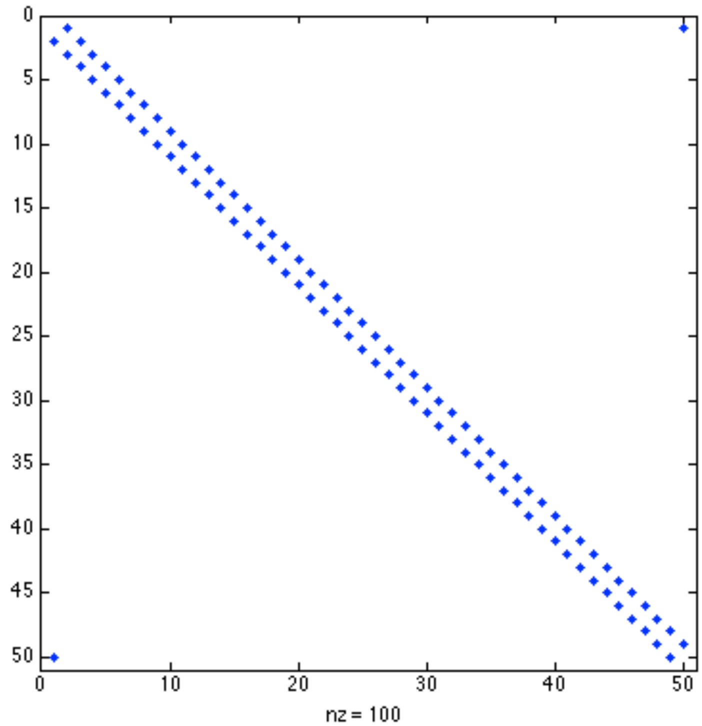
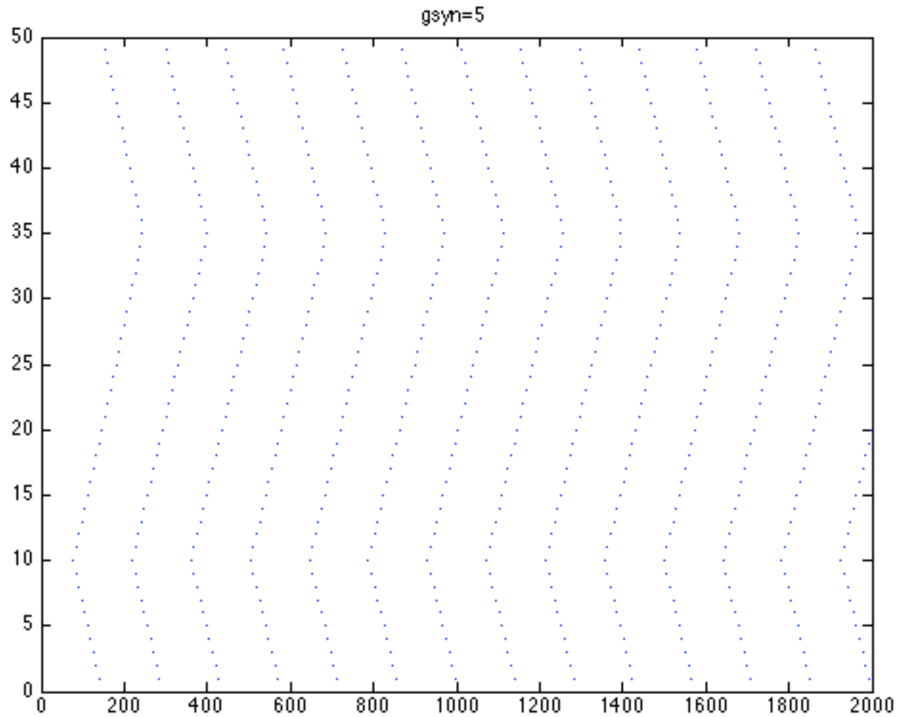
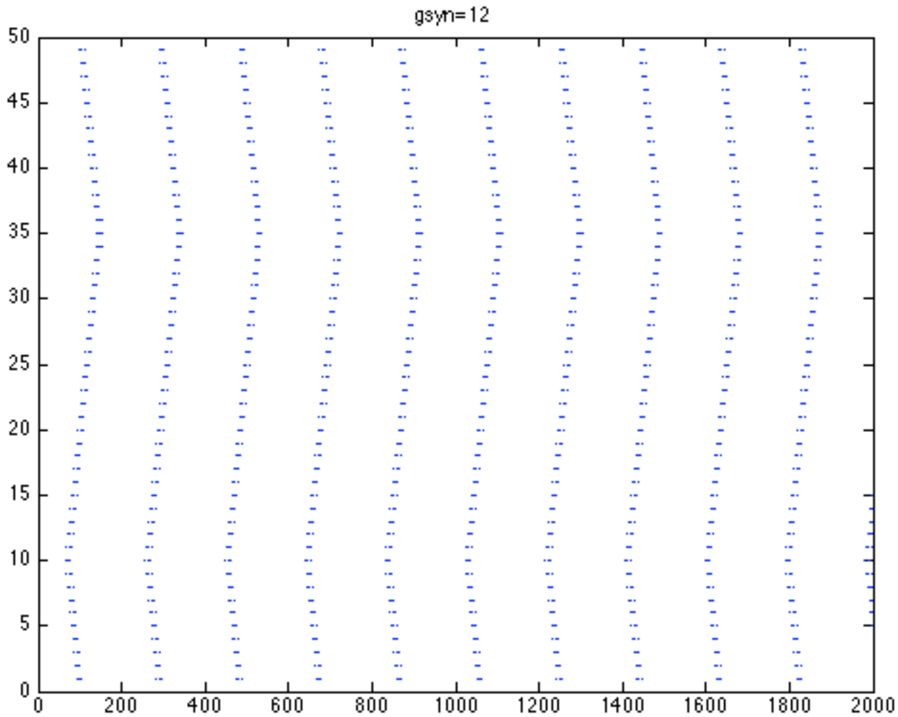
q1a.

```
% gsyn=5, Neighbor time diff (ms):7.3385
% gsyn=6, Neighbor time diff (ms):5.9643
% gsyn=7, Neighbor time diff (ms):4.9786
% gsyn=8, Neighbor time diff (ms):4.2
% gsyn=9, Neighbor time diff (ms):3.8083
% gsyn=10, Neighbor time diff (ms):3.6
% gsyn=11, Neighbor time diff (ms):3.3
% gsyn=12, Neighbor time diff (ms):3.0967
```

Network (q1a-q1c)




gsyn=5
50
45
40
35
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000

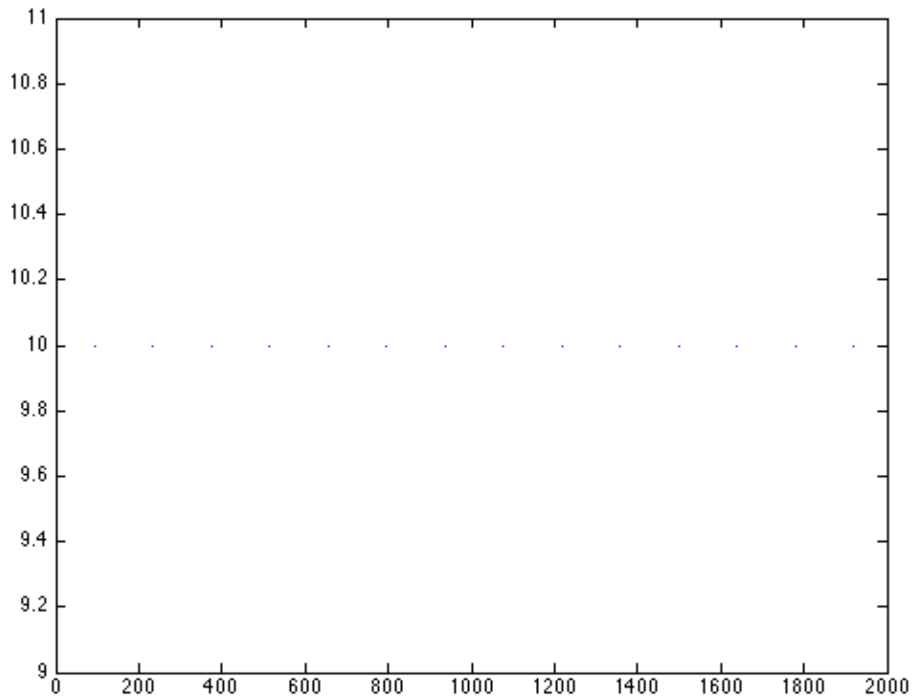

gsyn=12
50
45
40
35
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000

```
%function modified to accept gsyn
for gsyn=5:12
    [spiketimes]=ILIF_ExcNetwork(n,W,gsyn);
    spikes1 = extractSpikes(spiketimes,1,0);
    spikes2 = extractSpikes(spiketimes,2,0);
    spikesDiff = mean(spikes1-spikes2);

    disp(['gsyn=',num2str(gsyn),', Neighbor time diff
(ms):',num2str(spikesDiff)]);

    title(['gsyn=',num2str(gsyn)]);
end
```

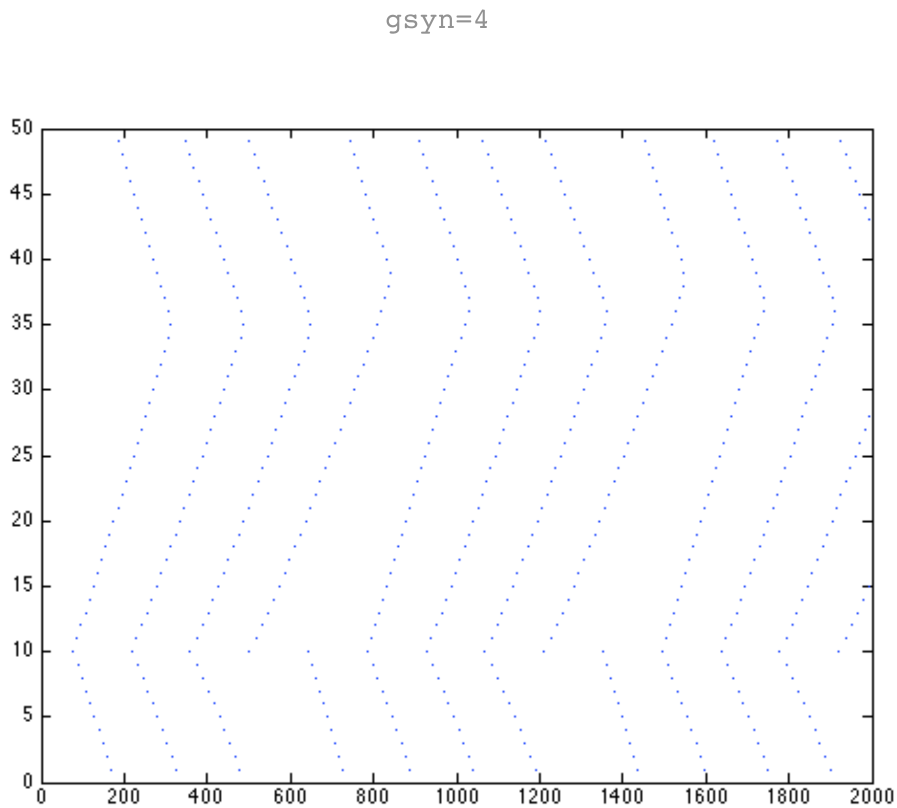
q1b.

```
% gsyn=1, Neighbor time diff (ms):NaN
% gsyn=2, Neighbor time diff (ms):NaN
% gsyn=3, Neighbor time diff (ms):NaN
% gsyn=4, Neighbor time diff (ms):10.8455
% gsyn=5, Neighbor time diff (ms):7.4571
```

gsyn=1



11
10.8
10.6
10.4
10.2
10
9.8
9.6
9.4
9.2
9
0
200
400
600
800
1000
1200
1400
1600
1800
2000


gsyn=4
50
45
40
35
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000

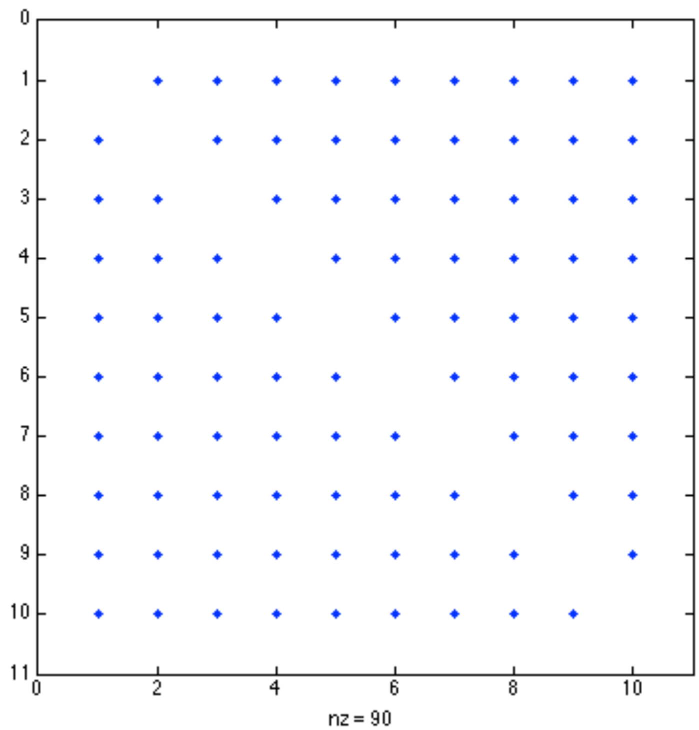
```
%function modified to accept gsyn
for gsyn=1:5
    [spiketimes]=ILIF_ExcNetwork(n,W,gsyn);
    spikes1 = extractSpikes(spiketimes,1,0);
    spikes2 = extractSpikes(spiketimes,2,0);
    spikesDiff = mean(spikes1-spikes2);

    disp(['gsyn=',num2str(gsyn),', Neighbor time diff
(ms):',num2str(spikesDiff)]);

    title(['gsyn=',num2str(gsyn)]);
end
```

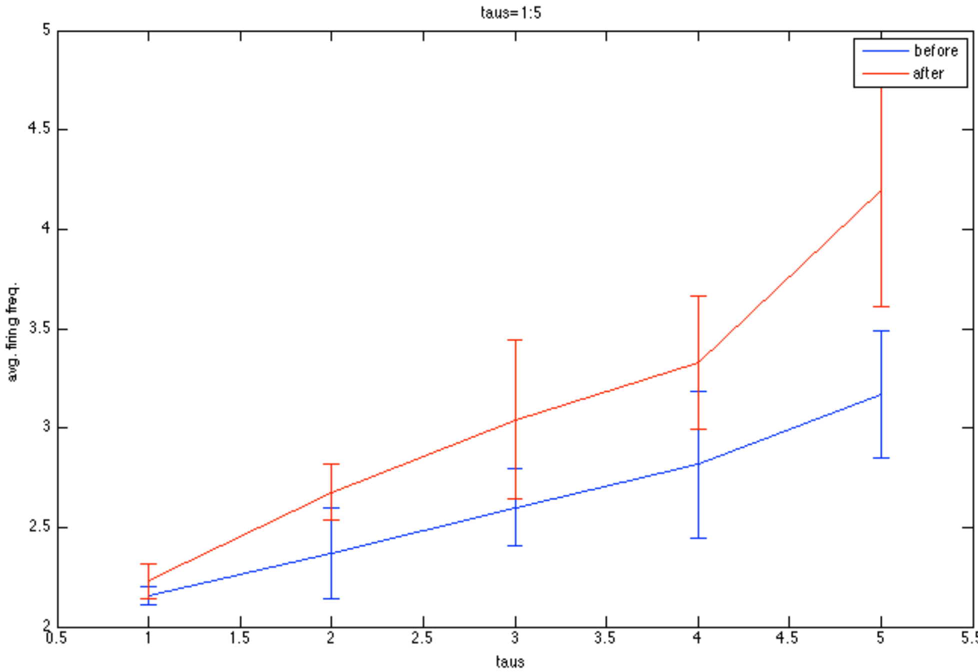
q1c. The data shows that as synaptic strength increases, so does the spike propagation through the network. Also, for gsyn < 5, the network is either unstable or q2a.

```
% taus=1
% Average cell frequency before current pulse is      2.166
% Average cell frequency after current pulse is      2.130
% Average cell frequency before current pulse is      2.198
% Average cell frequency after current pulse is      2.157
% Average cell frequency before current pulse is      2.164
% Average cell frequency after current pulse is      2.229
% Average cell frequency before current pulse is      2.168
% Average cell frequency after current pulse is      2.341
% Average cell frequency before current pulse is      2.075
% Average cell frequency after current pulse is      2.290
% taus=2
% Average cell frequency before current pulse is      2.445
% Average cell frequency after current pulse is      2.497
% Average cell frequency before current pulse is      2.062
% Average cell frequency after current pulse is      2.608
% Average cell frequency before current pulse is      2.354
% Average cell frequency after current pulse is      2.660
% Average cell frequency before current pulse is      2.687
% Average cell frequency after current pulse is      2.773
% Average cell frequency before current pulse is      2.292
% Average cell frequency after current pulse is      2.848
% taus=3
% Average cell frequency before current pulse is      2.483
% Average cell frequency after current pulse is      2.868
% Average cell frequency before current pulse is      2.706
% Average cell frequency after current pulse is      2.650
% Average cell frequency before current pulse is      2.412
% Average cell frequency after current pulse is      3.429
% Average cell frequency before current pulse is      2.511
% Average cell frequency after current pulse is      3.510
% Average cell frequency before current pulse is      2.886
% Average cell frequency after current pulse is      2.749
% taus=4
% Average cell frequency before current pulse is      2.776
% Average cell frequency after current pulse is      3.203
% Average cell frequency before current pulse is      2.259
% Average cell frequency after current pulse is      3.218
% Average cell frequency before current pulse is      3.305
% Average cell frequency after current pulse is      2.943
% Average cell frequency before current pulse is      2.865
% Average cell frequency after current pulse is      3.447
% Average cell frequency before current pulse is      2.869
% Average cell frequency after current pulse is      3.831
% taus=5
% Average cell frequency before current pulse is      3.506
% Average cell frequency after current pulse is      3.726
% Average cell frequency before current pulse is      2.705
```

```
% Average cell frequency after current pulse is      4.821
% Average cell frequency before current pulse is      3.366
% Average cell frequency after current pulse is      3.645
% Average cell frequency before current pulse is      3.278
% Average cell frequency after current pulse is      3.952
% Average cell frequency before current pulse is      2.992
% Average cell frequency after current pulse is      4.828
```

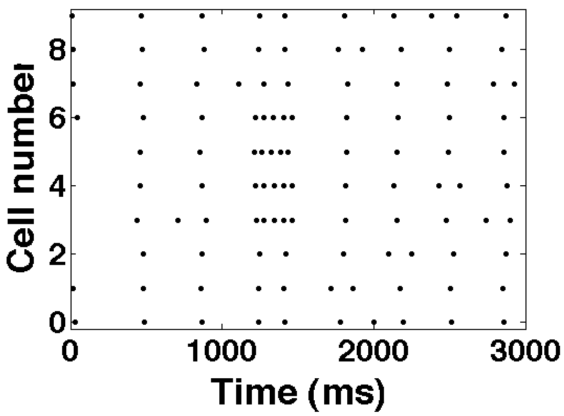
Network (q2a-q2b)

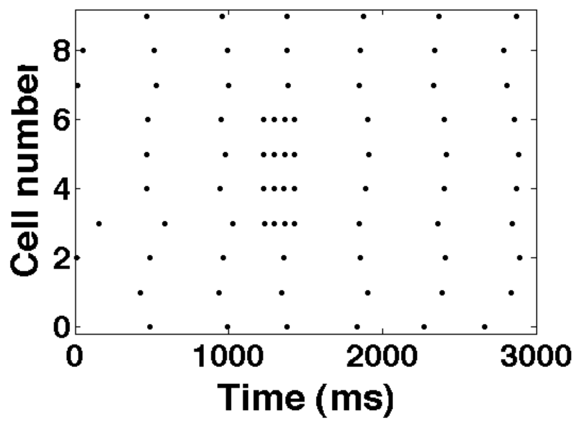



taus=1:5
before
after
avg. firing freq.
taus
5
4.5
4
3.5
3
2.5
2
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5

```
%function modified to accept taus
allAv1 = [];
allAv2 = [];
allStd1 = [];
allStd2 = [];
for taus=1:5
    disp(['taus=',num2str(taus)]);
    curAv1 = [];
    curAv2 = [];
    for i=1:5
        [spiketimes,avcfreq1,avcfreq2]=WBnetwork(n,W,taus);
        curAv1(i) = avcfreq1;
        curAv2(i) = avcfreq2;
    end
    allAv1(taus) = mean(curAv1);
    allAv2(taus) = mean(curAv2);
    allStd1(taus) = std(curAv1);
    allStd2(taus) = std(curAv2);
end
```

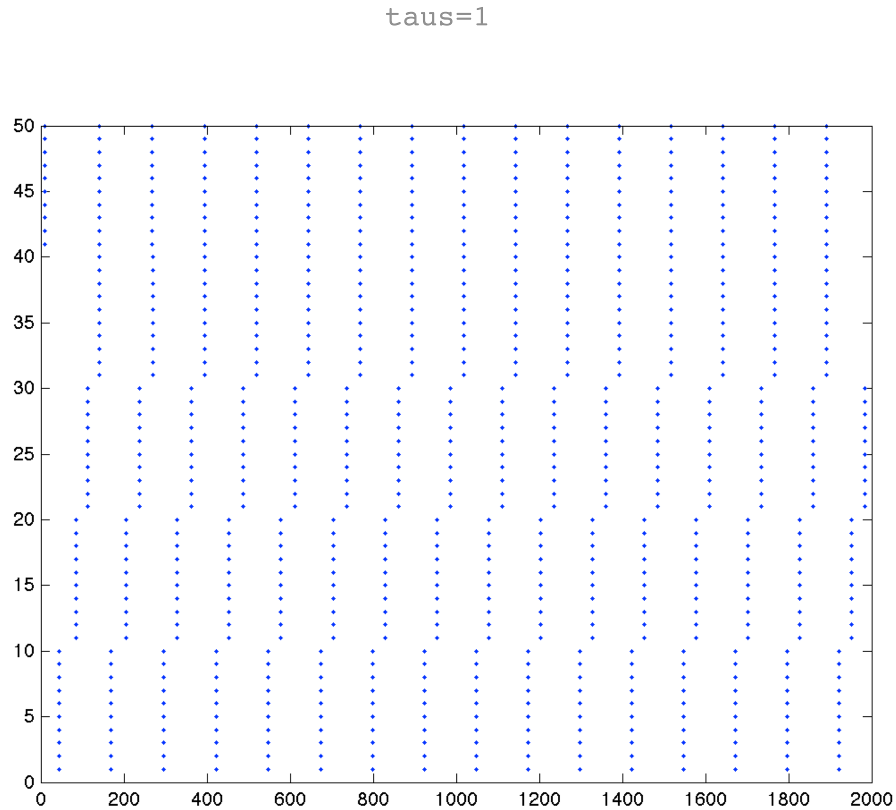
q2b. As taus increases, so does the reverberatory activity in the network. This is evidenced by the increase in firing frequency (both before, and after stimulation). Firing frequency also appears to be influenced by the relative burstiness of the network as taus increases.



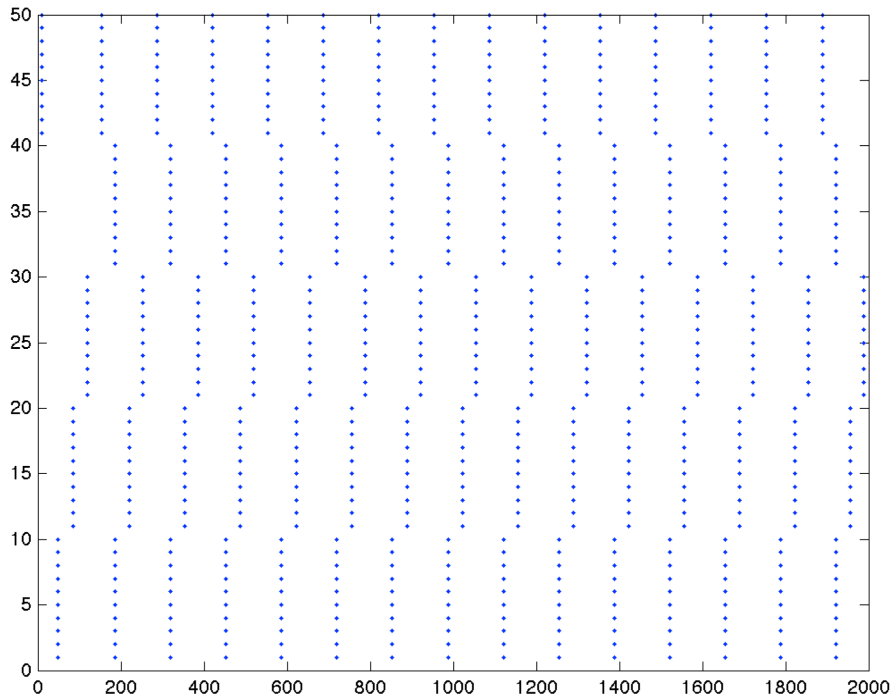


taus=5 | taus=1

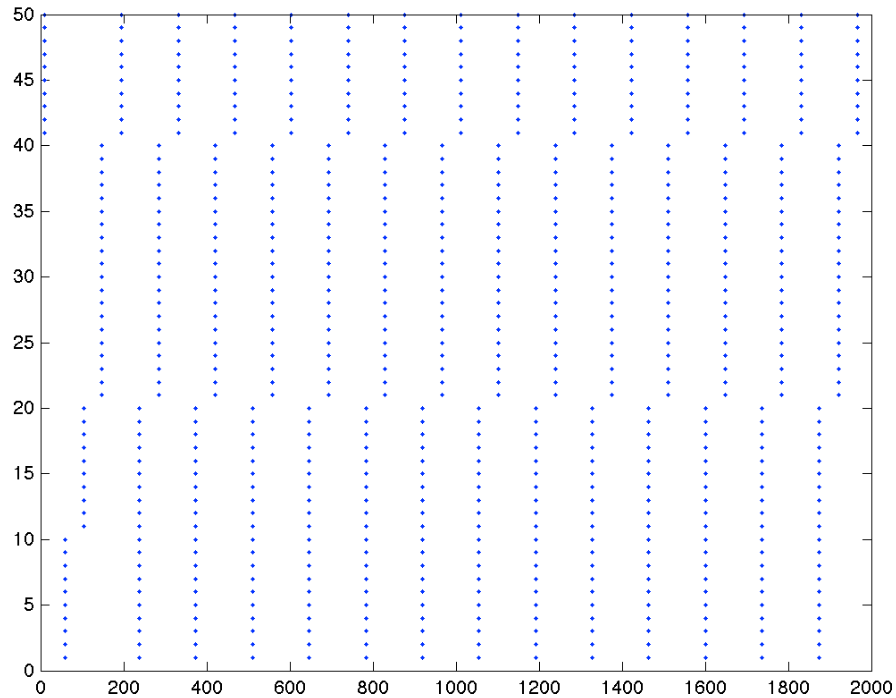
q3a. The following plots represent the taus epochs at which cluster quantity changes.



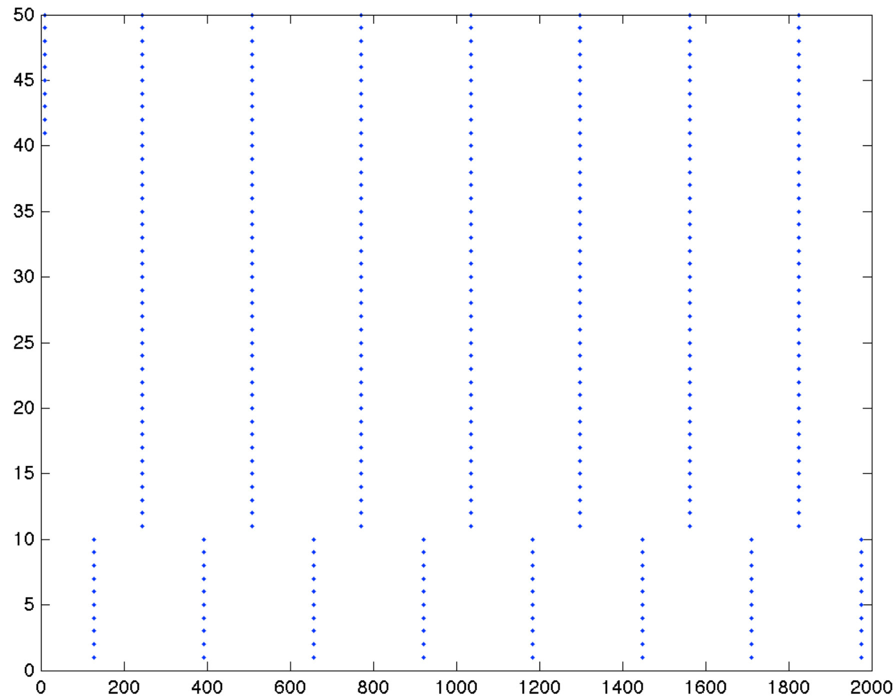
taus=6, cluster=5

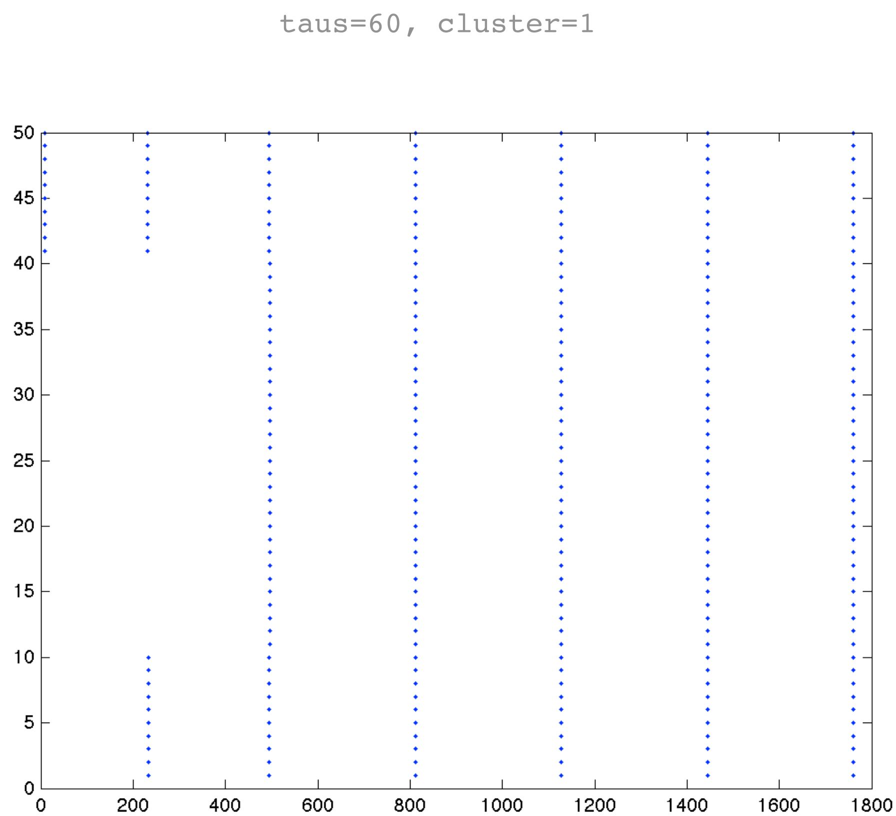


taus=10, cluster=3



taus=35, cluster=2

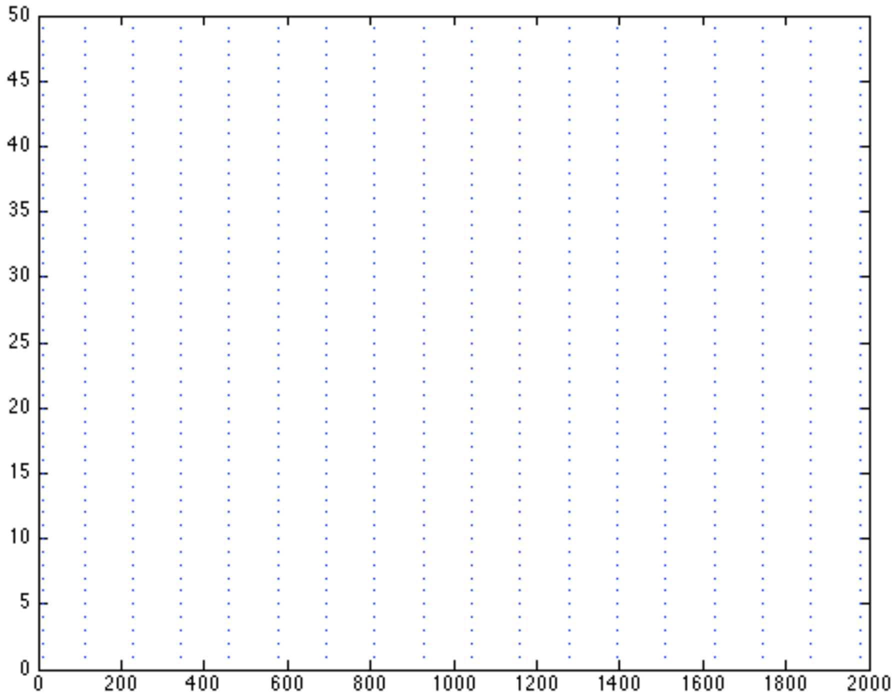



taus=60, cluster=1
50
45
40
35
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
1600
1800

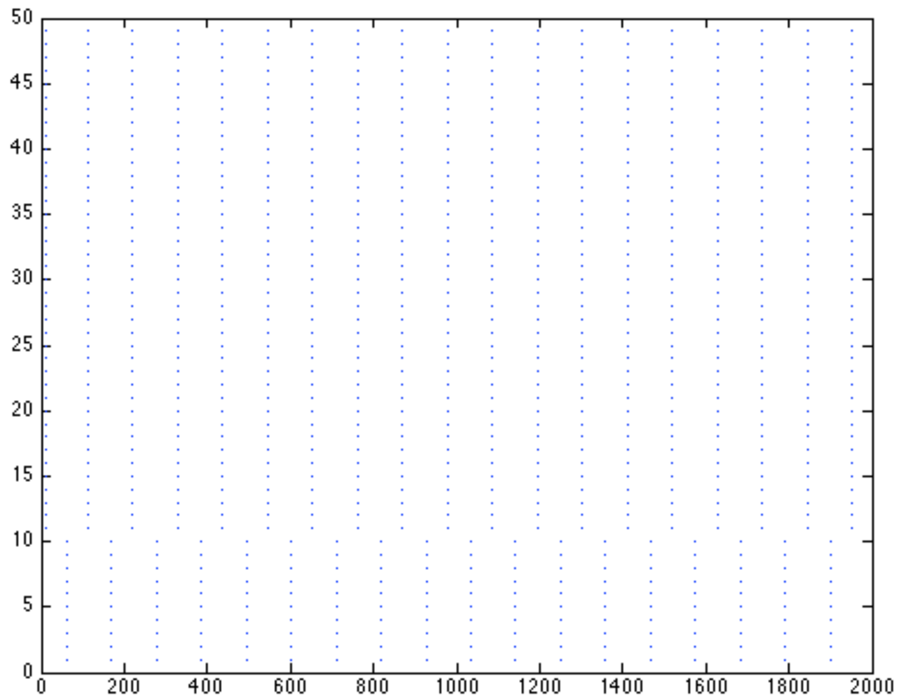
```
for taus=50:5:75
    [spiketimes,freqs,nisis]=ILIFnetwork_clusters(n,W,taus);
    disp(['taus=',num2str(taus)]);

    saveas(1,['q3a_taus=',num2str(taus),'.png'],'png');
end
```

q3b. I found that taus=10 relates to a maximum of 3 clusters.

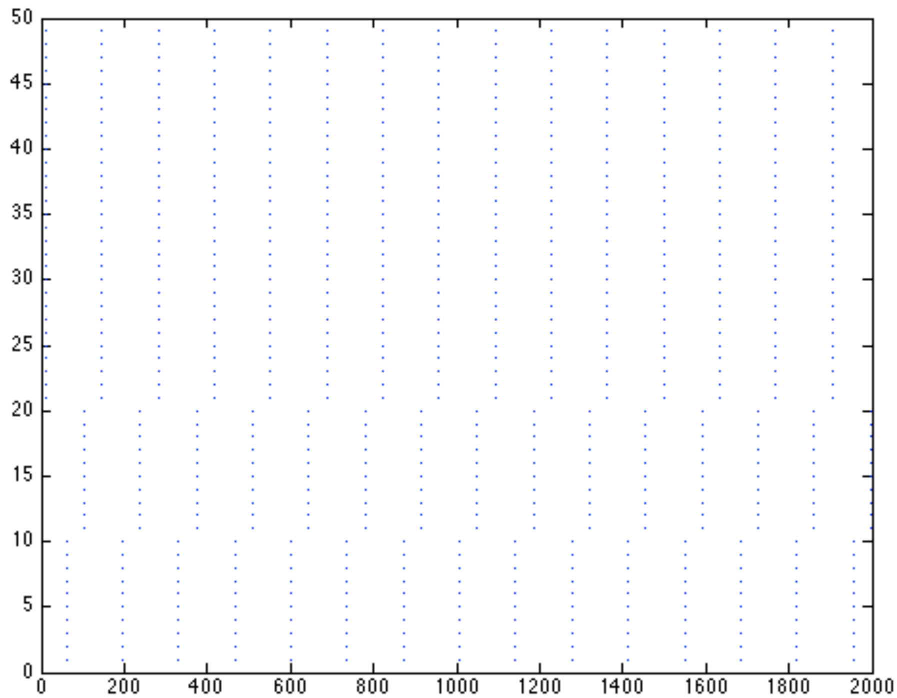
taus=10, clusters=1



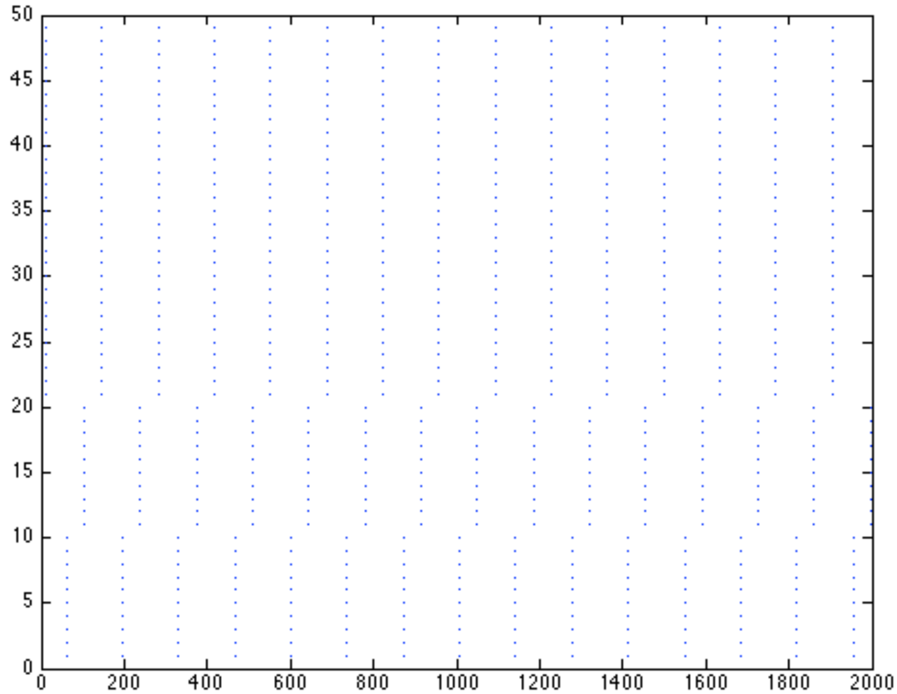
taus=10, clusters=2



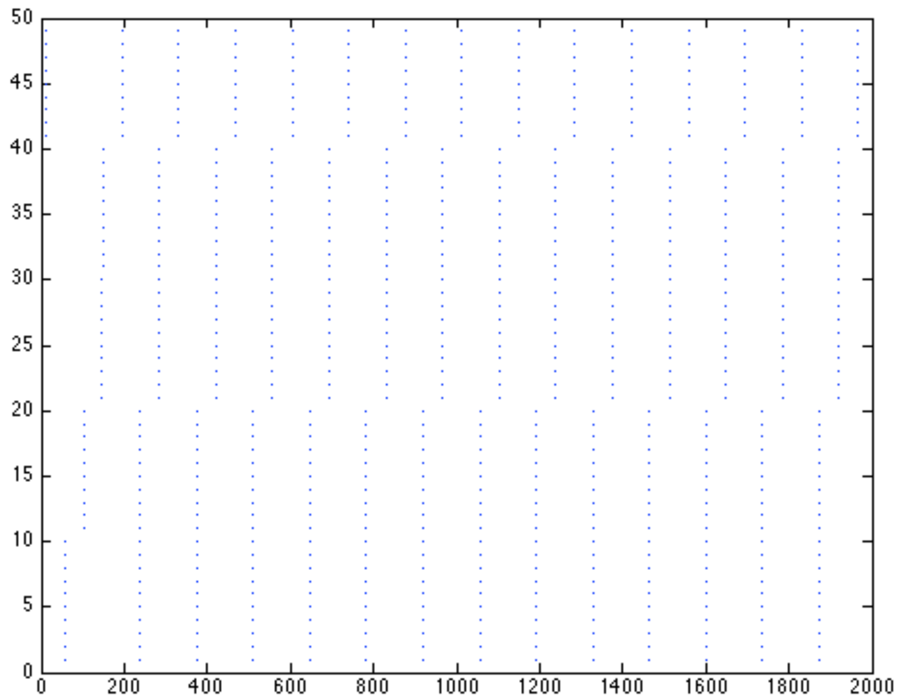
taus=10, clusters=3



taus=10, clusters=3



taus=10, clusters=3



q3c. As taus increases in this inhibitory network (with gsyn constant), cell firing frequency and cluster number decreases. Also shown, is that for a given taus, there is a maximum number of clusters in the cell firing pattern/network that can be achieved.