Properties of Evolving Networks

part of “Graphen und Netzwerke in der Biologie”

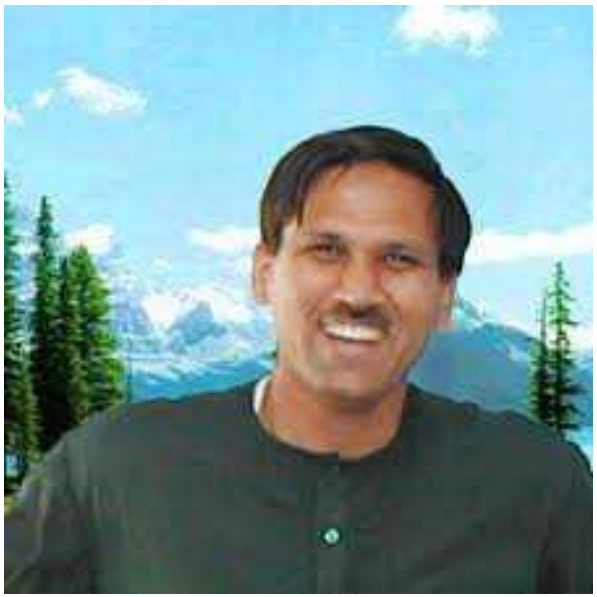
Sonja Prohaska

Computational EvoDevo
University Leipzig

Leipzig, SS 2011

developed by

Prof. Sanjay Jain



Department of Physics and Astrophysics
University of Delhi

External Faculty at Santa Fe Institute

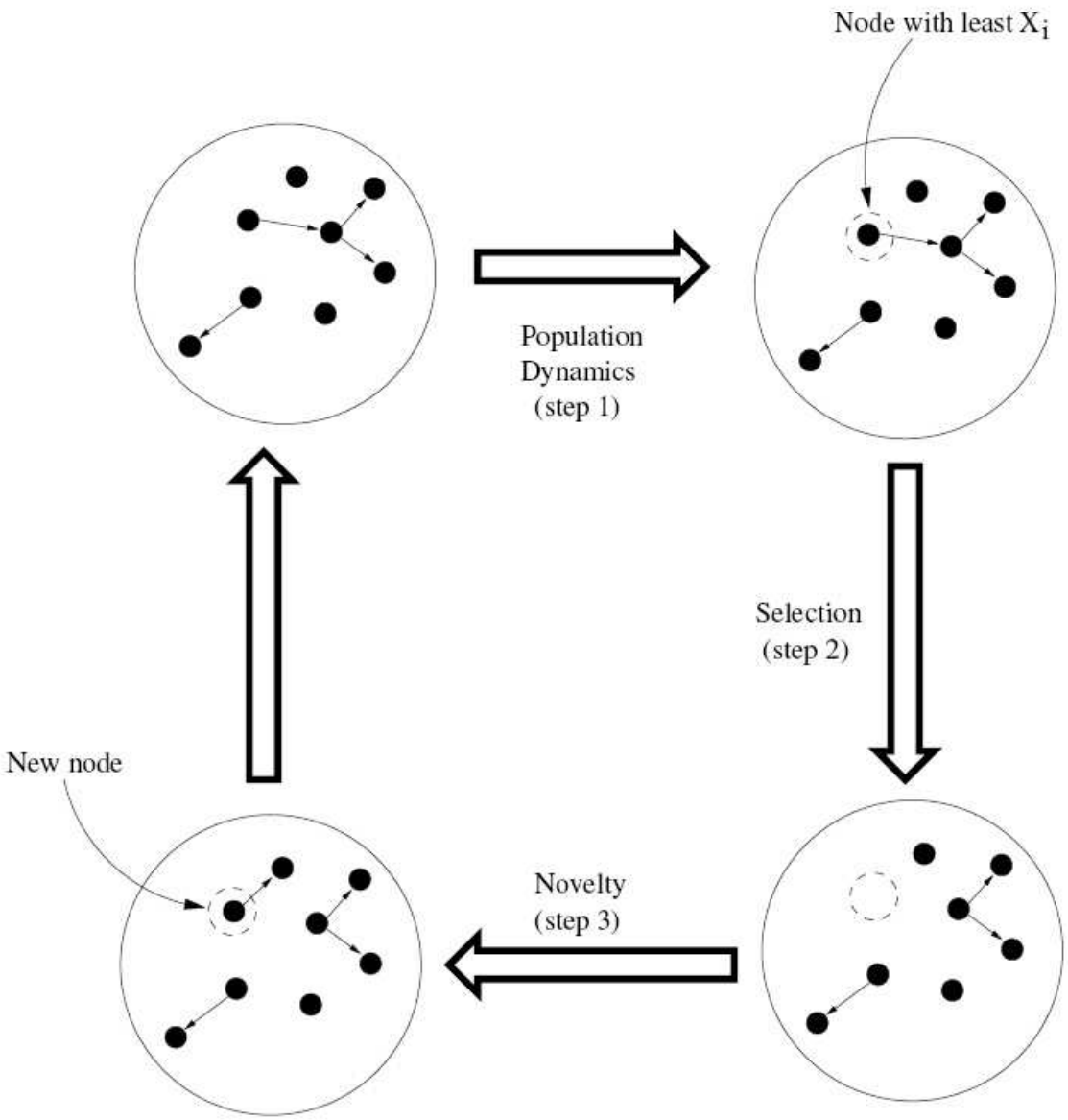
The Network

Initiation of the Network

Evolving the Network

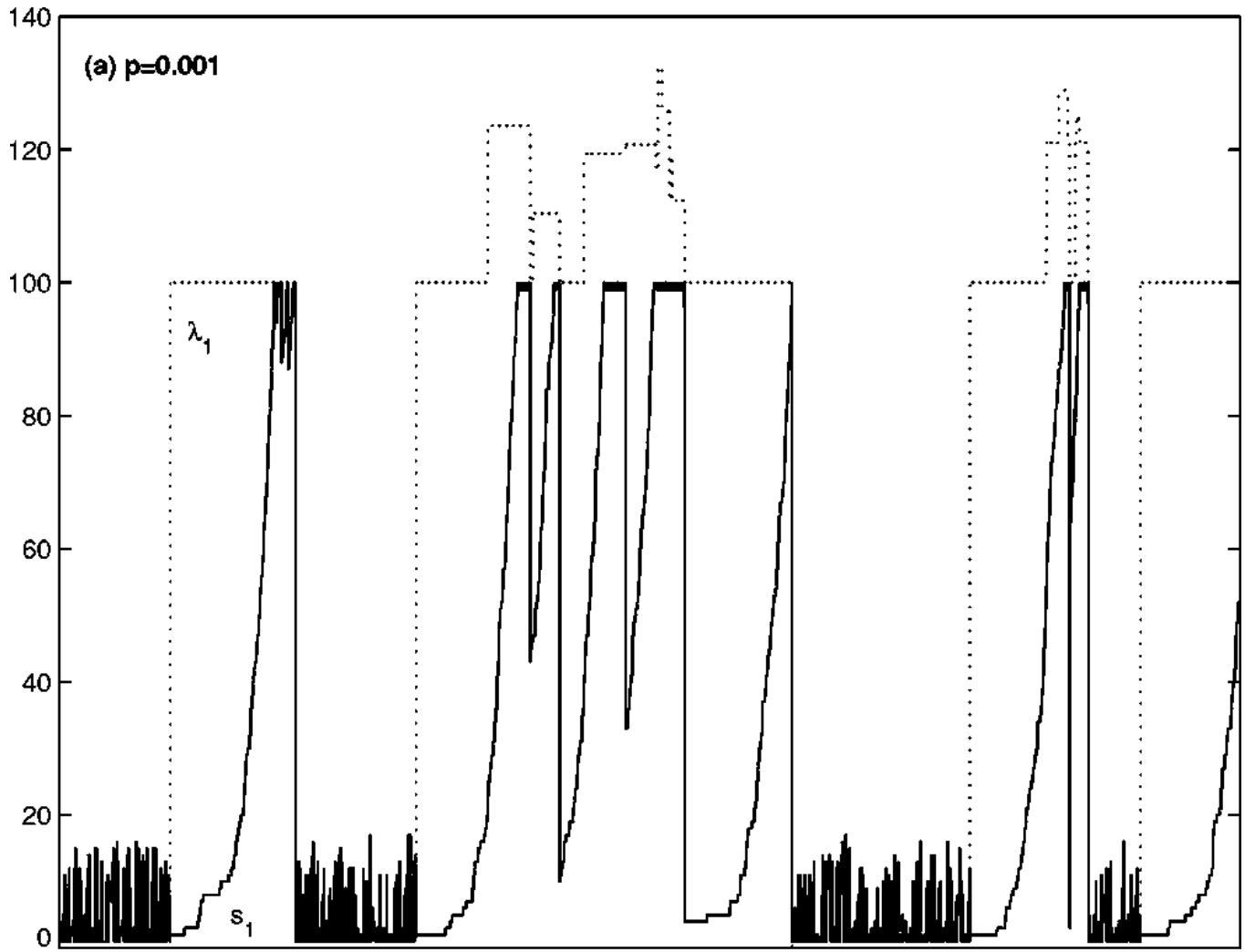
Fluctuations in the Network

Overview


Node with least X_i
Population
Dynamics
(step 1)
Selection
(step 2)
Novelty
(step 3)
New node

The autocatalytic set (ACS)

Network Dynamics

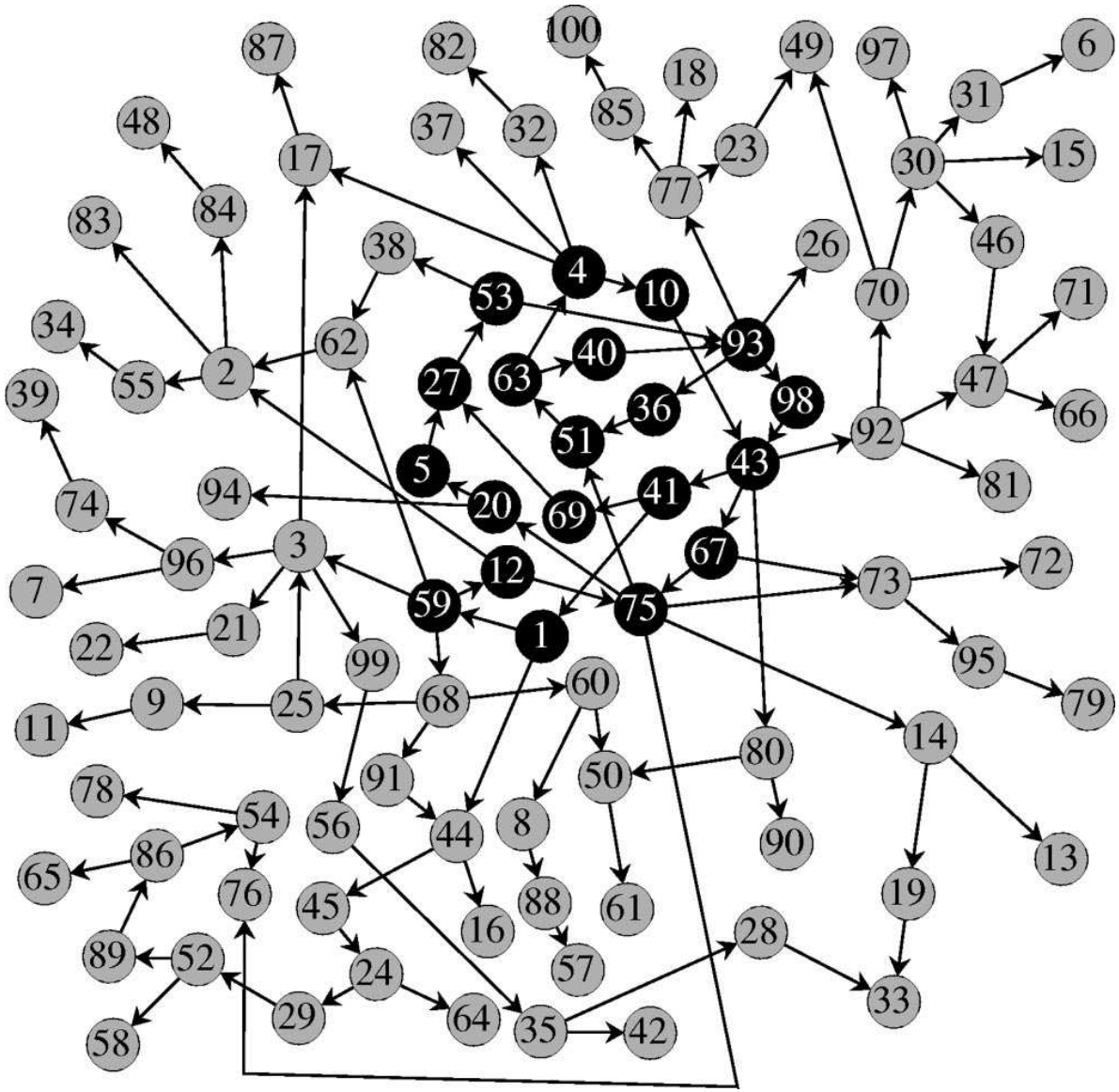


Phases of the Network Dynamics

- random phase
- growth phase
- organized phase
- crash
- recovery

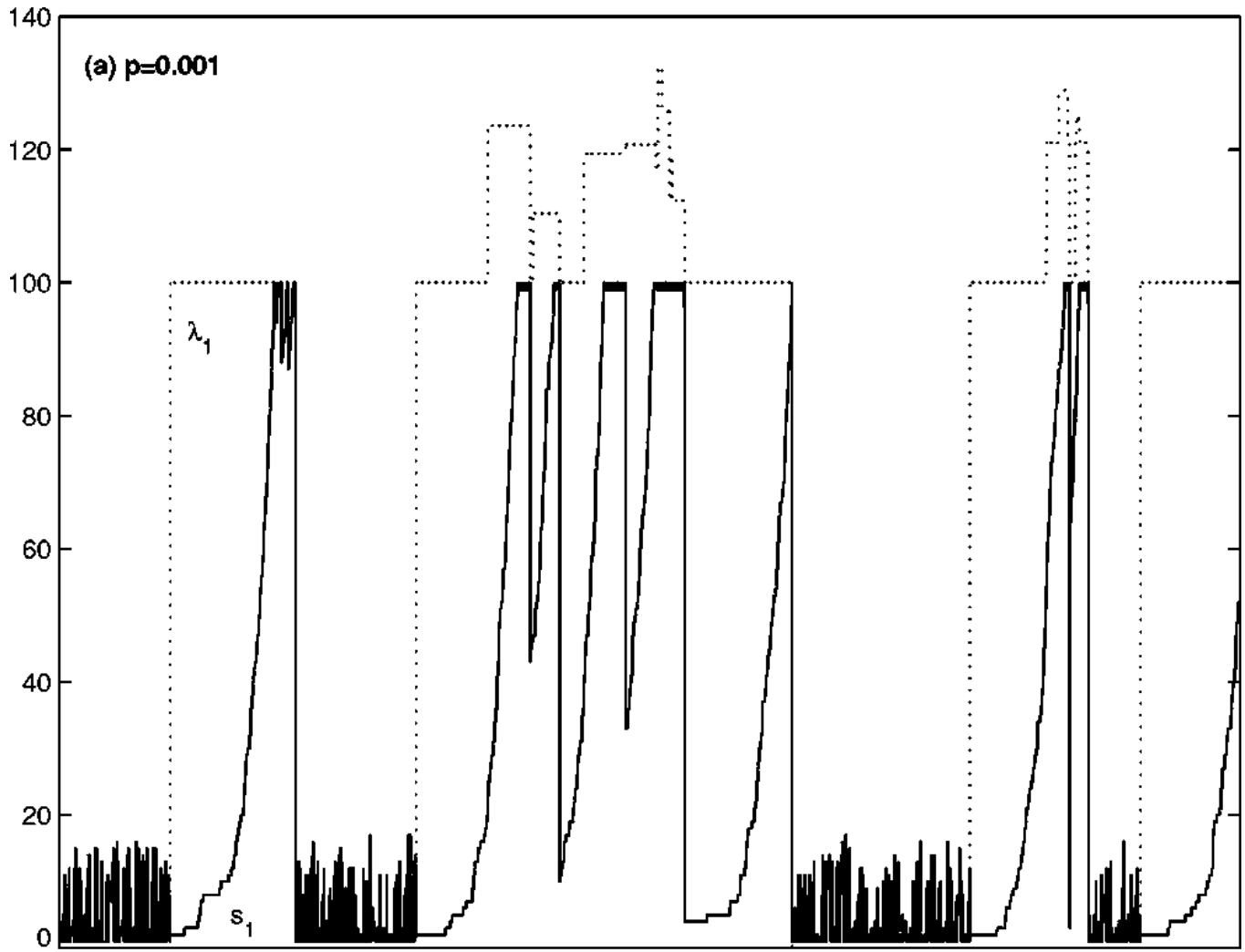
Core and Periphery of a ACS

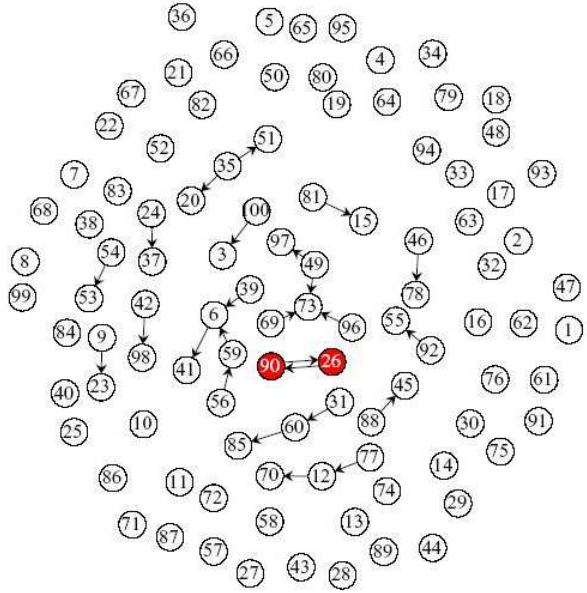
Network Structure

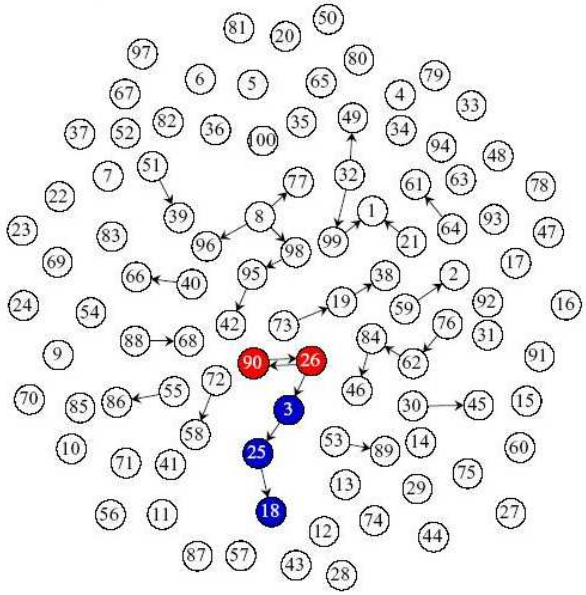


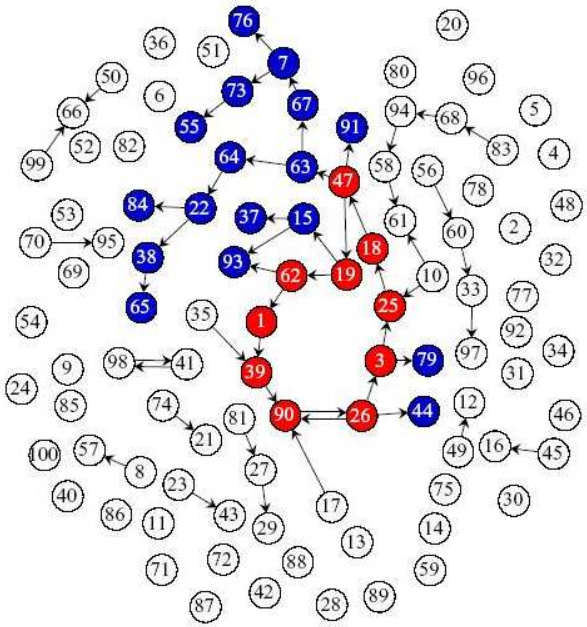
Eigenvector and Eigenvalue

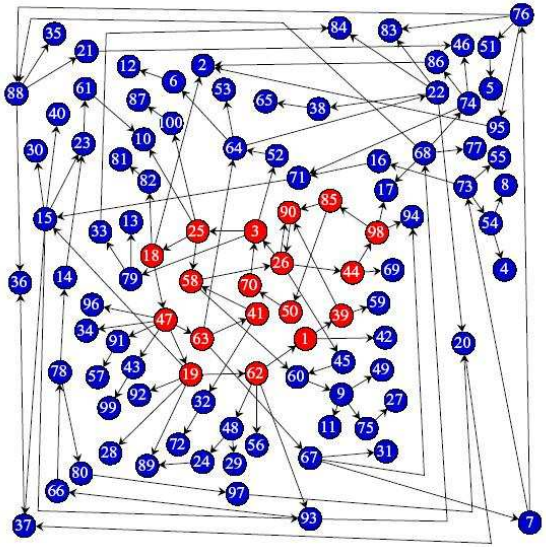
Prediction for the Crash

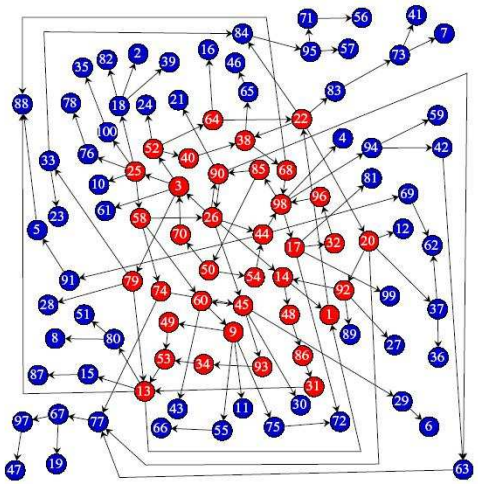


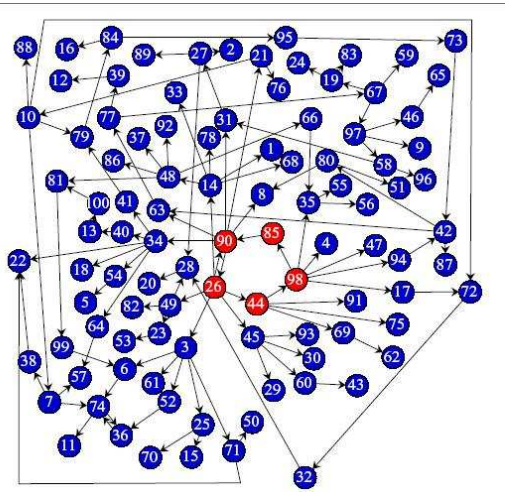


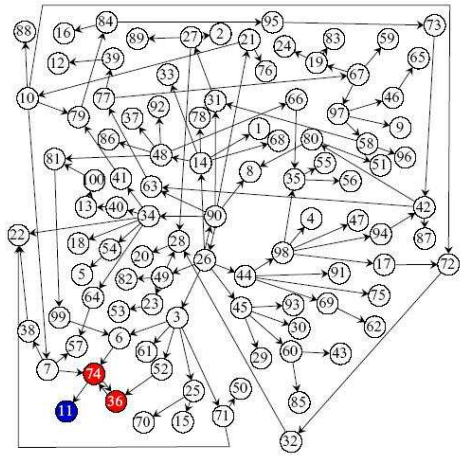


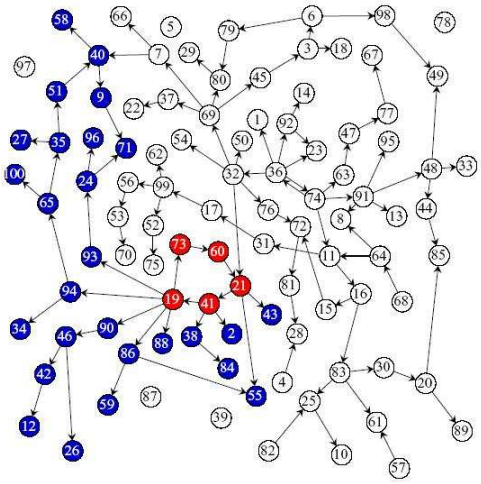


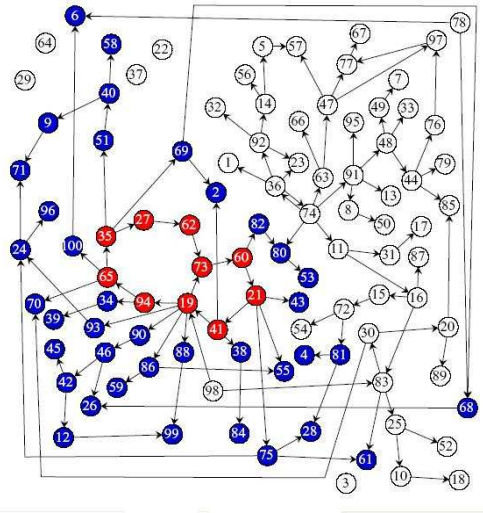


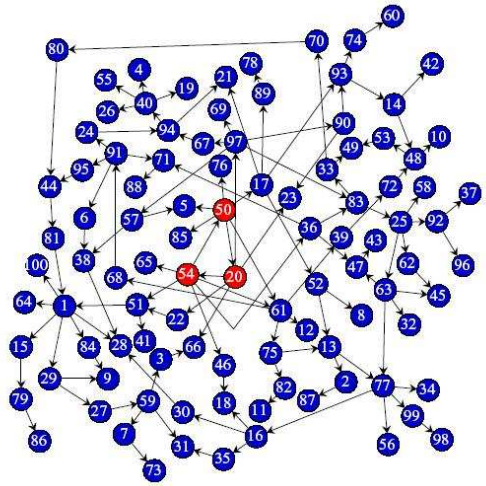


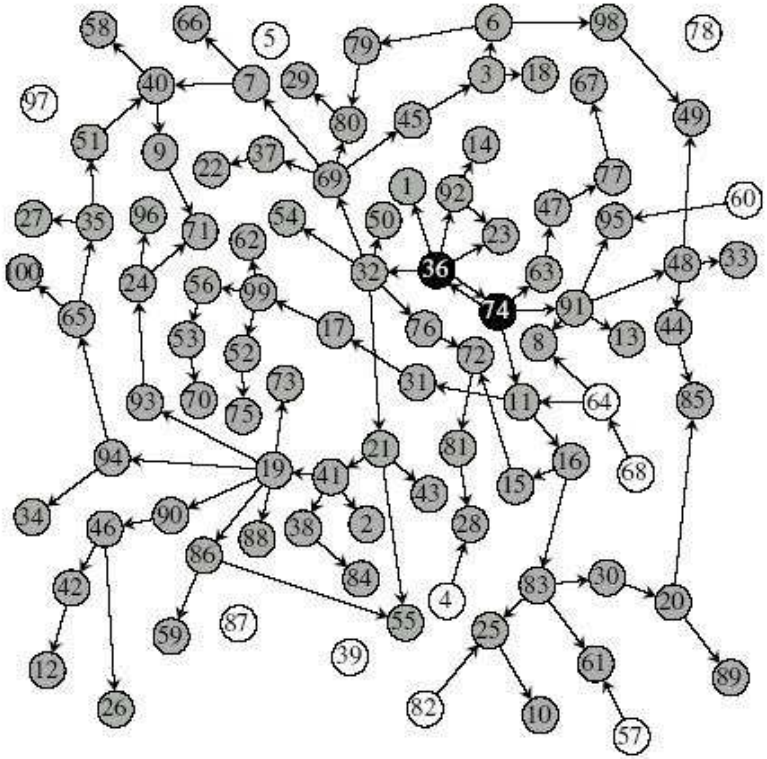


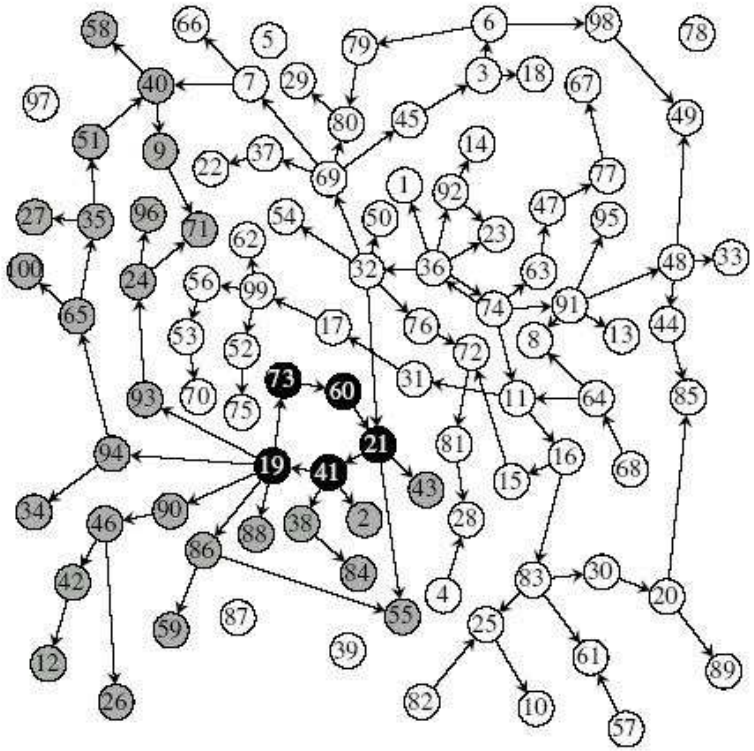






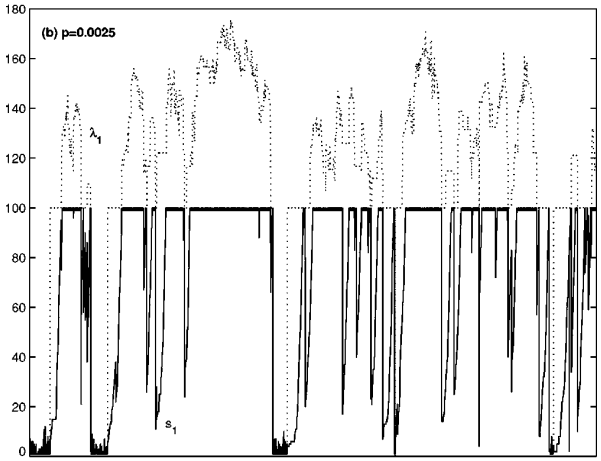



58 66 5 79 6 98 78
40 7 29 3 18 67
97 80 45 49
51 9 22 37 69 14
1 92 77
27 35 96 71 54 50 23 47 95 60
62 32 36 63 48 33
100 24 56 99 74 91
65 53 17 76 8 13 44
52 72
93 70 73 31 11 64 85
75 21 81
94 19 41 43 15 16 68
34 46 90 88 38 2 28
86 84
42 4 83 30 20
59 87 55 25
12 39 61 89
26 82 10 57

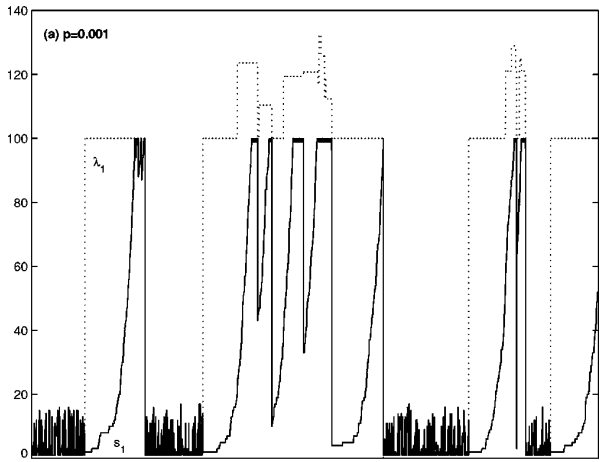

58 66 5 79 6 98 78
40 7 29 3 18 67
97 80 45 49
51 9 22 37 69 14
1 92 77
27 35 96 71 54 50 23 47 95
62 32 36 63 48 33
100 24 56 99 74 91
65 53 17 76 8 13 44
52 72
93 70 73 60 31 11 64 85
75 21 81
94 19 41 43 15 16 68
34 46 90 88 38 2 28
86 84
42 4 83 30 20
59 87 55 25
12 39 61 89
26 82 10 57

Network Structure Depends on the Edge Density p

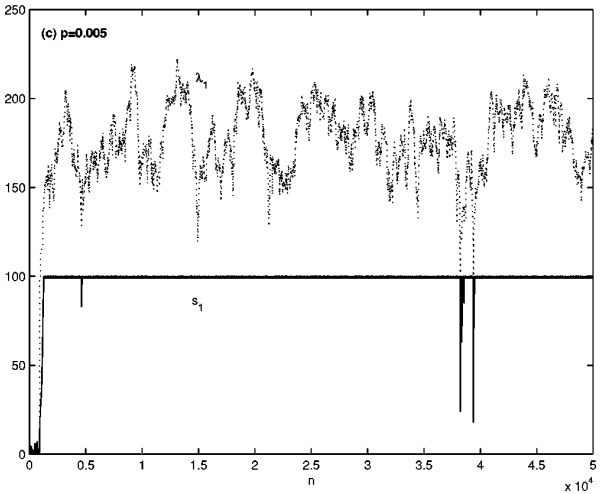
$p = 0.001$



smaller p



larger p



Literature

Crashes, recoveries, and "core shifts" in a model of evolving networks. Sanjay Jain and Sandeep Krishna; Physical Review E (2002), 65, 026103