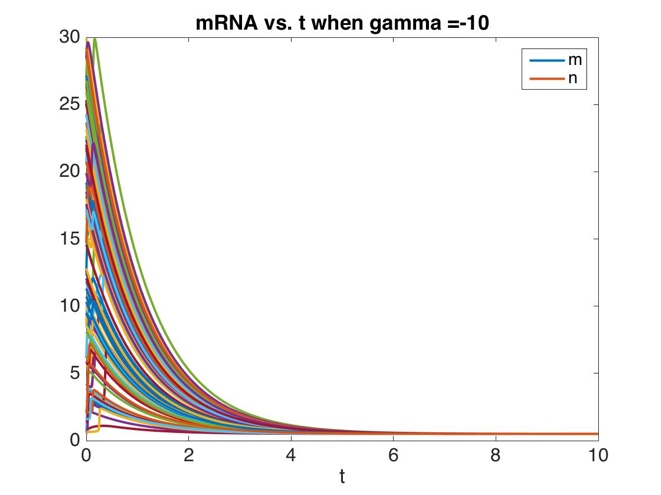
1. **Coupled oscillators**

Do nonzero

****

**Figure 1:** when gamma = 10, (a) mRNA dynamics, (b) protein dynamics (c) mRNA relationship, (d) protein relationship

****

**Figure 2:** when gamma = -10, (a) mRNA dynamics, (b) protein dynamics (c) mRNA relationship, (d) protein relationship

% @Author: Baihan Lin

% @Date: Nov 2016

clear all; close all; clc;

rng(1);

close all

alpha=150;

alpha0=0.5;

beta=10.2;

n=2;

% gamma=10;

gamma=-10;

for numreps=1:50

p = [alpha,alpha0,beta,n,gamma];

x0 = 30\*rand(6,1) ;

Tmax=10;

[T,Y] = ode45(@coupleOsci,[0 Tmax],x0,[],p);

figure(1)

set(gca,'FontSize',16)

plot(T,Y(:,1:2),'LineWidth',2) ; hold on

% plot(T,Y(:,3:4),'LineWidth',2) ; hold on;

legend('m','n')

xlabel('t') ;

title(strcat('mRNA vs. t when gamma = ',num2str(gamma)));

figure(2)

set(gca,'FontSize',16)

% plot(T,Y(:,1:2),'LineWidth',2) ; hold on

plot(T,Y(:,3:4),'LineWidth',2) ; hold on;

legend('p','q')

xlabel('t') ;

title(strcat('protein vs. t when gamma = ',num2str(gamma)));

figure(3)

set(gca,'FontSize',16)

plot(Y(:,1),Y(:,2),'LineWidth',2) ; hold on

xlabel('m');ylabel('n');

title(strcat('mRNA relationship when gamma = ',num2str(gamma)));

figure(4)

set(gca,'FontSize',16)

plot(Y(:,3),Y(:,4),'LineWidth',2) ; hold on

xlabel('p');ylabel('q');

title(strcat('protein relationship when gamma = ',num2str(gamma)));

end

1. **Systems biology and network motifs**
2. **Python**

**# Exercise 1**

rn = np.random.RandomState() # initialize a new RandomState object

rn.seed(100)

F = 5+rn.randn(1,100) \* 2 \*\* 0.5

F.mean() # 4.8526872367575509

F.var() # 1.8808398082683166

**# Exercise 2**

import scipy.integrate as si

def onedim(y, t):

yprime = np.array([y[0]])

return yprime

t = np.arange(0, 10.01, .01) # time points on which to solve

yzero = np.array([1.])

print (len(yzero))

y = si.odeint(onedim, yzero, t)

plt.plot(t[:], y[:, 0])

plt.xlabel('t')

plt.ylabel('x')

plt.title('Figure: 1D ODE simulation')

