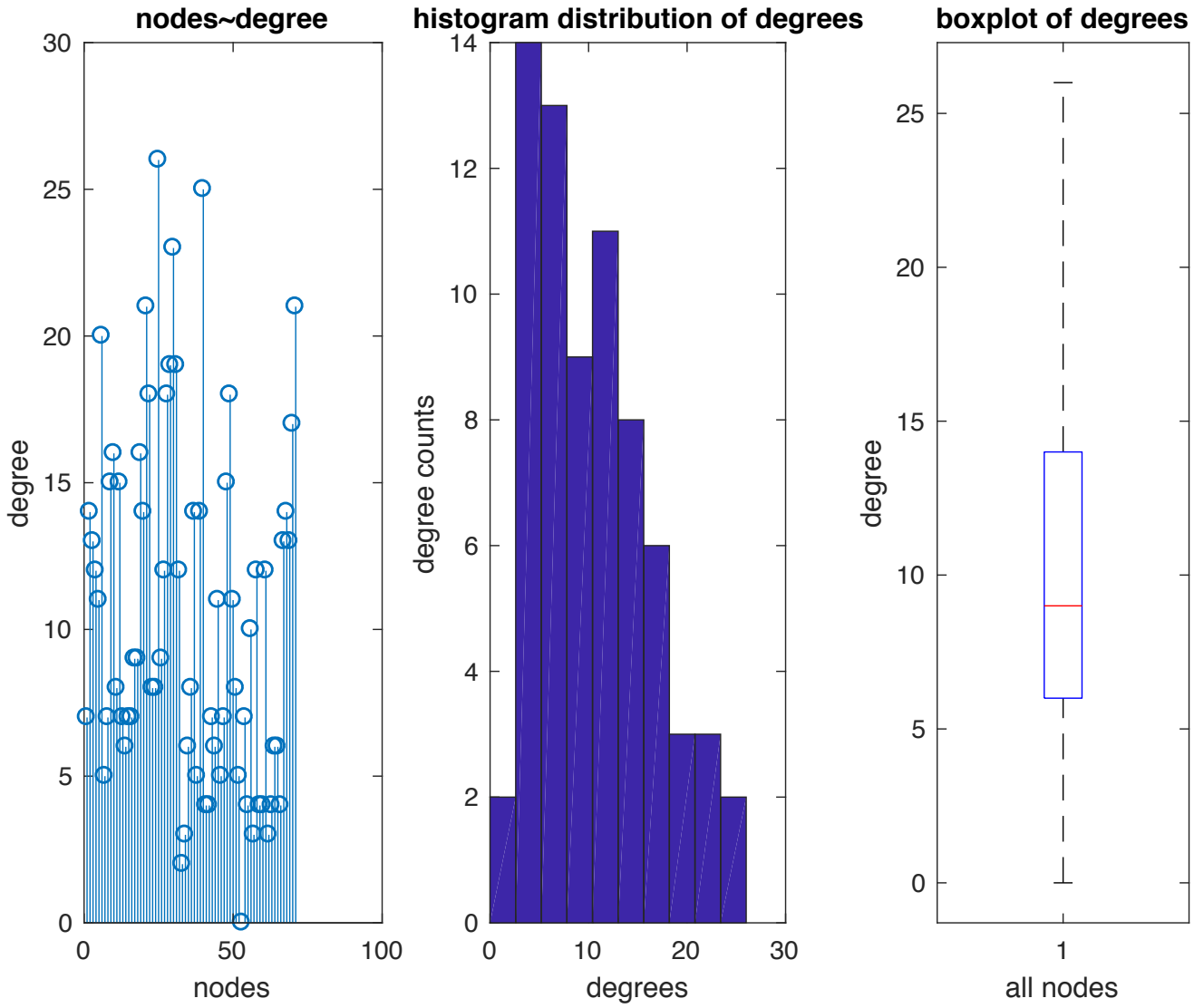
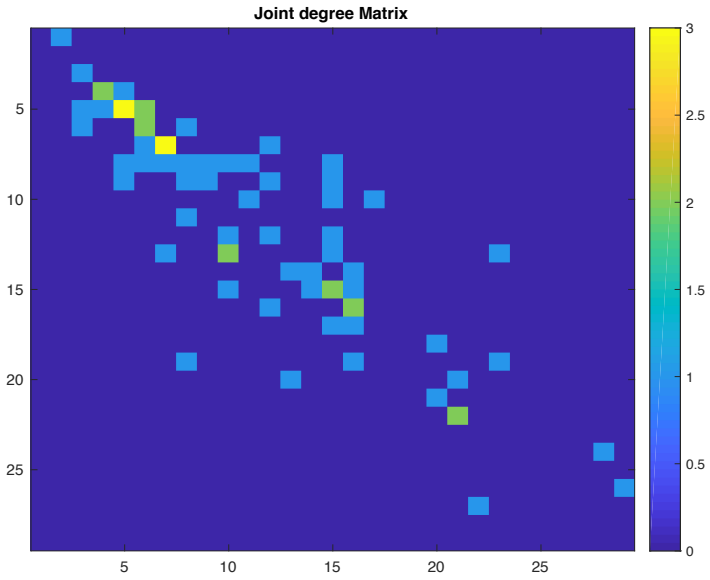
Part1

A) Degree and Similarity

a. Degree

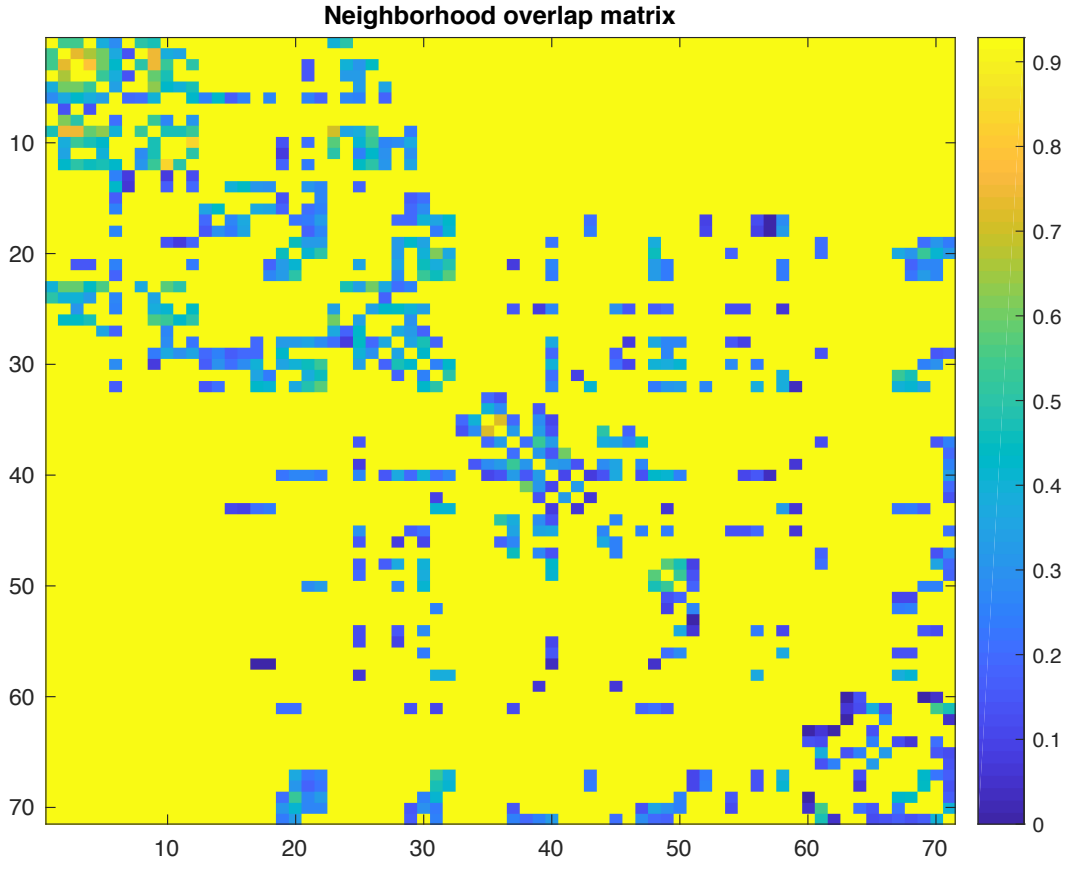


b. Joint degree

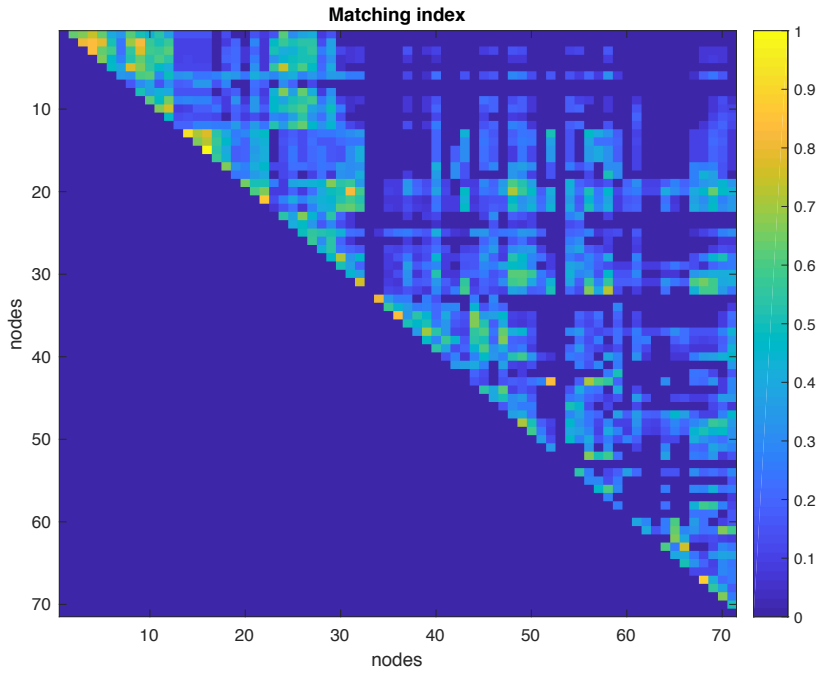


c. Edge Overlap

This matrix shows the neighbors of two nodes that are linked by an edge, and then computes their overlap



d. ***Matching index:*** The matching index computes for any two nodes u and v, the amount of overlap in the connection patterns of u and v. Self-connections and u-v connections are ignored.

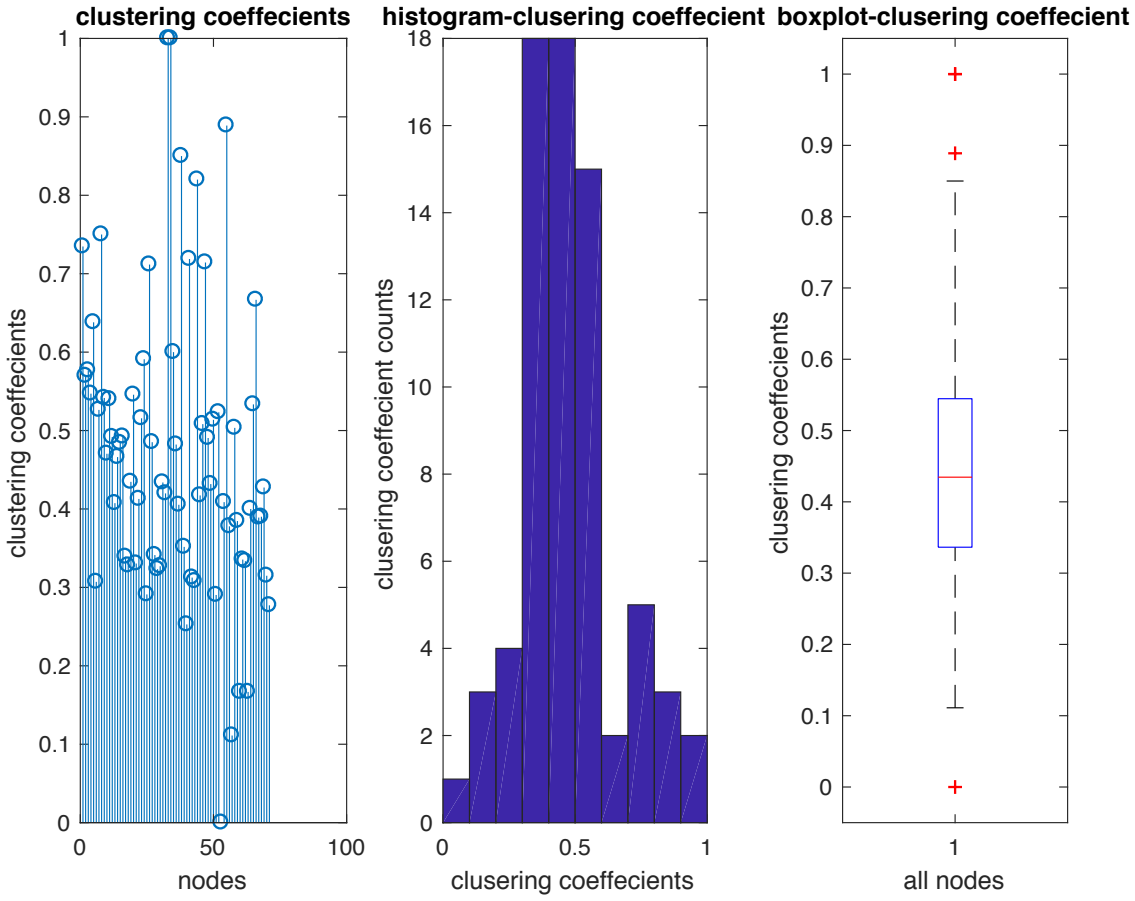


B) **Density and Rentian Scaling**

a. Density: Density is the fraction of present connections to possible connections= 0.1501

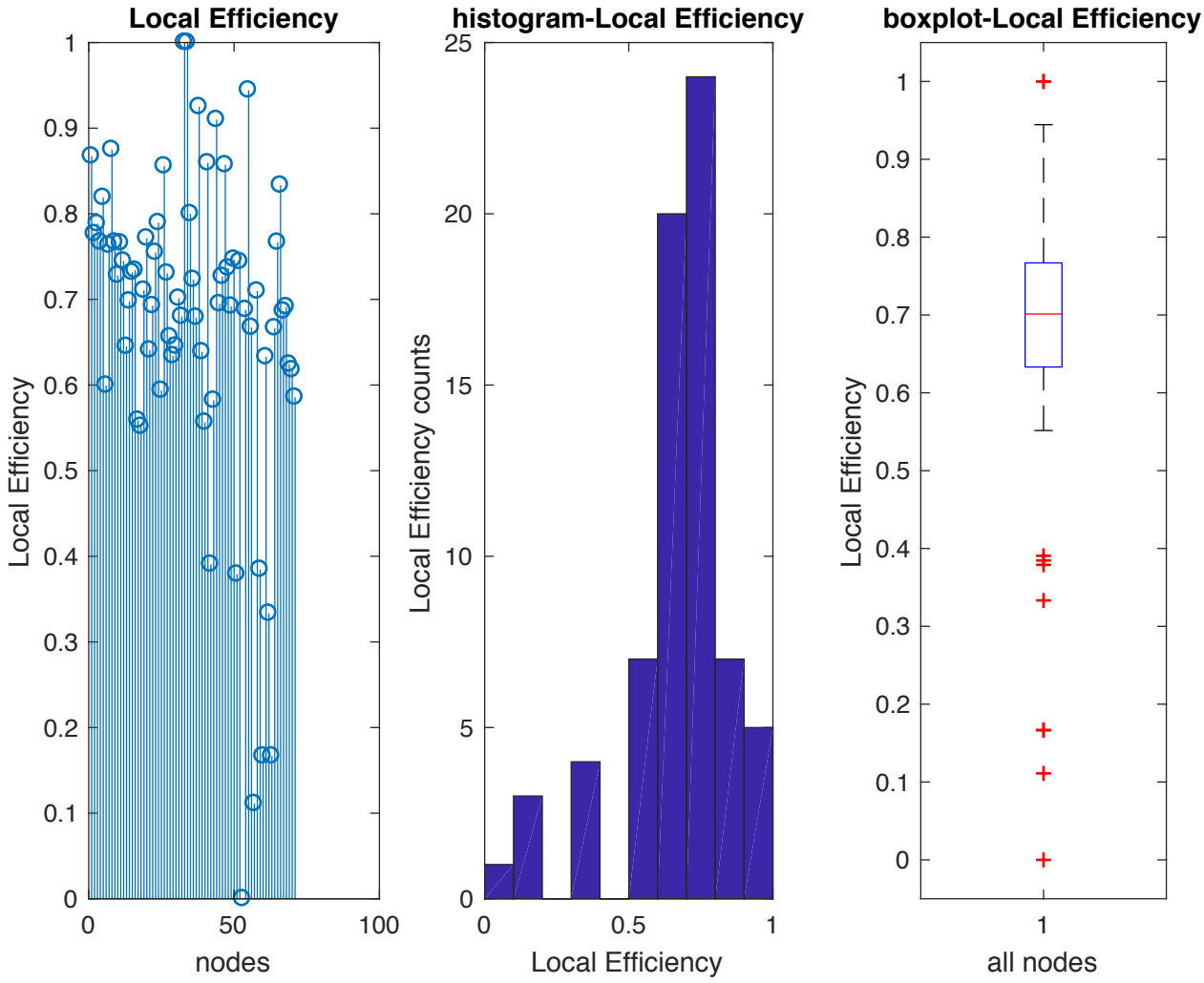
C) **Clustering and Community Structure**

a. *Clustering coefficient:* The clustering coefficient is the fraction of triangles around a node and is equivalent to the fraction of node's neighbors that are neighbors of each other

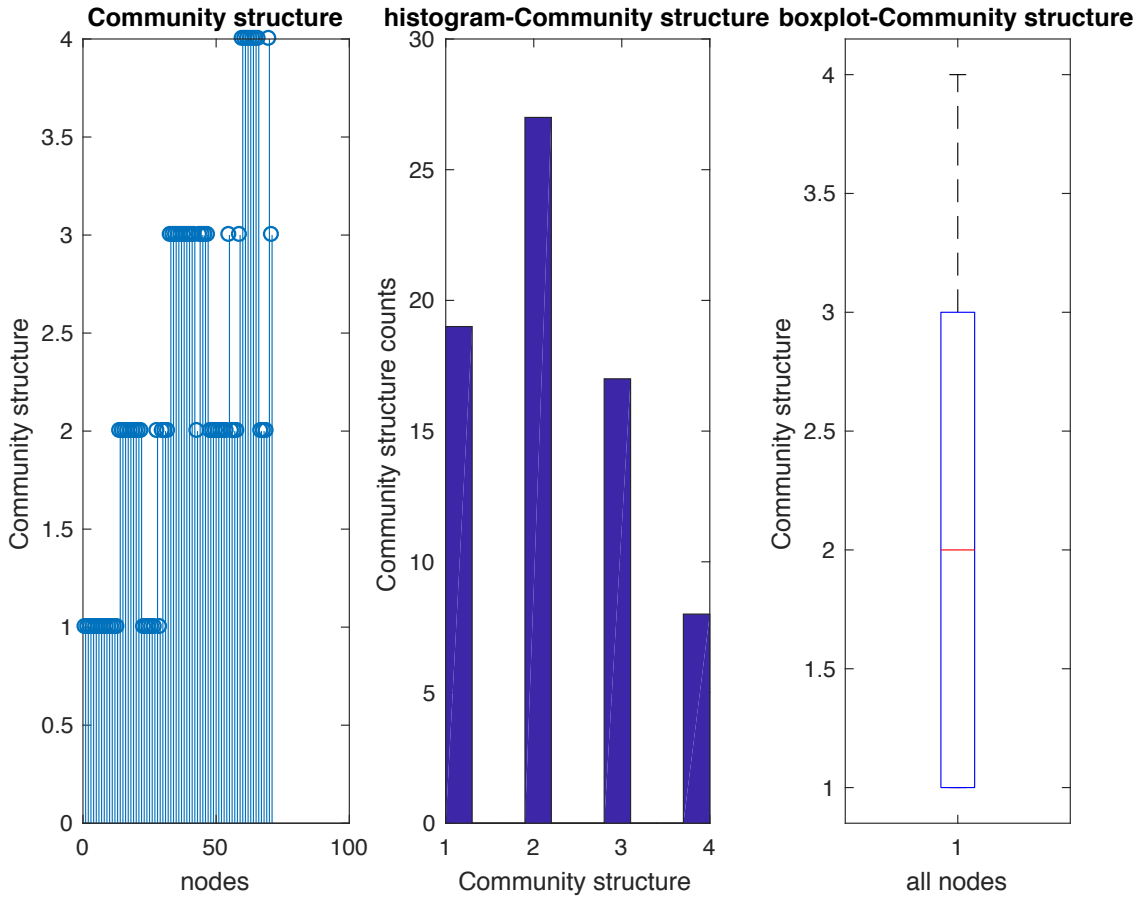


b. Transitivity: The transitivity is the ratio of triangles to triplets in the network and is an alternative to the clustering coefficient= 0.3980

c. Local efficiency*:* The local efficiency is the global efficiency computed on node neighborhoods, and is related to the clustering coefficient



d.Community structure and modularity: The optimal community structure is a subdivision of the network into nonoverlapping groups of nodes in a way that maximizes the number of within-group edges, and minimizes the number of between-group edges.



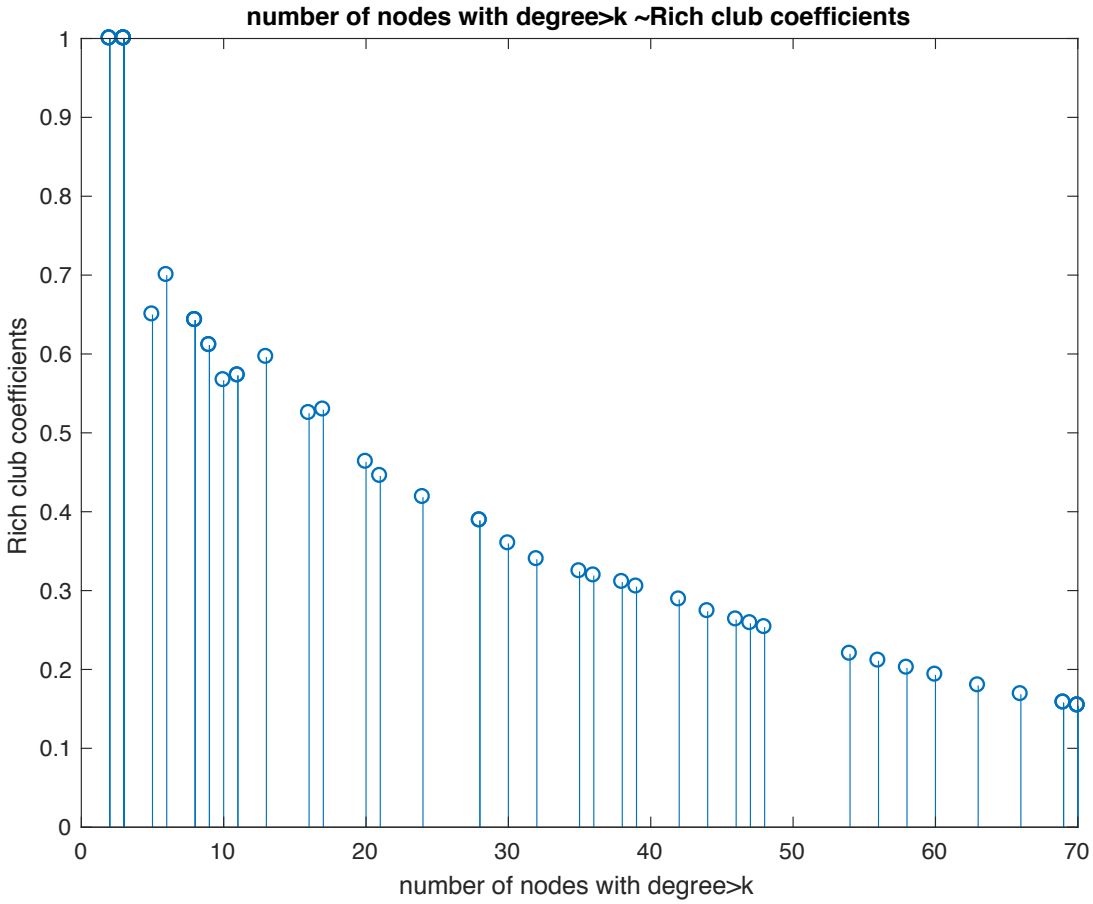
The modularity is a statistic that quantifies the degree to which the network may be subdivided into such clearly delineated groups.
Modularity=0.3945

D) **Assortativity and Core Structure**

a. Assortativity: The assortativity coefficient is a correlation coefficient between the degrees of all nodes on two opposite ends of a link. A positive assortativity coefficient indicates that nodes tend to link to other nodes with the same or similar degree

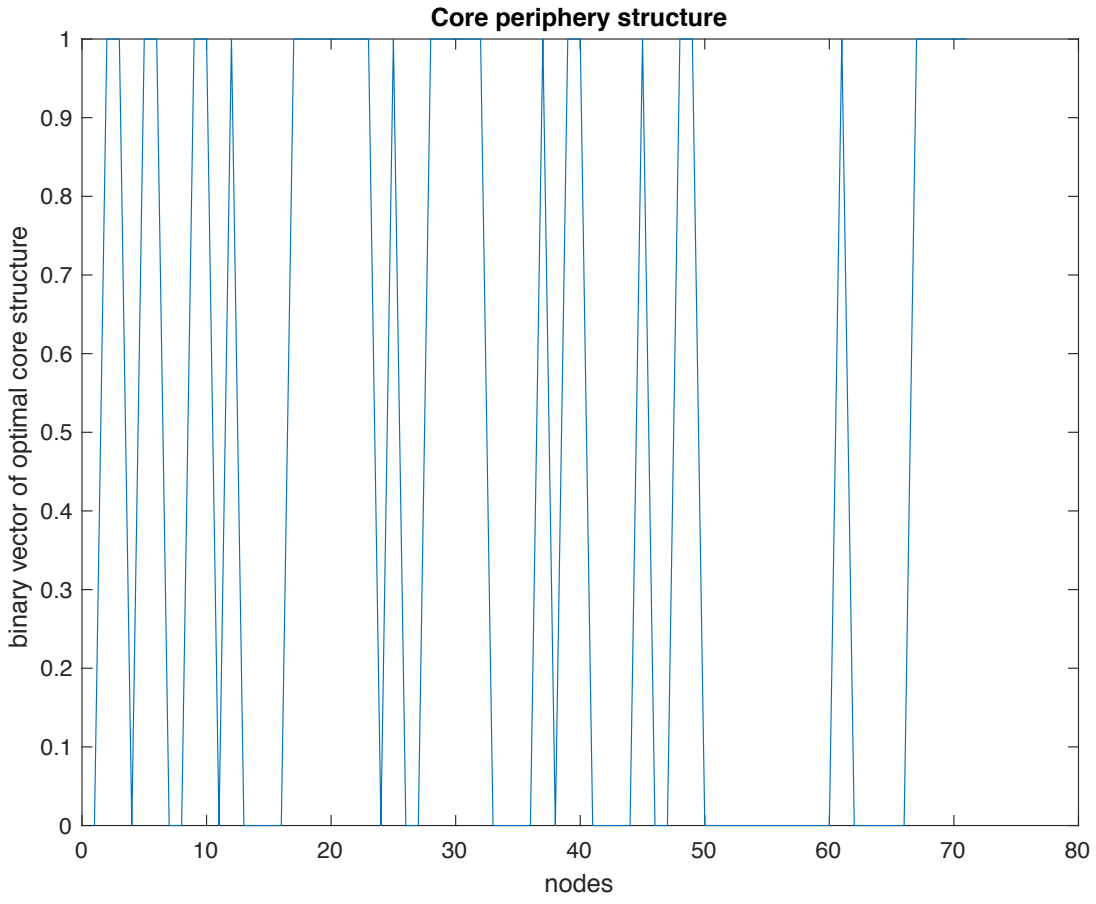
1, directed graph: out-degree/in-degree correlation
r1= -0.0066
2, directed graph: in-degree/out-degree correlation
r2= 0.0490
3, directed graph: out-degree/out-degree correlation
r3= -0.0095
4, directed graph: in-degree/in-degree correlation
r4=0.0566

b. The rich club coefficient at level k is the fraction of edges that connect nodes of degree k or higher out of the maximum number of edges that such nodes might share.



c. Core/periphery structure:The core/periphery subdivision is a partition of the network into two non-overlapping groups of nodes, a core group and a periphery group, in a way that maximizes the number/weight of within core-group edges, and minimizes the number/ weight of within periphery-group edges.

C = 1 represents nodes in the core
C = 0 represents nodes in the periphery



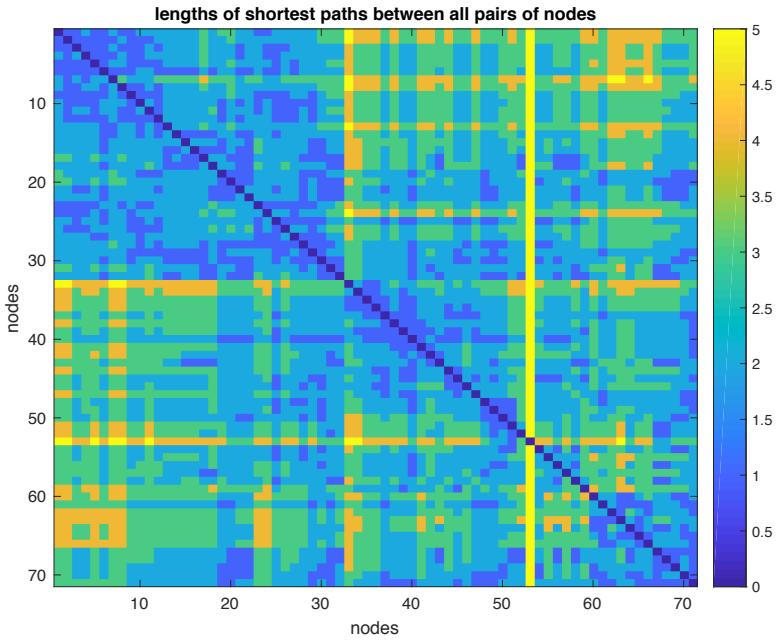
maximized core-ness statistic q=0.4565

d. K-core: The k-core is the largest subnetwork comprising nodes of degree at least k. The k-core is computed by recursively peeling off nodes with degree lower than k, until no such nodes remain in the subnetwork.

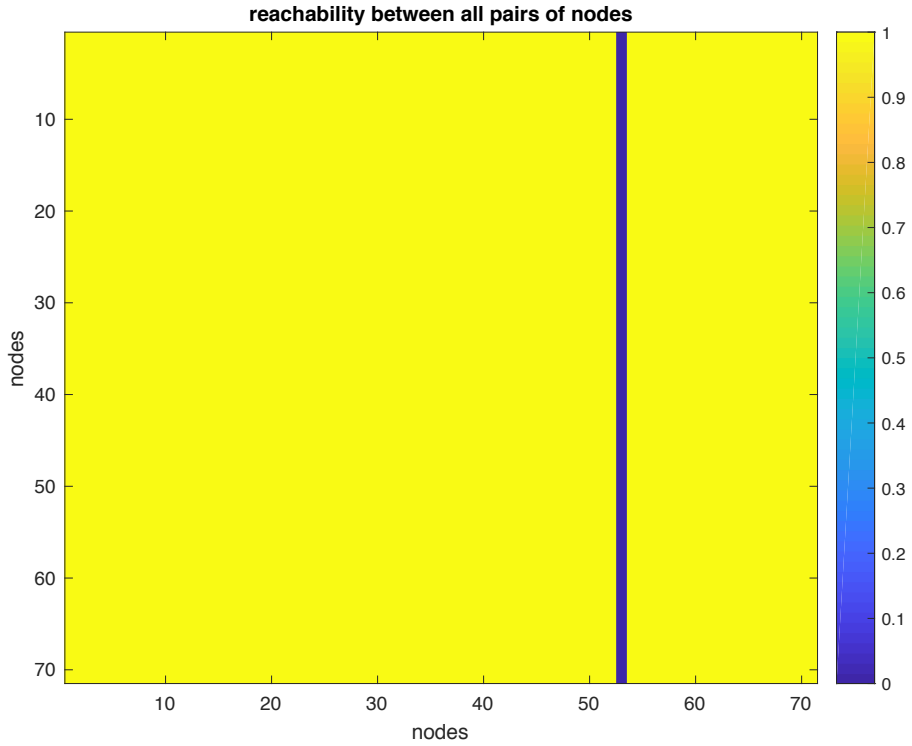
E. **Paths and Distances**

a. Walks: Walks are sequences of linked nodes, that may visit a single node more than once.

b. Distance:

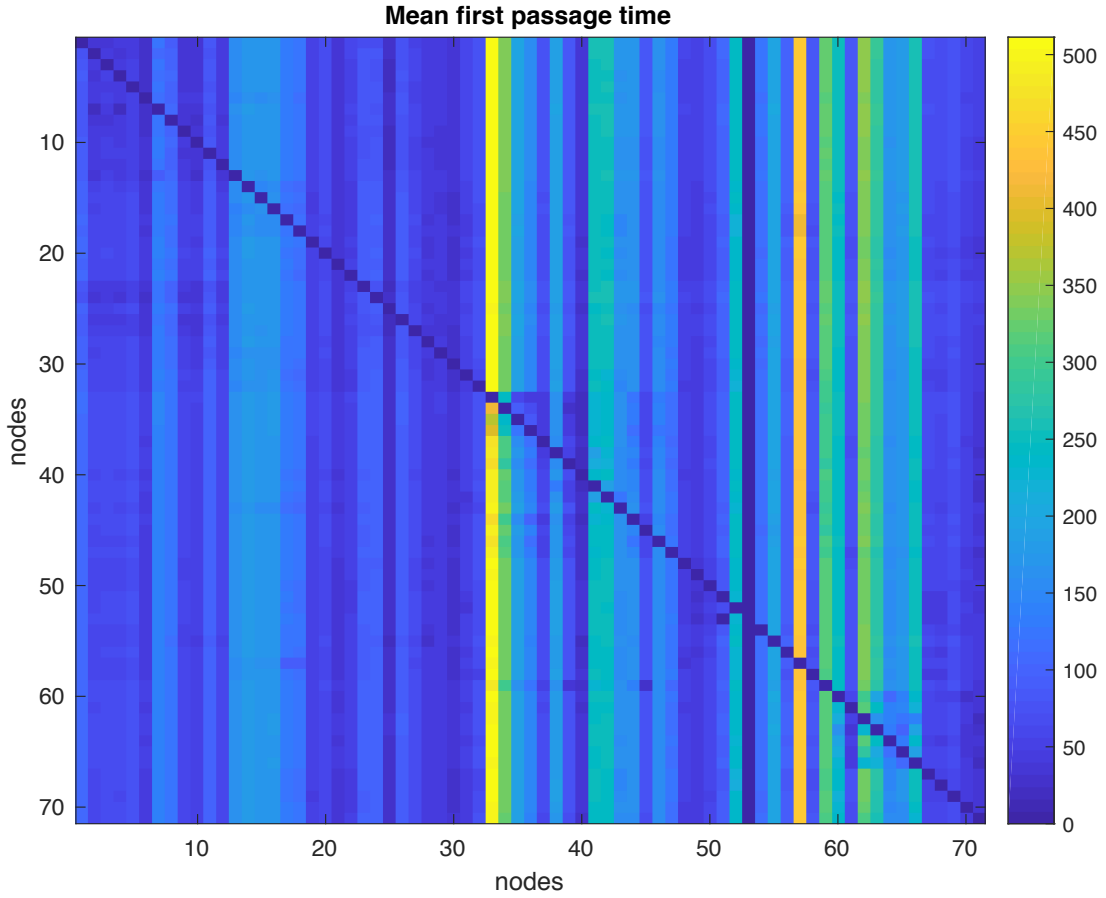


Reachability:

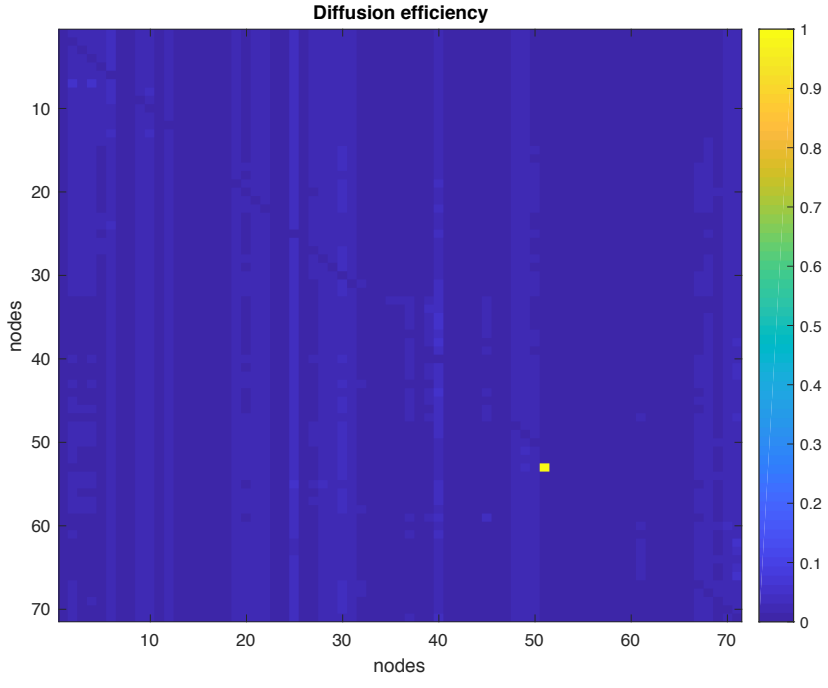


F) **Efficiency and Diffusion**

a. Mean first passage time: The first passage time is the expected number of steps it takes a random walker to reach one node from another.

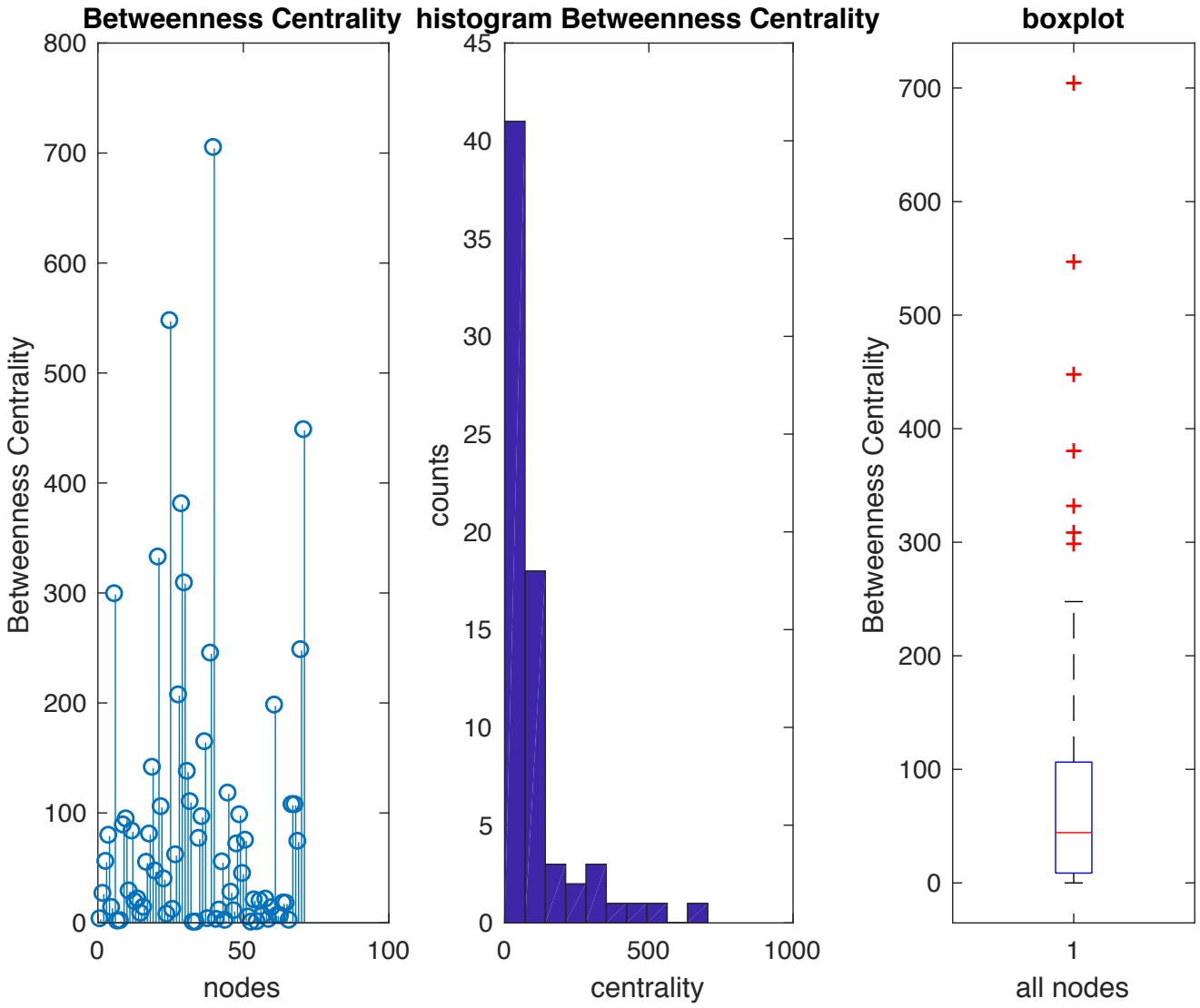


b. Diffusion efficiency: The diffusion efficiency is the inverse of the mean first passage time.

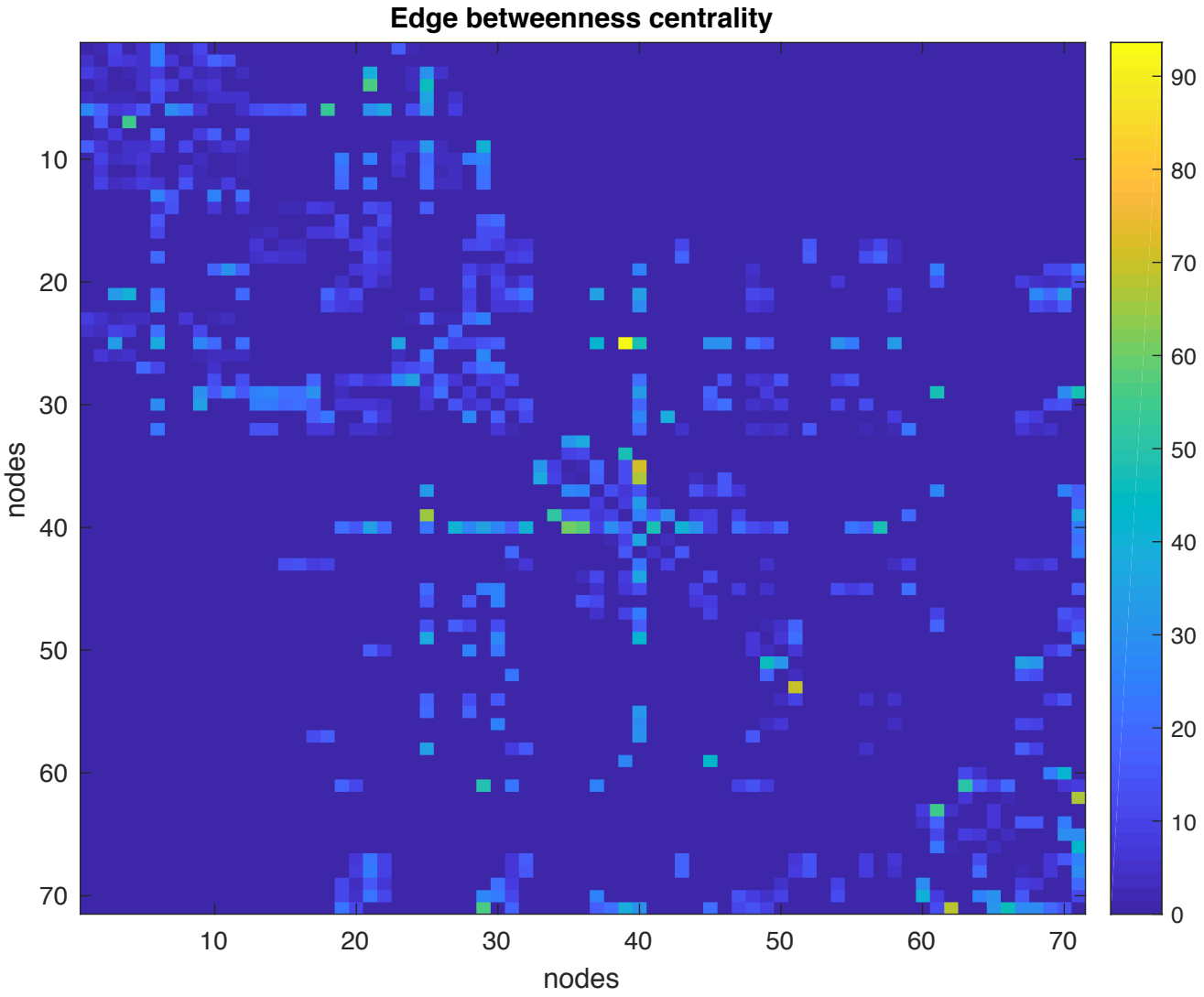


G) **Centrality**

a. Betweenness centrality: Node betweenness centrality is the fraction of all shortest paths in the network that contain a given node. Nodes with high values of betweenness centrality participate in a large number of shortest paths.

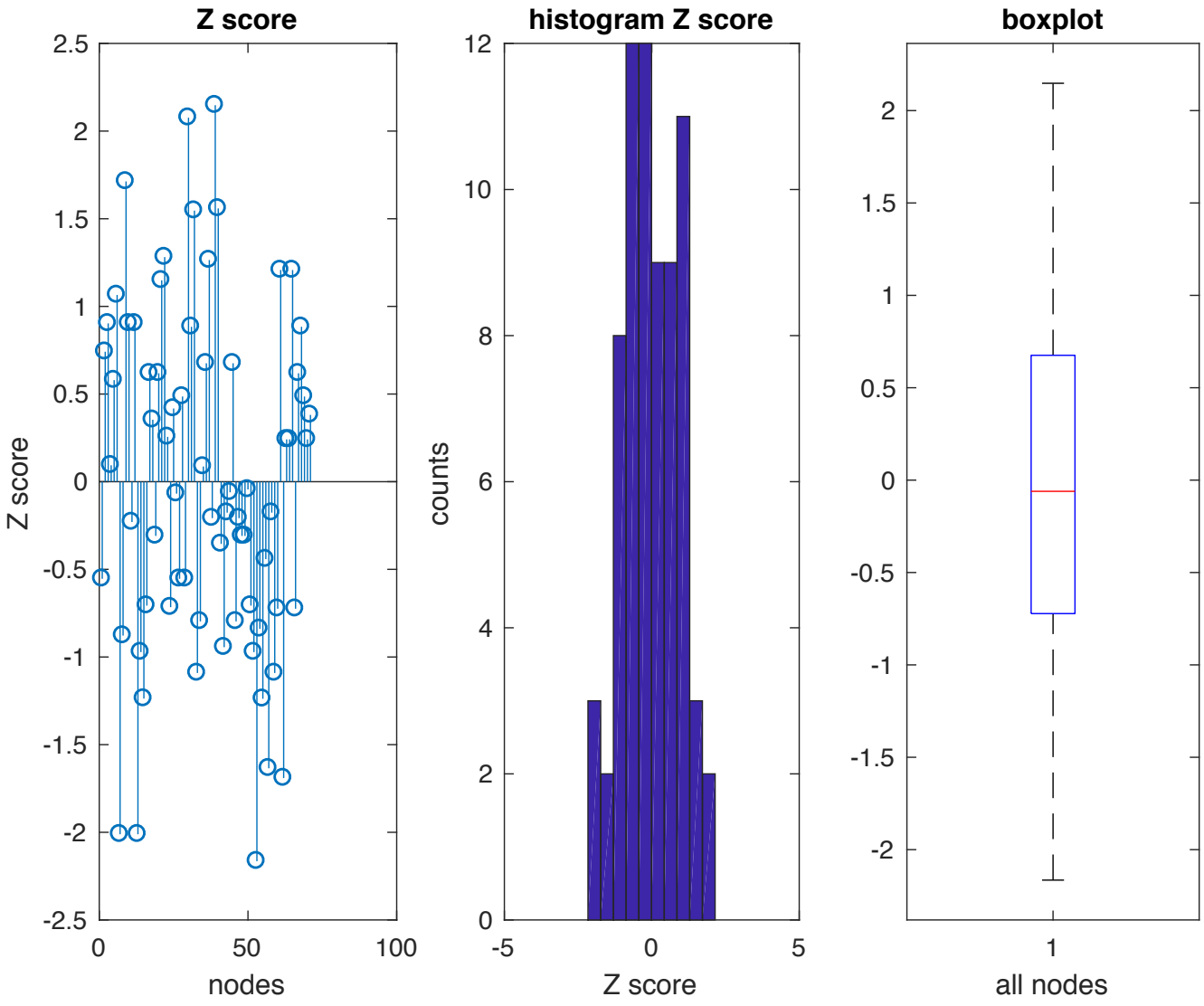


b. Edge betweenness centrality: Edge betweenness centrality is the fraction of all shortest paths in the network that contain a given edge. Edges with high values of betweenness centrality participate in a large number of shortest paths.



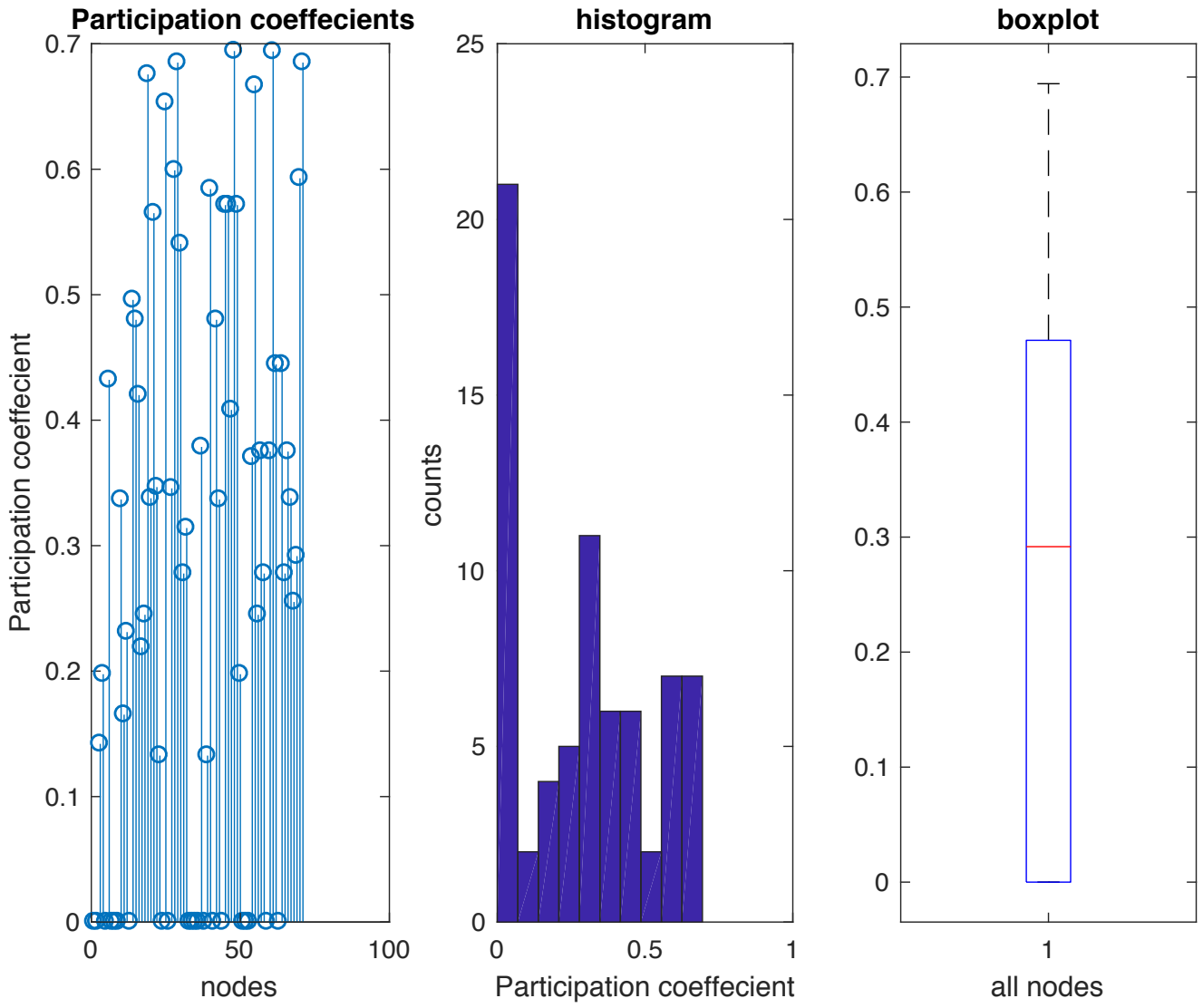
c. Within-module degree z-score: The within-module degree z-score is a within-module version of degree centrality.

for directed graph: out-degree and in-degree

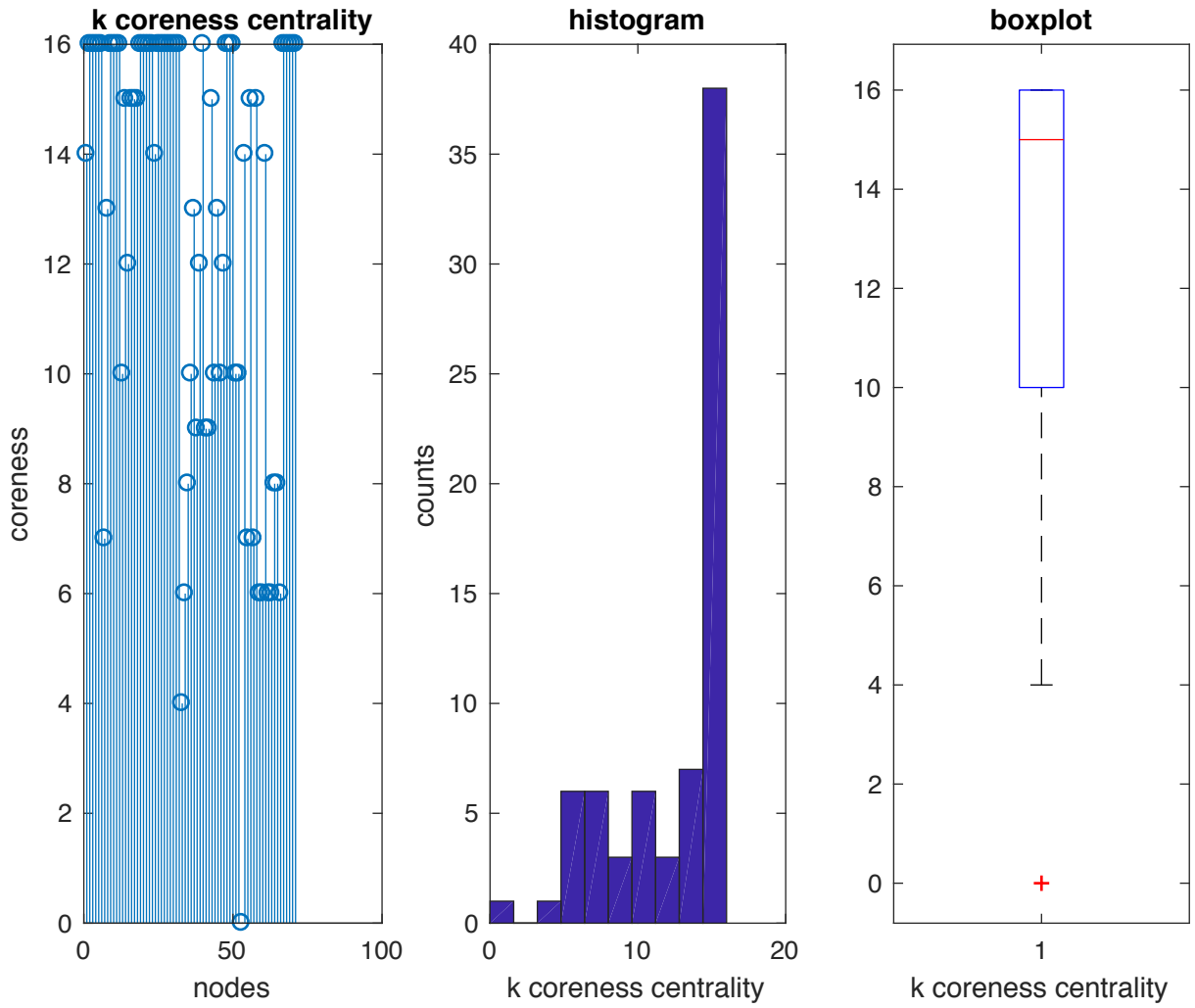


d. Participation and related coefficients: Participation coefficient is a measure of diversity of intermodular connections of individual nodes.

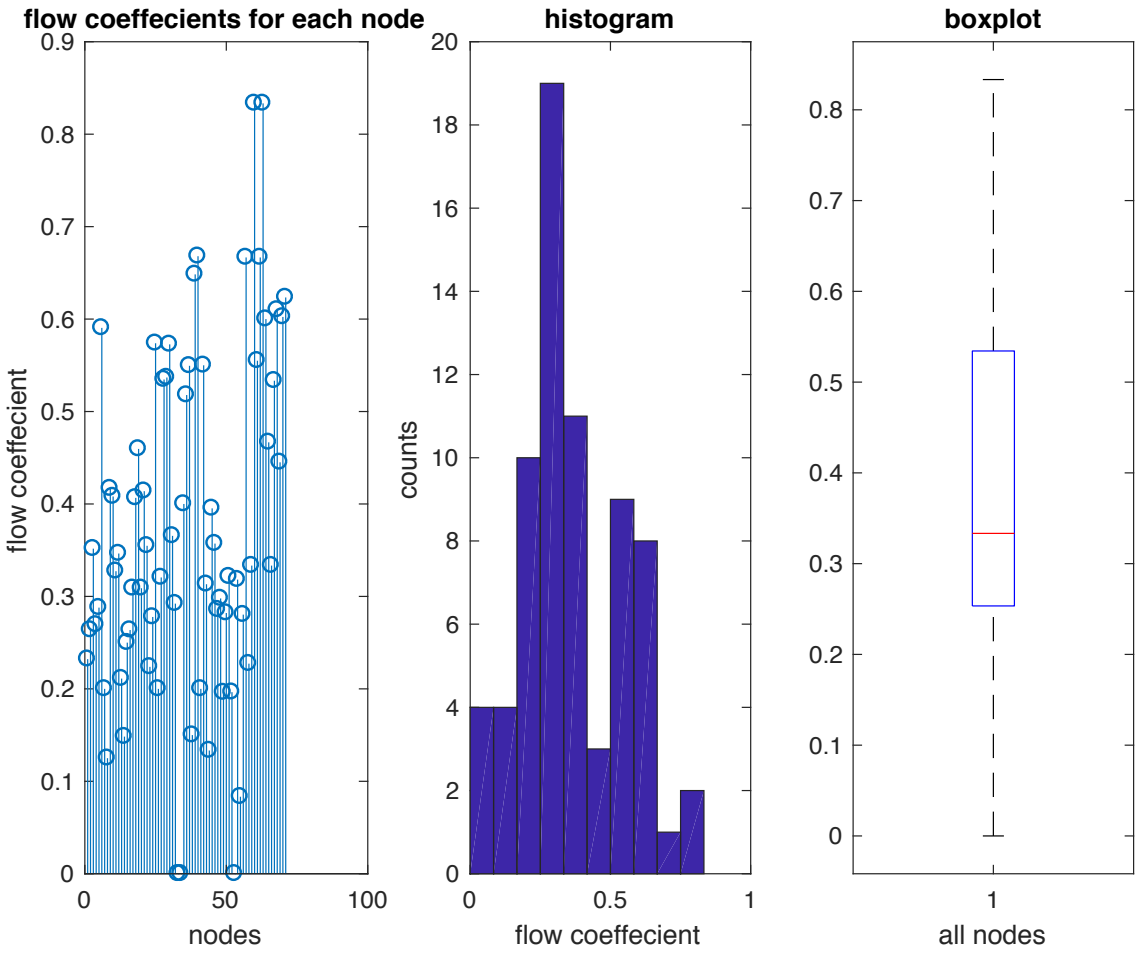
for directed graph: out-degree



e. K-coreness centrality: The k-core is the largest subgraph comprising nodes of degree at least k. The coreness of a node is k if the node belongs to the k-core but not to the (k+1)-core

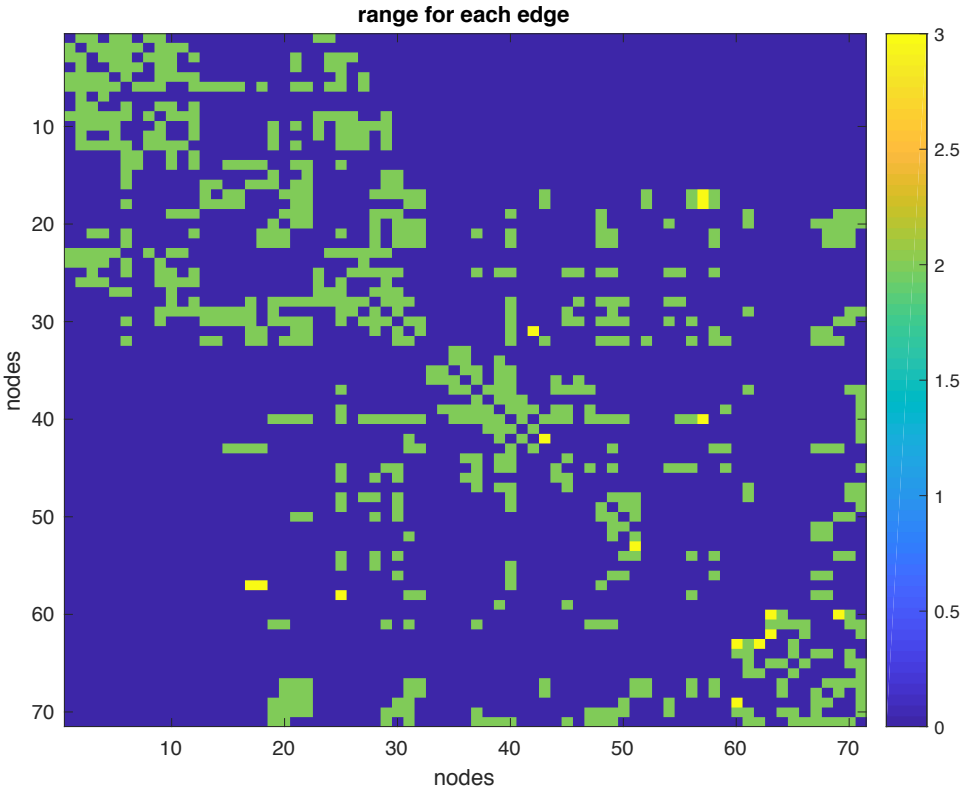


f. Flow coefficient: The flow coefficient is similar to betweenness centrality, but computes centrality based on on local neighborhoods. The flow coefficient is inversely related to the clustering coefficient.



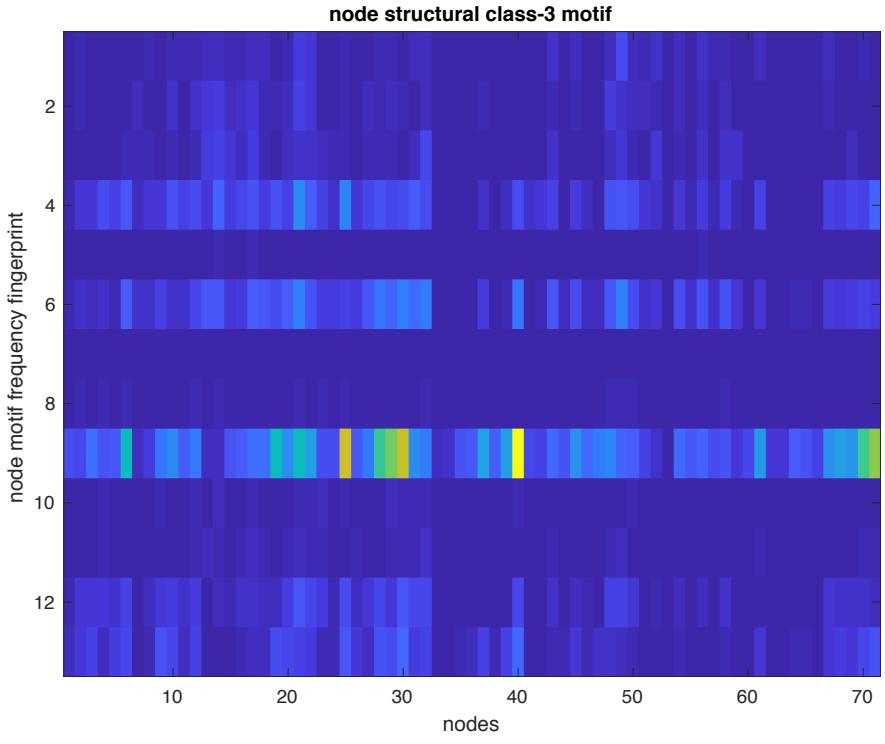
average flow coefficient over the network= 0.3706

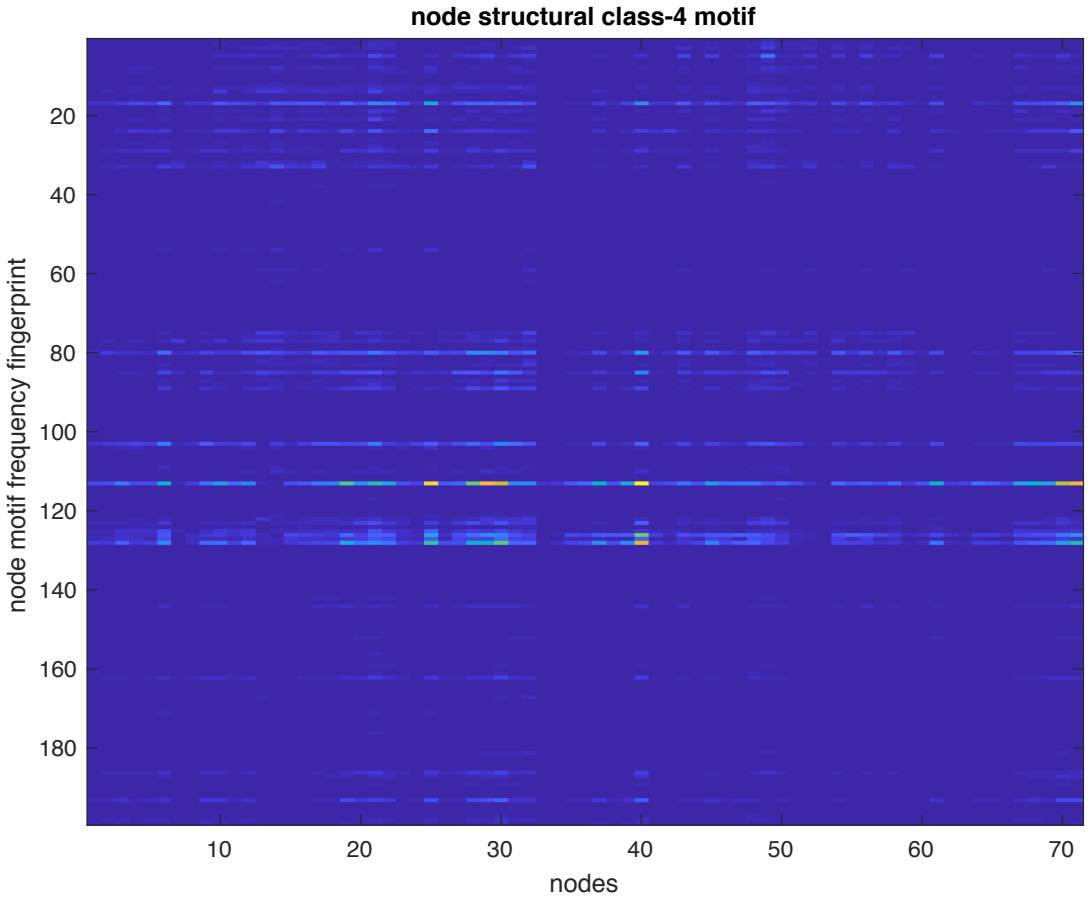
g. Shortcuts: Shorcuts are central edges which significantly reduce the characteristic path length in the network.



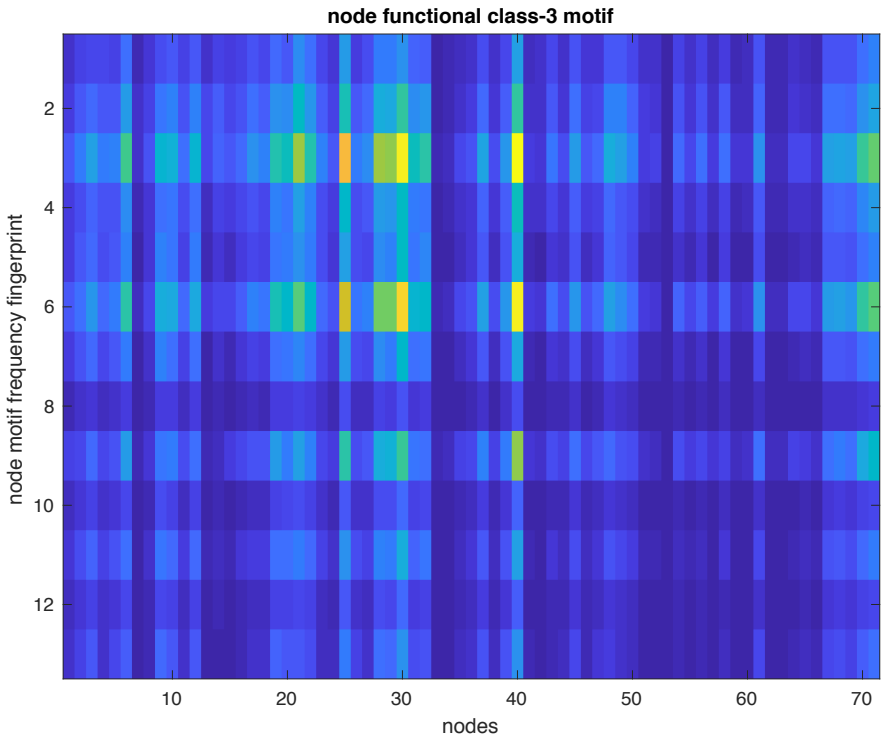
H) **Motifs**

a. Structural Motifs

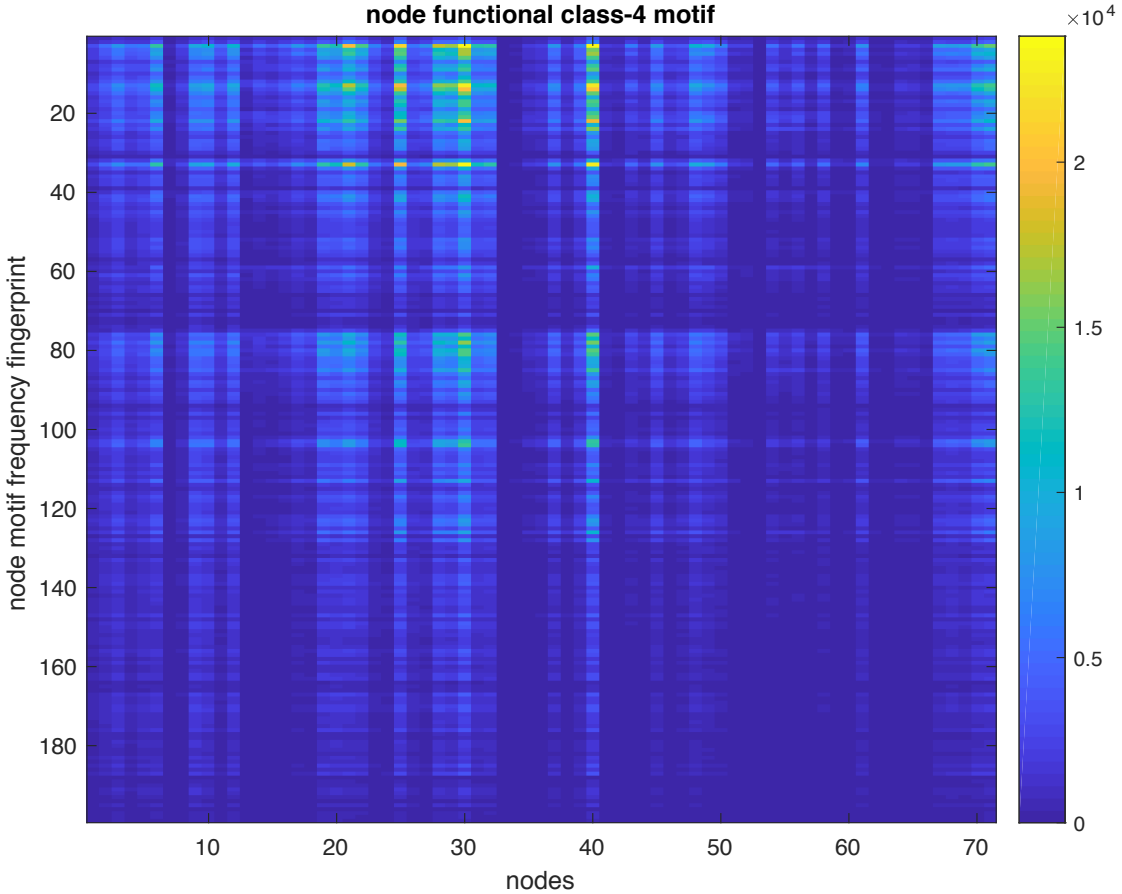



node structural class-4 motif
node motif frequency fingerprint
20
40
60
80
100
120
140
160
180
10
20
30
40
50
60
70
nodes

Functional Motifs
Class-3



Class-4



Part-2 Visualisation: