Pajek Instructions

When you are downloading the data files associated with the problem sets, then make sure that you Right click on a link that has the data set and then click 'save link as' and make sure it has the same file extension it started with. If instead you simply click on the file, some browsers will corrupt the file when saving it. In particular, many browsers will try to save a ".net" file as a ".txt" file (it will add the suffix and in some cases also corrupt the file). You can save a ".net" file properly using Chrome as follows. Go to the link. Then right click on the page and 'save as' - it will try to save it as text - so instead click on "all files" in the tab below. Then you need to remove the .txt that it will try to save with the name.

Download Pajek Pajek is free, available on its official website: http://pajek.imfm.si/doku.php?id=download.

The new versions should work fine, but if you experience any problems then you might download "version 2.05" (dated Sept 25, 2011) - This is an older version of the software that has more documentation from the Reference Manual. The instructions below are for the 4.10 version.

The following link has a list of changes made over time: http://mrvar.fdv.uni-lj.si/pajek/history.htm

If you are using a Mac, it will take you several more minutes to install Pajek. Please refer to the instructions here: HERE: Pajek-OS (and you can use other versions of wine if you already have something installed).

The following is a list of commands you will need for the various problem sets.

Open Pajek and load the data set:

- go to the "File" tab at the top of the Pajek page

- go to the "Network" in the dropdown

- select "read"

- find the directory where you have stored the data, and open it.

Using Pajek, you can draw the network:

- go to the "Draw" tab at the top of the Pajek page

- click "Network"

- you can play a bit with different layouts

  - go to the "layout" tab at the top of the figure page
  - click on some of the variations (circular, energy, etc.) and it will redraw things

- if the network data set is directed, you will see arrows indicating the direction of links when you draw the network

Using Pajek to calculate average degree of the network:

- go to the "Network" tab at the top of the Pajek page

- go to "Info"

- click "General" and then "OK"

- (Alternatively, on PCs you can simply press F7)

- it will generate a new window called "report", from which you can read basic properties of the network

- When calculating average degree, if the network is being treated as directed, Pajek will be report the total degree (in plus out) which will be double the usual measure - so in that case the average degree is found by dividing by two.

Using Pajek to calculate diameter of the network:

- go to the "Network" tab at the top of the Pajek page

- go to "Create Vector"

- click "Distribution of Distances"

- in the window "Report", you can find the Diameter (as the distance between the most distant vertices), as well as the average distance.

Using Pajek to calculate clustering coefficients for each node:

- go to the "Network" tab at the top of the Pajek page

- click "Create Vector"

- click "Clustering Coefficients"

- click "CC1" and then "input"[1]

- it will generate something listed under "vector" on the Pajek page. You can double click on that to get the clustering values of each node

Using Pajek to calculate some basic centrality measures:

- go to the "Network" tab at the top of the Pajek page

- click "Create Vector"

- click "Centrality"

- click "Closeness"

  - choose "Input", "Output" or "All", depending on which you want (for this exercise, choose "All")

  - it will generate something listed under "vector" on the Pajek page. You can double click on that to get the output numbers for closeness centrality

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[1]CC1 gives the clustering in the first neighborhood, while CC2 expands the neighborhood. The primed versions weight the coefficient by a node's degree. CC1 corresponds to the measure we will cover in class.

- redo this for "Betweenness" centrality instead of closeness

Using Pajek to generate Poisson random networks:

- go to the "Network" tab at the top of the Pajek page

- click "Create Random Network", then "Bernoulli/Poisson"

- click "Undirected", then "General"

- input "400" (or how every many nodes you wish, depending on the problem) when asked "How many vertices"

- input the average degree you want, when asked "Average degree of vertices"

- to see the network, you need to draw it, as described above

- to count the number of components:

  - go to "Network", then "Create Partition", then "Components", then "Weak"
  - Keep minimum size as 1 and click "Ok"
  - the "Report" window will report the number of components

Using Pajek to add a link
(for instance, "1-13" i.e. an undirected link between nodes 1 and 13):

- Under "File", go to "Networks", then "View/Edit"

- when asked "Select vertex number or vertex label", input the node whose link you want to add (for example, input 1)

- you should see a window summarizing all links that the node (1) has

- double click "Newline"

- input the node you want to link to (for example, input 13)

– if you want directed link(s): add "+" or "-" in front of the node

Redo this until you have added all links you want.

Using Pajek to delete a link
   (for instance, "3-1" i.e. an undirected link between nodes 3 and 1):

- Under "File", go to "Networks", then "View/Edit"

- when asked "Select vertex number or vertex label", input the node whose link you want to delete (for example, input 3)

- you should see a window summarizing all links that the node (3) has

- double click the link you want to delete (for example, "1-3"), and click "Yes"

   – since the network is undirected, by deleting "1-3" you also delete "3-1"

Redo this until you have deleted all links you want to delete.

You are encouraged to generate random network(s) with 25 nodes and similar average degree (4), then examine the diameter and average clustering coefficient there.

You may want to see the network in more detail. Recall that to draw a network:

- go to the "Draw" tab at the top of the Pajek page

- click "Network"

- you can play a bit with different layouts, so as to see the network more clearly

   – if you want to get rid of the names of vertices, click "GraphOnly"
   – go to the "Layout" tab at the top of the figure page

- click on some of the variations (circular, energy, etc.) and it will redraw things

- if you want to examine the connectedness of the network, you can try the "Separate Components" layout. To do this:

  - go to the "Layout" tab at the top of the figure page
  - click "energy", then "Kamada-Kawai", and then "Separate Components"

- probably you have already noticed some useful shortcuts:

  - "Ctrl"+"G": draw a network
  - "Ctrl"+"K": redraw using "Separate Components" layout

To look at the sizes of components

- go to "Network", then "Create Partition", then "Components", then "Weak"

- Keep minimum size as 1 and click "Ok"

- the "Report" window will report the number of components

- Click on the "Info Partition" button in the "Partition" box, hit "Ok"

- If asked if you still want to continue, hit "Yes"

- Information on every component will be shown in the Report window. The second column "Freq" will give the size of each component.

You can also play with some other data sets if you like: There are ones on international trade (World_trade.paj) and one on social interactions of a group of women based on which events they participated in (Davis.paj). In those cases you should "read" them in as "Pajek project files". Both of them are available in "Data" under Pajek installation folder. You can find other ones by googling.

Have fun!