

# Appendix to “A comparative study of six software packages for complex network”

## Software Web Sites (Section 2)

The respective Web sites for UCINET, Pajek, Networkx, iGraph, JUNG, statnet are:

<http://www.analytictech.com/>

<http://vlado.fmf.uni-lj.si/pub/networks/pajek/>

<http://networkx.lanl.gov/>

<http://cneurocv.s.rmkf.kfki.hu/igraph/>

<http://jung.sourceforge.net/index.html>

<http://CRAN.R-project.org/package=statnet>

## Data details

### Section 3.2

For all packages:  $|V| = 5120(N1)$ ,  $10240(N2)$ ,  $20480(N3)$ ,  $40960(N4)$ , and  $|E| = 0.004*|V|*(|V|-1)$ .

For data generation, we use Pajek by clicking on Net->Random Network->Total No. of Arcs. For the popup dialog, please input the number of vertices and press ‘OK’. Then input the number of edges and press ‘OK’. Then set ‘Network without multiple lines’ as ‘Yes’.

### Section 3.3

For all packages:  $|V| = 20480$ , and  $|E| = 0.004*|V|*(|V|-1)(N1)$ ,  $|E| = 0.008*|V|*(|V|-1)(N2)$ ,  $|E| = 0.012*|V|*(|V|-1)(N3)$ ,  $|E| = 0.016*|V|*(|V|-1)(N4)$ .

For data generation, we use Pajek by clicking on Net->Random Network->Total No. of Arcs

Since UCINET can only read ‘UCINET’ file before performing analysis. All networks in ‘Pajek’ file should be transformed by UCINET to ‘UCINET’ file first.

### Section 3.4

For diameter computation,  $|V| = 5120$ , and  $|E| = 0.004*|V|*(|V|-1)(N1)$ ,  $|E| = 0.008*|V|*(|V|-1)(N2)$ ,  $|E| = 0.012*|V|*(|V|-1)(N3)$ ,  $|E| = 0.016*|V|*(|V|-1)(N4)$ .

For data generation, we use Pajek by clicking on Net->Random Network->Total No. of Arcs

For clustering coefficient computation,  $|V| = 10240$  and  $|E| = 0.004*|V|*(|V|-1)(N5)$ ,  $|E| = 0.008*|V|*(|V|-1)(N6)$ ,  $|E| = 0.012*|V|*(|V|-1)(N7)$ ,  $|E| = 0.016*|V|*(|V|-1)(N8)$ . Since UCINET can only read ‘UCINET’ file before performing analysis. All networks in ‘Pajek’ file should be transformed by UCINET to ‘UCINET’ file first.

### Section 3.5

The parameters for network generation is  $|V| = 20480$  and  $p = 0.004(N1)$ ,  $0.008(N2)$ ,  $0.012(N3)$ ,  $0.016(N4)$

### Section 3.6

The parameters for community detection is  $|V| = 5120$  and  $|E| = 0.004*|V|*(|V|-1)(N1)$ ,  $|E| = 0.008*|V|*(|V|-1)(N2)$ ,  $|E| = 0.012*|V|*(|V|-1)(N3)$ ,  $|E| = 0.016*|V|*(|V|-1)(N4)$ .

### Section 3.7

The parameters for community detection is  $|V| = 5120$  and  $|E| = 0.004*|V|*(|V|-1)(N1)$ ,  $|E| = 0.008*|V|*(|V|-1)(N2)$ ,  $|E| = 0.012*|V|*(|V|-1)(N3)$ ,  $|E| = 0.016*|V|*(|V|-1)(N4)$ .

### Section 4.2

The parameters for visualization is  $|V| = 10240$  and  $|E| = 0.004*|V|*(|V|-1)(N1)$ ,  $|E| = 0.008*|V|*(|V|-1)(N2)$ ,  $|E| = 0.012*|V|*(|V|-1)(N3)$ ,  $|E| = 0.016*|V|*(|V|-1)(N4)$ .

To download the data, please refer to <http://www.shenlejun.cn/data.7z>. Please uncompress it with winrar.

## Software Options/Settings

### Section 3.2

To transform 'Pajek' file into 'UCINET' file using UCINET, please click on Data->Import text file->Pajek.

To read 'Pajek' file using Pajek, please click on File->Network->Read

To write 'Pajek' file using Pajek, please click on File->Network->Save

### Section 3.3

To get shortest path of given two nodes using UCINET, please click on Network->Paths. For the popup dialog, choose the specified dataset. Set 'From node' as 'v1' and "To node" as 'v20481' first; then set 'Type of paths desired' as 'Lengths <= K'; set 'Value of K' as '3'.

To get shortest path of given two nodes using Pajek, please click on Net->Paths between 2 nodes->All Shortest For the popup dialog, set 'From' as '1' and press OK. Then set 'from (1) to' as '20481' and press 'OK'. Then set 'Forget values on lines' as 'NO'. At last, set 'identify vertices in source network' as 'Yes'.

### Section 3.4

To get clustering coefficient using UCINET, please click on Network->Cohesion->Clustering Coefficient.

To get diameter using Pajek, please click on Net->Paths between 2 nodes->Diameter.

To get clustering coefficient using Pajek, please click on Net->Vector->Clustering Coefficient->CC1.

### Section 3.5

To generate graph with Erdos-Renyi model using UCINET, please click on Data->Random-> Erdos-Renyi random model. For the popup dialog, set 'Number of nodes' be '20480' first; then set 'density' be '0.004'(N1), '0.008'(N2), '0.012'(N3), '0.016'(N4); set 'Number of graphs' as '1' then; at last set 'Type of graph' as 'Undirected'.

To generate graph with Erdos-Renyi model using Pajek, please click on Net->Random Network->Erdos-Renyi->Undirected->General. For the popup dialog, set 'How many vertices' as 20480 first and press OK; then set 'average degree of vertices' as '40.958'(N1), '81.916'(N2), '122.874'(N3), '163.832'(N4) and press OK.

### Section 3.6

To find clique using UCINET, please click on Network->Subgroups->Cliques. For the popup dialog, leave all the parameters as the default provided by the system.

To find clique using Pajek, please click on Net->Partitions->p-Cliques->Weak. For the popup dialog, set 'Proportion of linkage with member' as '1.0' and press OK.

### Section 3.7

To visualize data with circular layout using UCINET, please click on Visualize->Netdraw->File->Open->Ucinet dataset->Network first, then click on Layout->Circle.

To visualize data with circular layout using Pajek, please click on Draw->Draw first, then click on Layout->Circular->Original.

To download source code for the other software packages, please refer to <http://www.shenlejun.cn/sourcecodecomplexnetwork.rar>.

### Messages from statnet for the scalability test

Table	Message
Table 2	Error: cons memory exhausted (limit reached?)
Table 5	Error: cons memory exhausted (limit reached?)
Diameter	“Error: cannot allocate vector of size 200.0 Mb” “Error: cannot allocate vector of size 400.0 Mb” In addition: Warning messages: 1: In array(dim = c(1, n)) : Reached total allocation of 1840Mb: see help(memory.size)
Table 7	Clustering coefficient
	2: In array(dim = c(1, n)) : Reached total allocation of 1840Mb: see help(memory.size) 3: In array(dim = c(1, n)) : Reached total allocation of 1840Mb: see help(memory.size) 4: In array(dim = c(1, n)) : Reached total allocation of 1840Mb: see help(memory.size)”
Table 9	Error: cannot allocate vector of size 1.6 Gb
Table 13	Error: cannot allocate vector of size 200.0 Mb