Lab: the final models

Add a gwesp term to the faux.mesa.high model

And conduct model assessments

We will compare three models

Model	Network Statistics g(y)
Edges + nodal attributes + mixing by attributes + degree(0)	# of edges # edges for each grade and race group # edges that are within-race & within-grade (DH) # Isolates
Edges + Attributes + GWESP(0.25)	# of edges # edges for each grade and race group # edges that are within-race & within-grade (DH) weighted shared partners, with decay set to 0.25
Edges + Attributes + GWESP(0.5)	# of edges # edges for each grade and race group # edges that are within-race & within-grade (DH) weighted shared partners, with decay set to 0.5

These fits can take a while

- So we won't do this interactively now
  - We'll just show the results
- But you can implement these on your own when you have some time

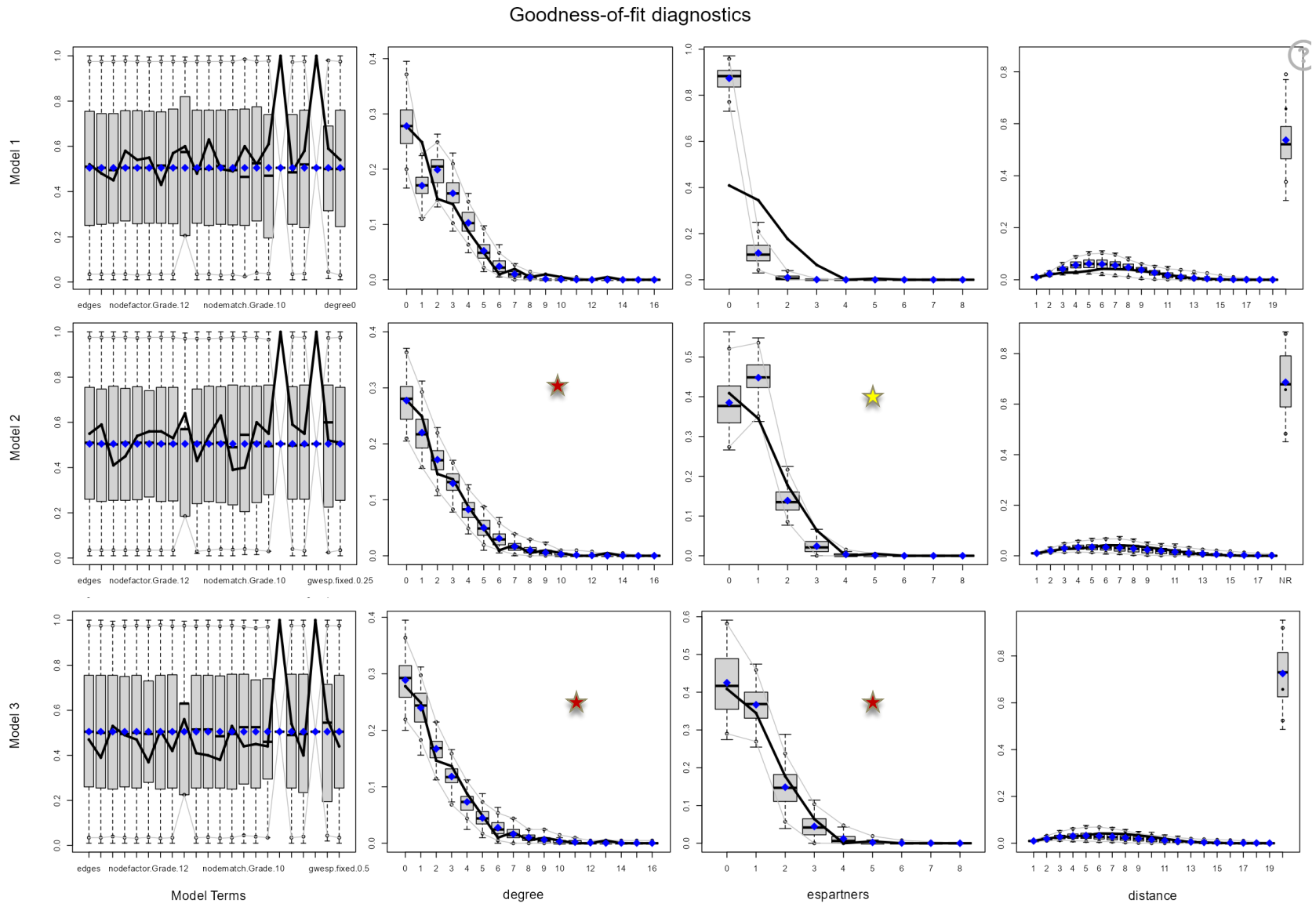
Model Comparison

Current Model Summary | Current Model Fit Report | Model Comparison

	Model1	Model2	Model3
edges	-8.186***	-8.522***	-8.551***
nodefactor.Grade.8	1.633*	1.396*	1.428*
nodefactor.Grade.9	2.670***	2.178***	2.213***
nodefactor.Grade.10	3.053***	2.475***	2.516***
nodefactor.Grade.11	2.712***	2.247***	2.285***
nodefactor.Grade.12	3.501***	2.871***	2.910***
nodefactor.Race.Hisp	-1.396***	-1.114***	-1.092***
nodefactor.Race.NatAm	-1.336***	-1.087***	-1.093***
nodefactor.Race.Other	-2.165*	-2.074*	-2.134*
nodefactor.Race.White	-0.725*	-0.588*	-0.604*
nodematch.Grade.7	7.469***	5.975***	6.006***
nodematch.Grade.8	4.292***	3.237***	3.215***
nodematch.Grade.9	2.060***	1.613***	1.626***
nodematch.Grade.10	1.281*	1.052*	1.059*
nodematch.Grade.11	2.495***	1.831***	1.789***
nodematch.Grade.12	1.361.	0.971	0.911
nodematch.Race.Black	-Inf***	-Inf***	-Inf***
nodematch.Race.Hisp	0.678.	0.569.	0.555.
nodematch.Race.NatAm	1.272***	1.053***	1.058***
nodematch.Race.Other	-Inf***	-Inf***	-Inf***
nodematch.Race.White	0.340	0.315	0.342
degree0	1.305***	NA	NA
gwesp.fixed.0.25	NA	1.398***	NA
gwesp.fixed.0.5	NA	NA	1.257***
AIC	1806	1664	1659
BIC	1965	1823	1818

- The gwesp term is clearly significant.
- And note how the homophily coefs changes from model 1 after the gwesp is added to models 2 & 3
  - About 10-20% smaller
  - That's the impact of controlling for triadic closure effects
- Some weak evidence here that the 0.5 decay is a better fit for the gwesp term

GOF comparison for all 3 models:



Simulating networks from the model

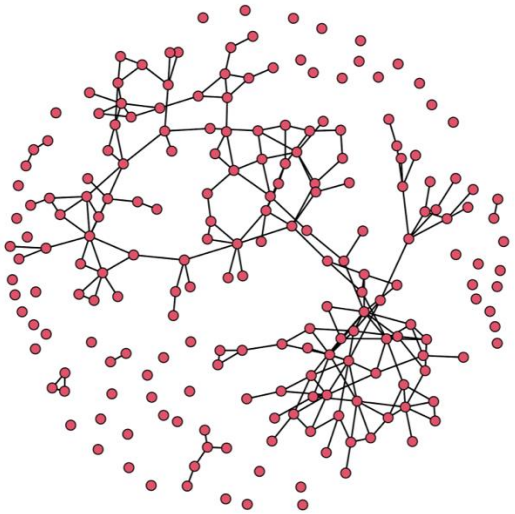
- A fitted model describes a probability distribution across all networks of this size
  - The model assigns a probability to every possible network
  - The model terms and the estimated coefficients make some networks more likely than others
- You can simulate networks from this distribution
  - Using the same MCMC algorithm that was used for estimation and GOF
- And the simulated networks will be centered on the network statistics in the original observed network
  - This is why these models are really useful for network epidemiology

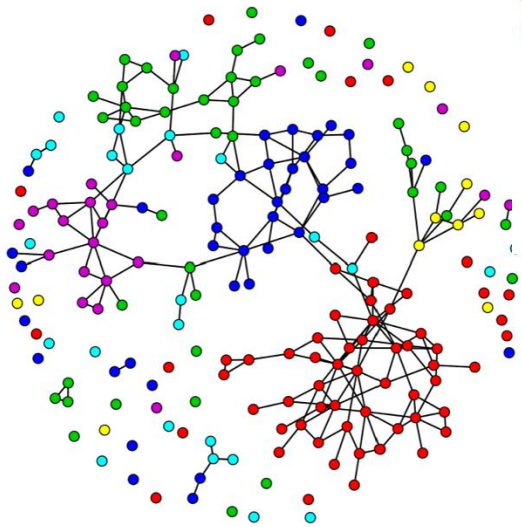
Simulation (finally!) from Model 3

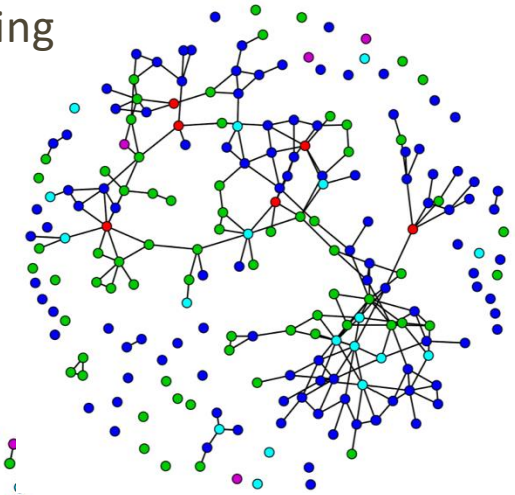
So does mixing by race

Grade mixing looks good

Overall structure looks good





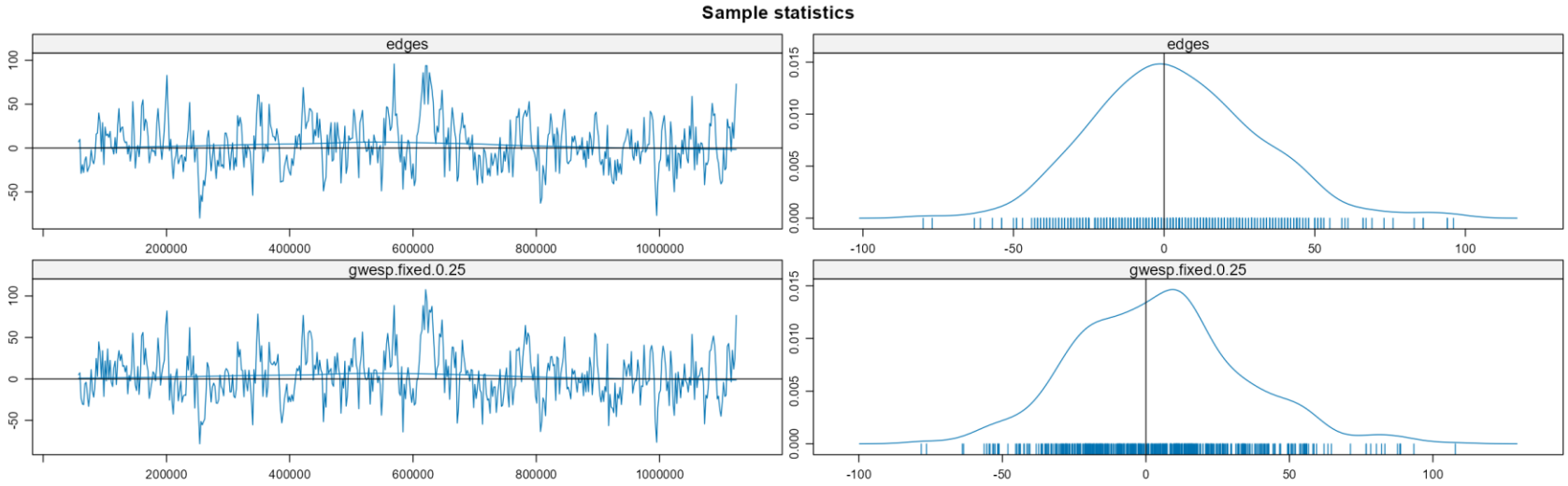


Now I’m curious

- What happens if we fit just edges + gwesp?

- So I tried it
  - gwesp(0.5) triggered a degeneracy stop
  - so did gwesp(0)
  - gwesp(0.25) did return a fit …

MCMC dx for edges + gwesp(0.25)

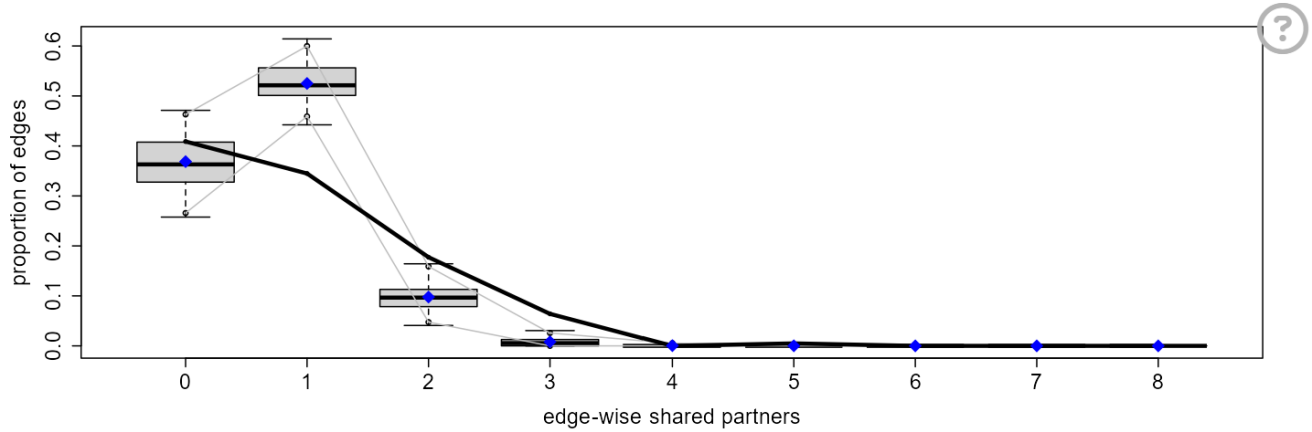


The traceplots show moderate autocorrelation

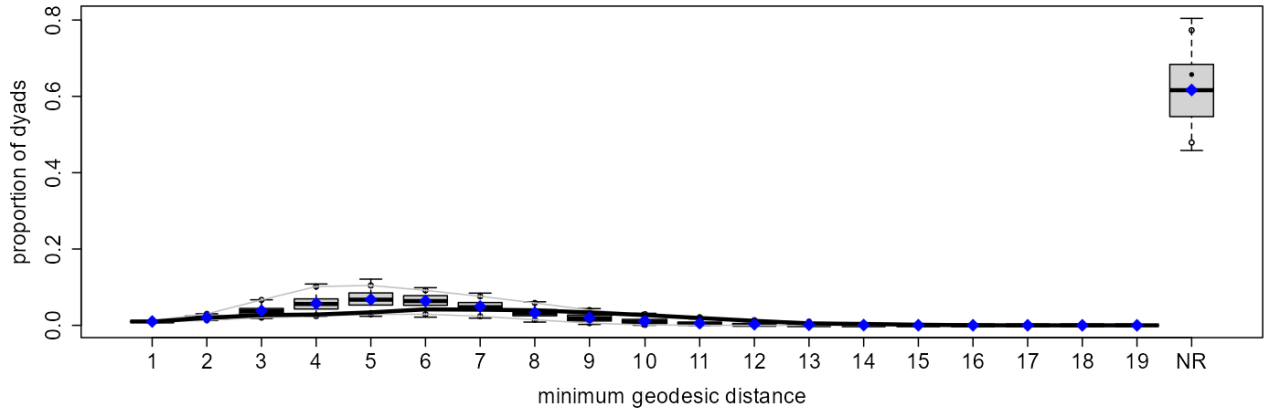
Could try upping the MCMC.interval control parameter

The distributions look ok tho

GOF for edges + gwesp(0.25)



Better than Model 1, about the same as Model 2



But the fit to the geodesics is poor, especially near the mode

Summary

- Now we can say something about this network
- Both transitivity and homophily clearly play a role in clustering these friendships
  - Homophily
    - Also reproduces the geodesic distribution
    - But not the degree distribution of the local shared partner clustering
  - Transitivity (Triadic closure)
    - Reproduces the degree distribution and captures the local clustering (ESP) well
    - But not the geodesic distribution
- The model with both does best
  - And simulations from this model look remarkably similar to the observed network

This is what makes EpiModel so powerful

Believable network simulations, based on:

- Robust, principled statistical methodology for estimation and inference with a fully general modeling framework (ergms/tergms)
- Simulations deeply rooted in empirical network data that reproduce observed network statistics (in and out of the model)
- And simple data collection requirements (egocentric samples)

All of this is also embedded in a fully general stochastic epidemic modeling package