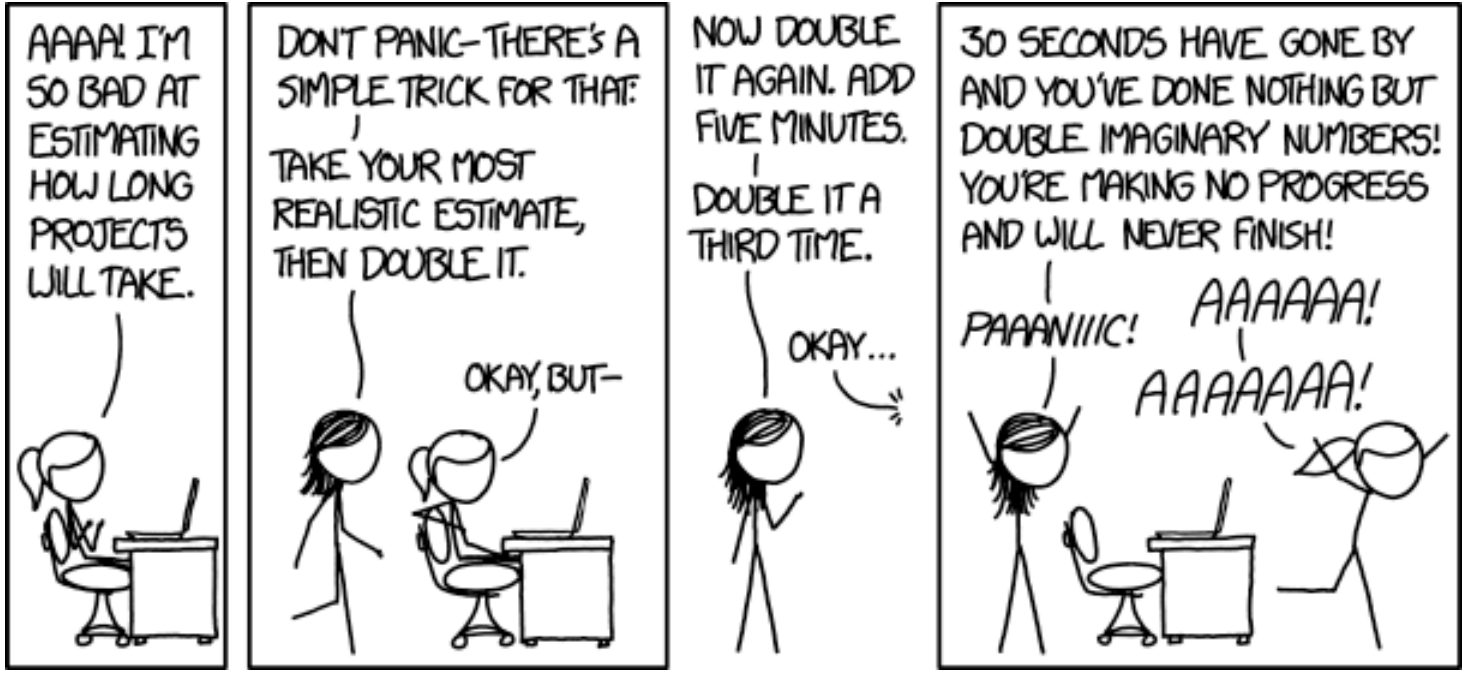
DS8104: Network Science

Class 3: Revisiting Foundations a.k.a. When is a node a node?



www.alexandergates.net

FINAL PROJECT

1. Pick a (network-related) publication
2. Reproduce some of the key results
3. Extend key ideas (to new data, change an assumption, re-derive on a new graph type, etc.)

FINAL PROJECT

1. Pick a (network-related) publication

   Find something that interests you!!!!
   (related to current research / cool application / sounds fun)

   Use citation graphs
   (pick class readings and find publications that they reference or that reference them)

   What else has a favorite author worked on?

   Come talk to me! and/or Go talk with your advisor!

   Written approval from me by February 21

   5-7 minute presentation in class March 2nd
   Summary, key ideas and methods
   IDENTIFY WHICH RESULTS YOU WANT TO REPRODUCE

FINAL PROJECT

2. Reproduce some of the key results

   Work from a github account – share all code and data

   Identify a criteria for success: how do you know you've reproduced a result?

   3-5 page writeup: explain the result, explain your criteria for success, evaluate your own work. what worked, and what didn't work?!!

   Writeup due April 4th

   5-7 minute presentation April 6th

FINAL PROJECT

3. Extend key ideas

   to new data, change an assumption, re-derive on a new graph type, etc.

   Identify a criteria for success: how do you know you've correctly extended the concept?

   Final paper: pick a target journal/conference. Writeup your work in the style of that venue (intro / lit review / results / methods) (~10pg)

   One page reflection paper. What did you learn, how were network science concepts reflected in the work. What would you do differently?

   10 minute presentation April 25/27th

   Writeup due May 5th

FINAL PROJECT

Grading criteria

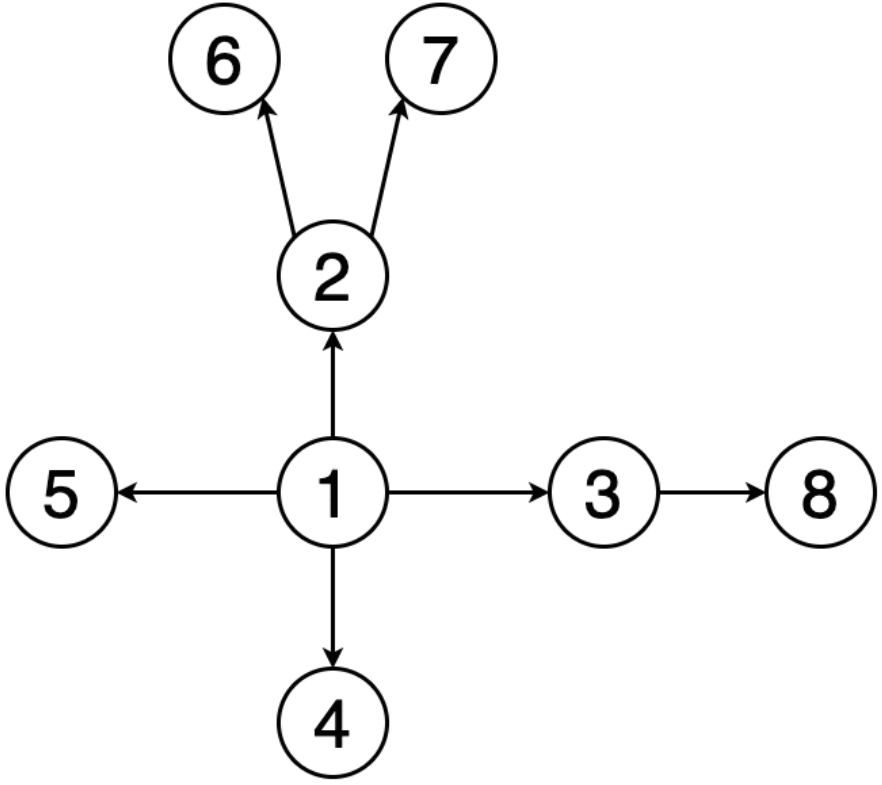
Effort - I want to see the process documented (github is awesome!)

Take Risks! Its OK if it doesn't work.

Ability to articulate why this project was interesting. And why it succeeded or failed.

Ability to articulate which network concepts you've engaged with (I'm not expecting every idea from class to pop up, but a few should be in there.)

Breadth first search (BFS)



Start at a seed node (here node 1)

Find all neighbors of your node.
Add to a que.

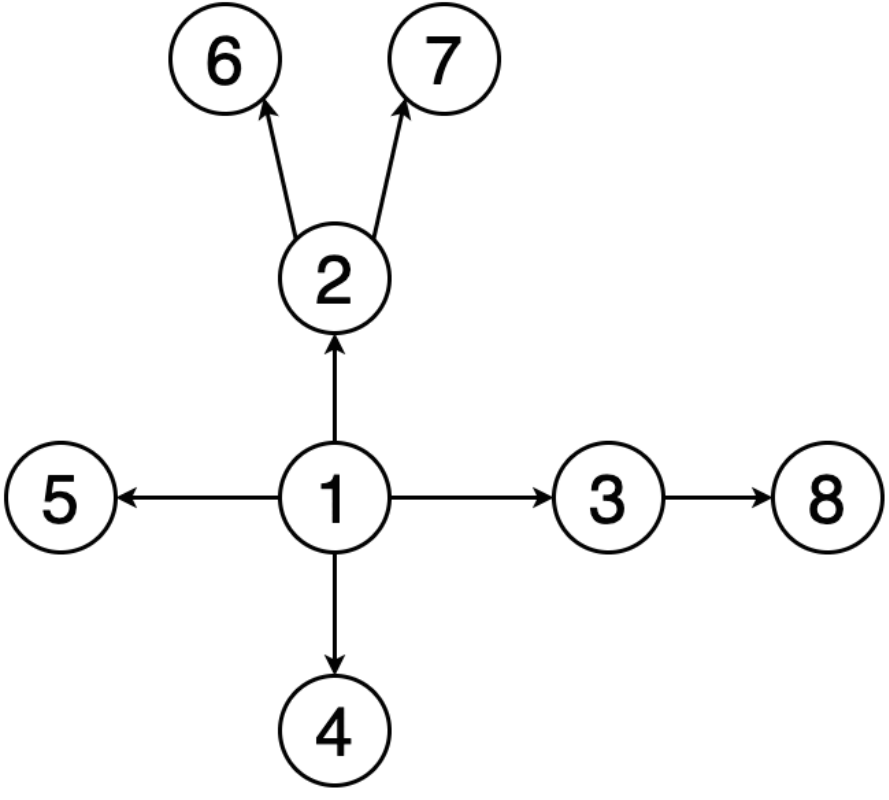
Take first node from the que
(here node 2).

Find all neighbors of your node.
Add to a que.

Take next node from the que
(here node 3). REPEAT

Viz: Vijini Mallawaarachchi

Depth first search (DFS)



Viz: Vijini Mallawaarachchi

Start at a seed node (here node 1)

Pick one neighbor of your node. Add to a que. (here node 2)

Take first node from the que.

Find one neighbor of your node. Add to a que. (here node 6)

If there are no other nodes, go back one step. Find another neighbor of your node. (here node 7). REPEAT

Models of Network Formation

Capture a mechanism by which networks are created.

Start with a network seed.
(sometimes one node, sometimes a sub-graph)

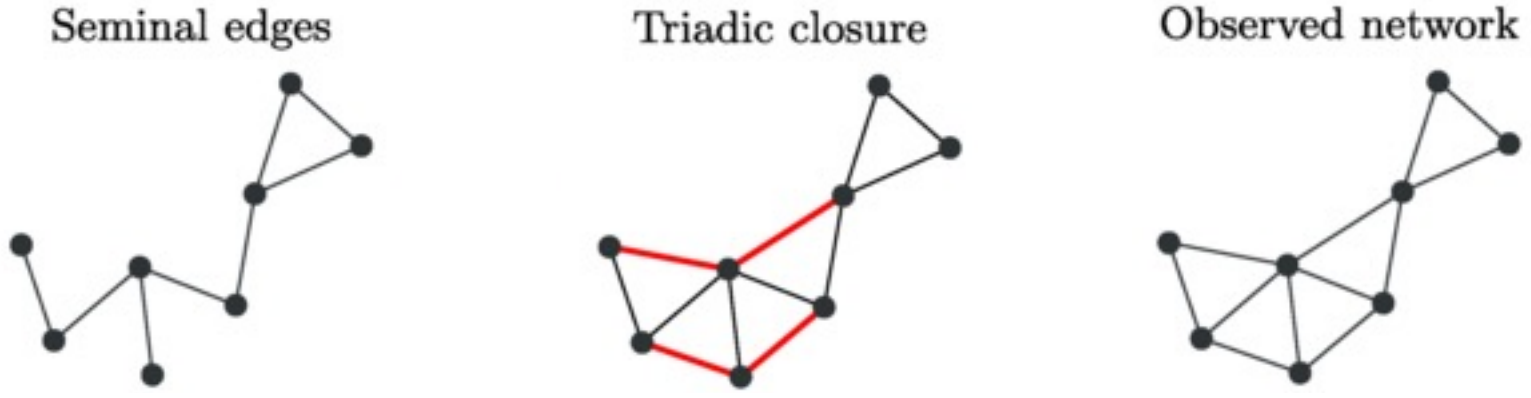
Have a (probabilistic) rule for the addition (removal) of nodes (edges)

The rule can be applied all at once, or sequentially

Models of Network Formation

Triadic closure

If a node A has edges to nodes B and C, then the B-C edge is formed with probability p.



Viz: Peixoto (2022) Phys. Rev. X

Models of Network Formation

Optimization Models

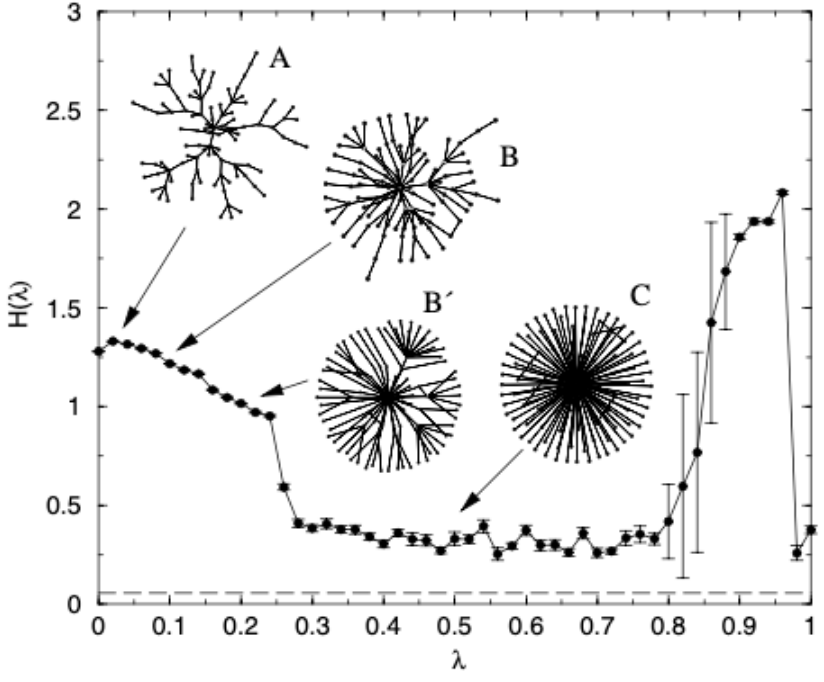
Add or move edges based on some (tradeoff) quality function:

$$E(m, \lambda, \alpha) = \alpha m + (1 - \alpha)\lambda$$

m – number of edges
(more connections cost more)

\lambda – path lengths

\alpha – control parameter



Viz: Ferrer I Cancho (2003) opt. complex networks