NME

Network Modeling for Epidemics

1

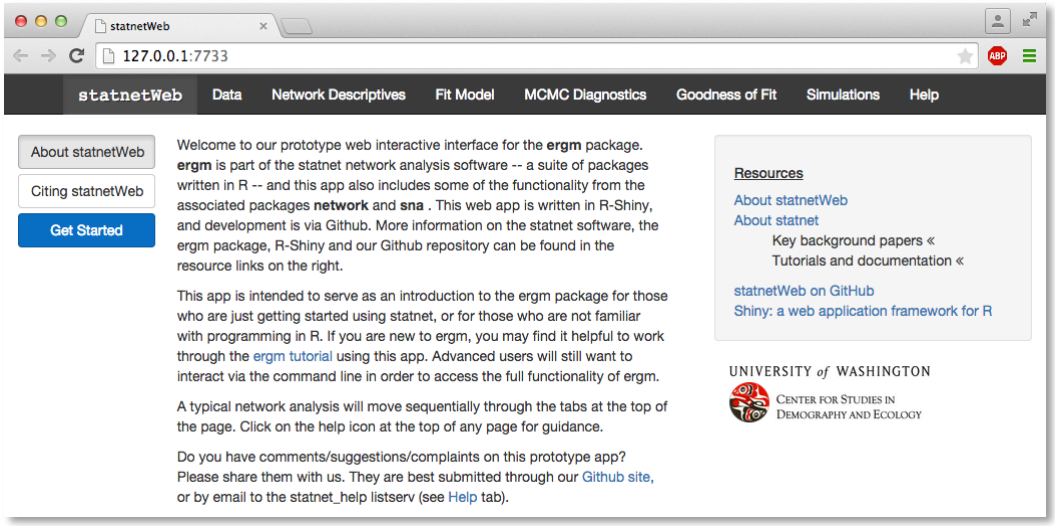
Lab: Descriptive network analyses

Explore with statnetWeb, just a bit

Intro to statnetWeb

statnetWeb is a graphical user interface for network analysis

- An Rshiny App
- Runs in a web browser, like epiweb
- Wiki: https://github.com/statnet/statnetWeb/wiki



Using statnetWeb on your computer

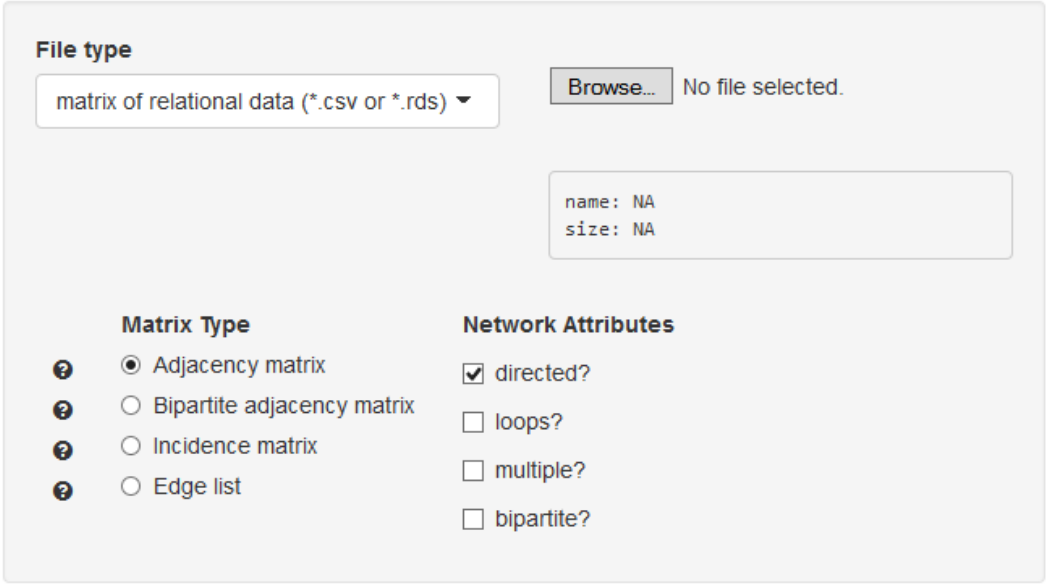
- Install the statnetWeb package
  - `install.packages("statnetWeb")`

- Load the package and launch the application
  - `library(statnetWeb)`
  - `run_sw()`

Note: Closing the browser window ends your session, so if you want to save something, do it before you quit

Network data in statnetWeb

- On the “Data” page, you can upload networks from multiple sources
  - Internal: built-in networks
  - External: R, Excel, Pajek files

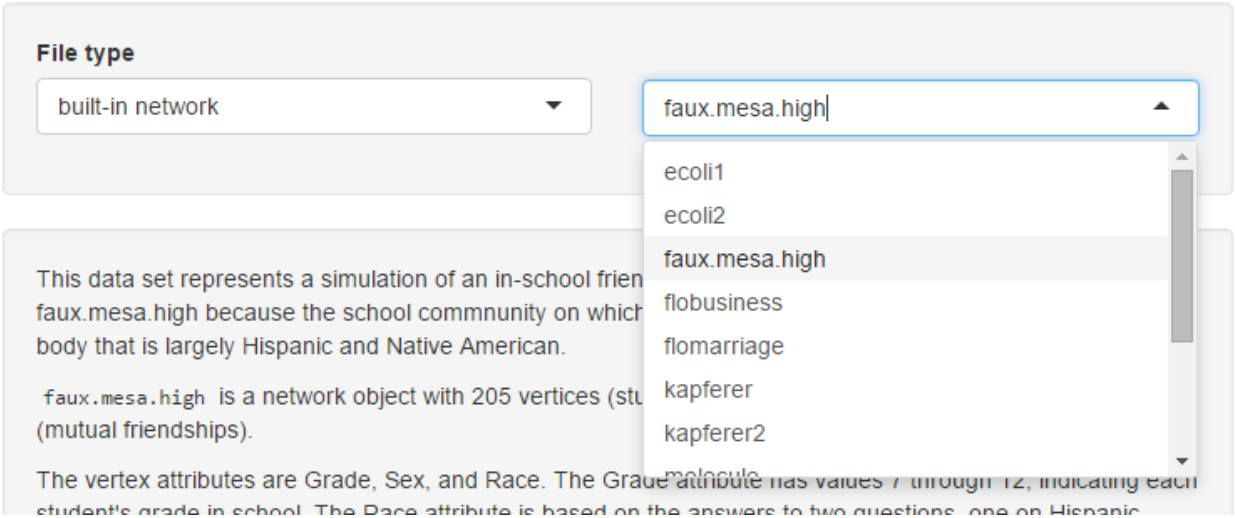


Examples in statnetWeb

- Load the “faux.mesa.high” network

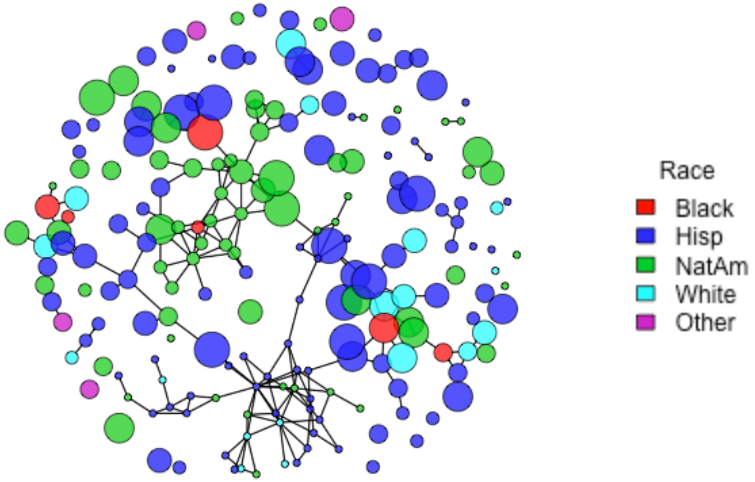
  High school network simulated from Add Health data

- We’ll explore more network concepts using these data



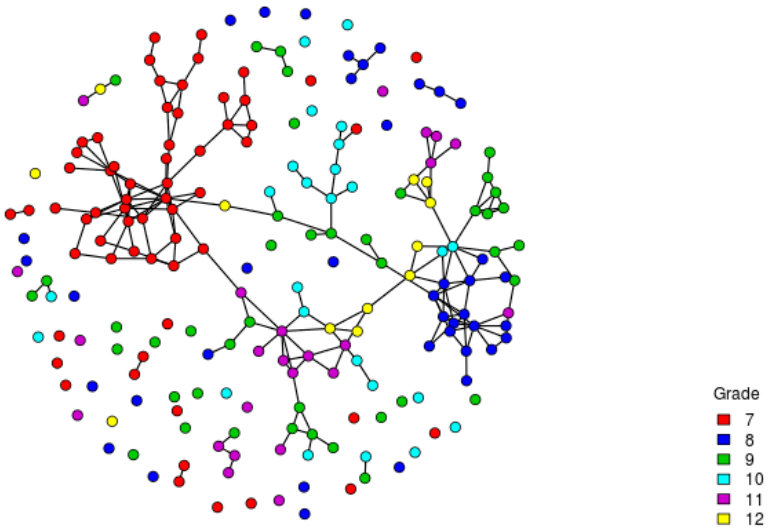
Attributes

- Individual nodes can have attributes like age, race, sex, etc.
- *Explore:*
  - *Color-code or size nodes on the network plot*
  - *Sort or search attributes in the interactive table*
  - *Look at histograms of attribute counts*
  - *How do these descriptive help you understand the structure of the network?*



Node mixing by attribute

- Collapses the adjacency matrix into categories
- Cell counts = # links between nodes in row and col. categories



Mixing Matrix

Choose attribute

Grade

```
Note:  Marginal totals can be misleading
 for undirected mixing matrices.
    7  8  9 10 11 12
7  75  0  0  1  1  1
8   0 33  2  4  2  1
9   0  2 23  7  6  4
10  1  4  7  9  1  5
11  1  2  6  1 17  5
12  1  1  4  5  5  6
```

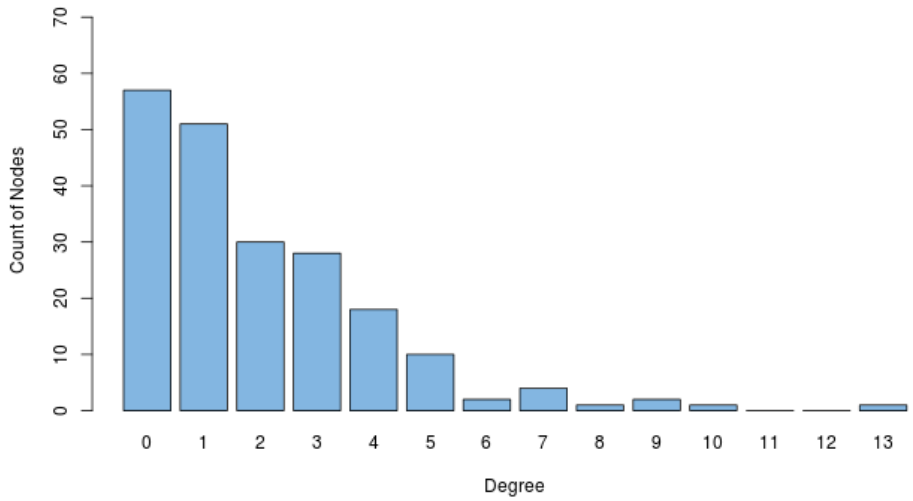
Degree metrics

- Node level: The number of edges "adjacent" to a node
  - Every node has a degree deg(i)
  - Di-graphs have in- and out- degrees, ideg(i) and odeg(i)
    - Indegree: the number of arcs that terminate at n_i
    - Outdegree: the number of arcs that orginate from n_i

- Network level: The degree distribution
  - Well-known parametric degree distributions: Uniform, Binomial, Poisson, Power-law
    - *The degree distribution in an empirical network may or may not resemble any of these*

Degree distribution

- To view it in statnetWeb:



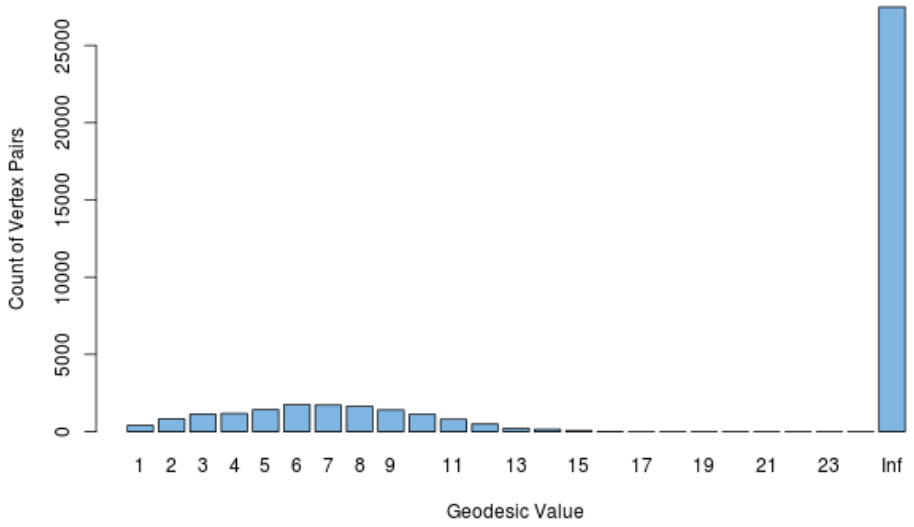
Connectivity measures: Geodesic

- Nodes are **reachable** if there is a path between them.

- A **geodesic** is the shortest path between two nodes
  - Two nodes have an infinite geodesic distance if they are unreachable

Geodesic distribution

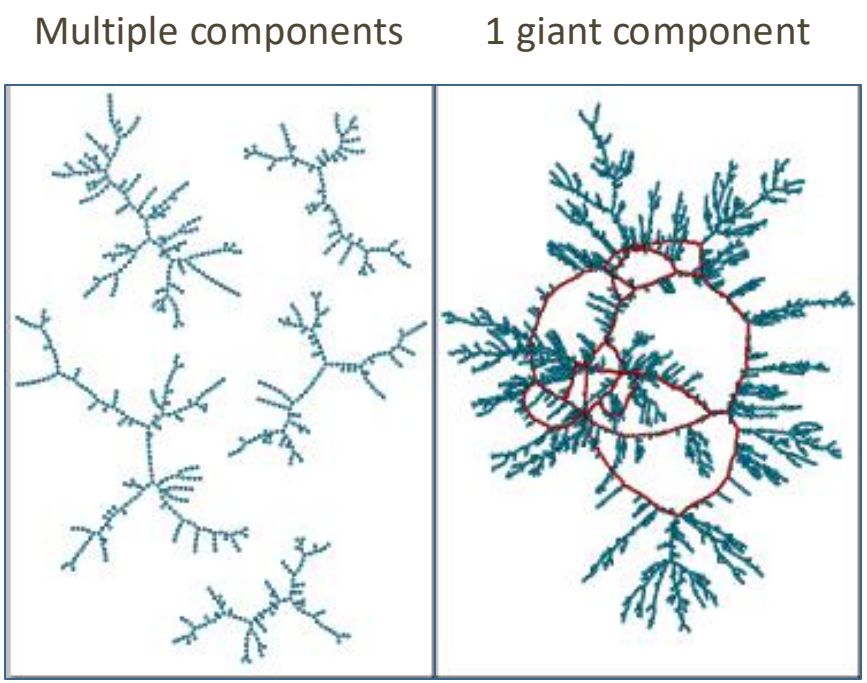
- To view it in statnetWeb:



The last bar represents the node pairs with infinite geodesic distance

Connectivity measures: Components

- If some node pairs are unreachable, the graph will have multiple "**components**"
  - subgraphs of reachable nodes
- The component size distribution is another basic property of the network



NB: Think about how this connectivity comes to be created…