PRACTICE WITH ERGM TERMS AND FORMULAS AND EGOCENTRIC DATA

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Egocentric data

- You want to simulate an artificial population of size 256.

- You have a **perfectly unbiased** sample of 16 people

- You have extracted out their partnerships on the day of the interview

Egocentric data

Partnerships by age of ego and alter

Ego	Partner 1	Partner 2	Partner 3
18	18	20	19
18	19		
19	23		
19	20		
20	21		
20			
21	24		
21	21	21	
22	24		
22			
23	23		
23	24	24	
24			
24	23	24	21
25			
25	24	23	

Egocentric data

- Task 1. Come up with code to create the empty network with attributes

- Task 2. Come up with a formula and target stats that include each of the following phenomena:

  - an overall effect for forming relations (i.e. edges term)

  - the proportion of men with >1 ongoing relationship

  - a term for mixing by age

  - a constraint that nobody can have >3 partners at a time

    - hint: ergm term is `degrange(from=4)`

- Task 3: Put it together into netest and netdx functions, assuming homogeneous dissolution of ties with mean duration 90 days

- Task 4: Conduct an infectious disease simulation of your choice on this network

- Task 5: Extract the mean age difference from this simulation

Network Models and HIV/STI with EpiModel

- Code for network:

```
library(EpiModel)
mynet <- network.initialize(256, directed=FALSE)
age <- rep(18:25, each=32)
mynet %v%'age' <- age
```

Model terms, target stats

| Network phenomenon	term	target stat(s)	Formula	Notes
overall effect for forming relations	`edges`	**152**	# nodes * mean degree / 2 256 * (19/16) / 2	divide by 2 to convert from tot deg to edges
degree distribution	`degree(2:3)`	**80**	# nodes * prop. w/ deg. > 1 256 * (5/16)	must leave 2 values out
mixing by age	`absdiff("age")`	**192**	# edges * avg. abs. age diff 152 * 1.263	could do diff by race if wanted
max deg of 3	`degrange(from=4)`	**0**		"nobody" means 0, QED

Estimating and diagnosing

```
formation <- ~edges+concurrent+absdiff("age")+ degrange(from = 4)
target.stats <- c(152, 80, 192, 0)

myfit <- netest(mynet,
            formation=formation,
            target.stats = target.stats,
            coef.diss = dissolution_coefs(~offset(edges), 90))

mydx <- netdx(myfit, nsims=10, nsteps=100)
mydx
boxplot(mydx$stats[[1]])
```
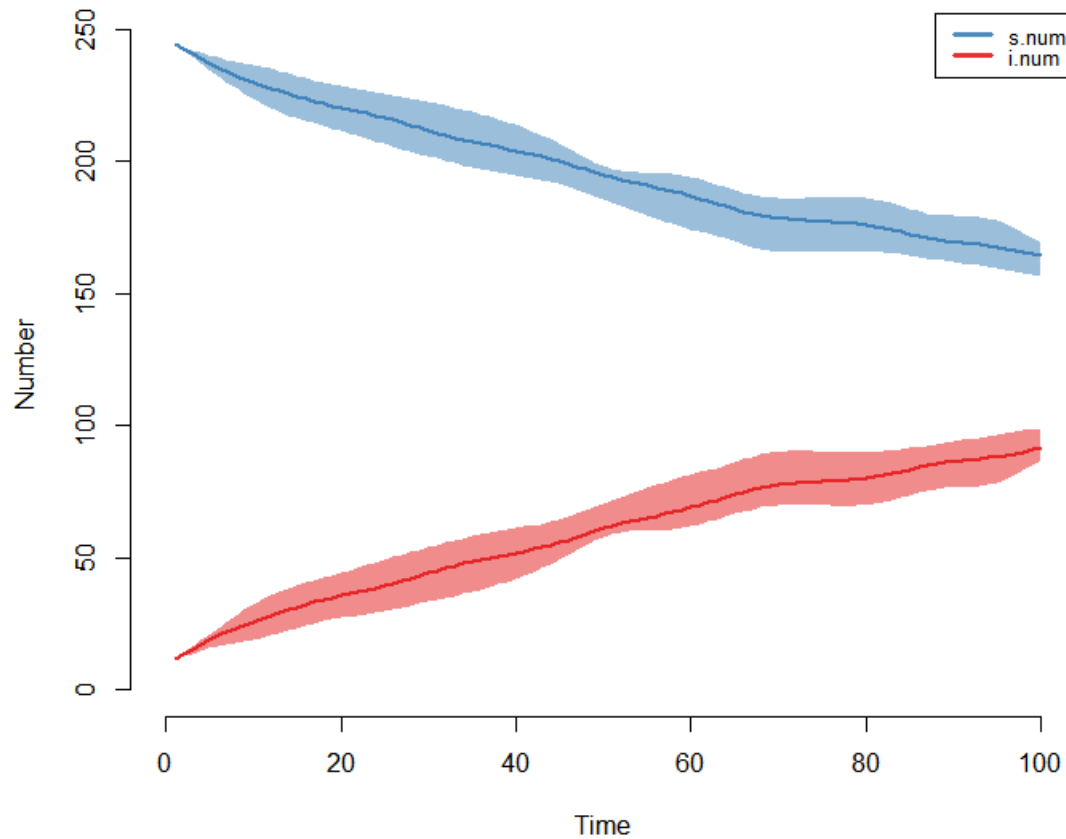
Estimating and diagnosing
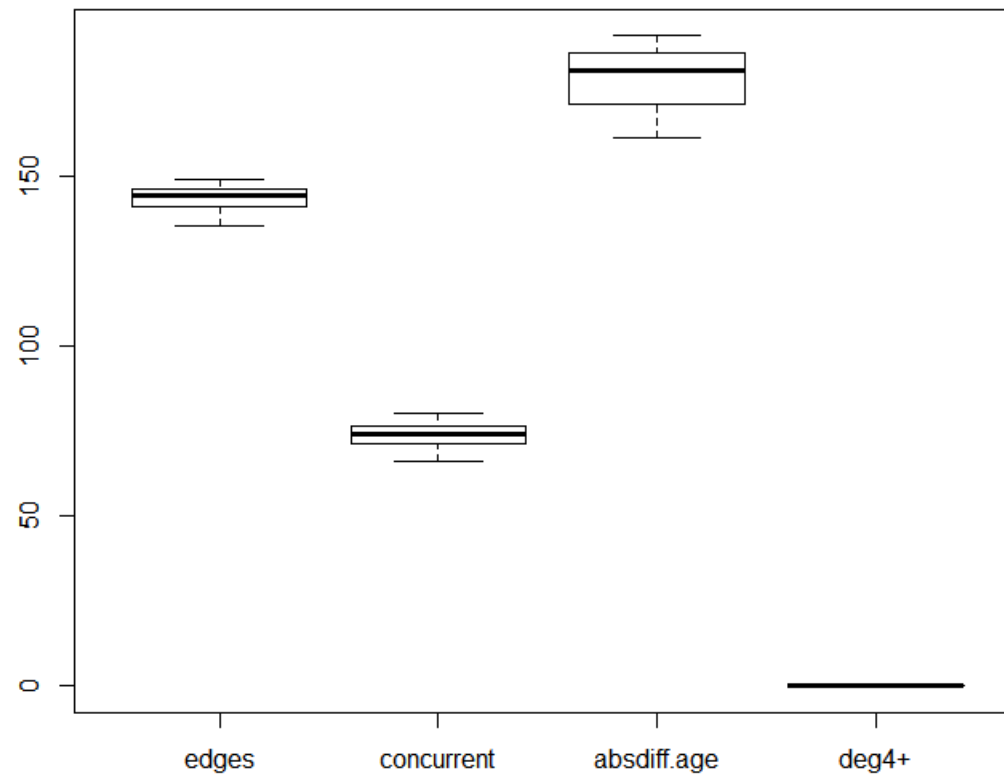
Disease simulation

```
mycontrol <- control.net("SIS", nsteps = 100, nsims = 10,
                verbose = TRUE)
myinit <- init.net(i.num = 10)
myparam <-param.net(inf.prob = 0.5, act.rate = 0.6,
                rec.rate = 0.1)
mySIS <- netsim(myfit, param = myparam, control = mycontrol,
                init = myinit)
plot(mySIS)
```
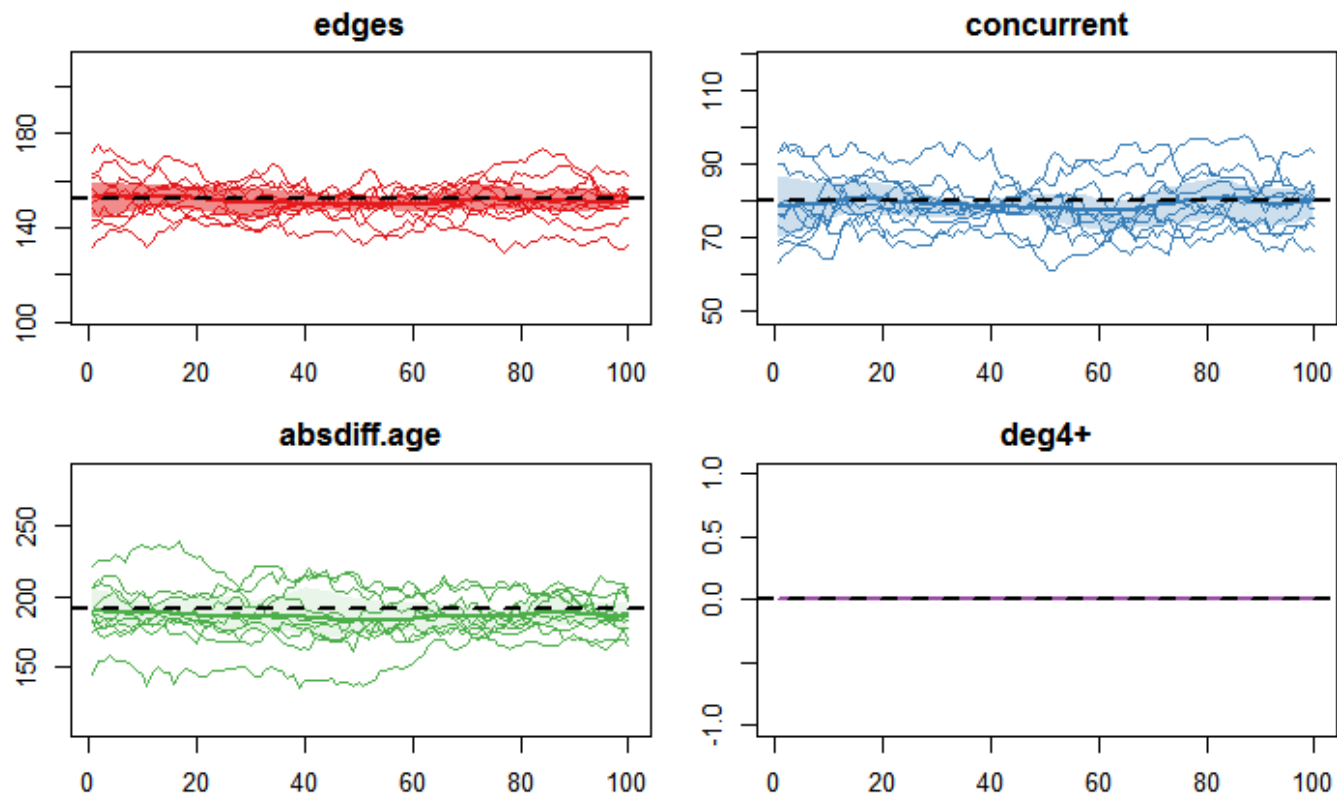
Disease simulation

Examining target stats

```
mySIS$stats$nwstats
plot(mySIS, type = "formation", sim.lines = TRUE)
```

Examining target stats

But wait…..

- People have ages, but they don't age….
- Foreshadowing:

```
mycontrol <- control.net("SIS", nsteps = 100, nsims = 10,
                aging.FUN = aging, depend = TRUE)


aging <- function(dat, at) {
  dat$attr$age <- dat$attr$age + 1/365
  return(dat)
}
```

Egocentric data

Bonus: add terms and stats for

- differential mean degrees by race

- race homophily

Partnerships by age of ego and alter

Ego	Partner 1	Partner 2	Partner 3
18, B	18, B	20, B	19, W
18, W	19, W		
19, B	23, B		
19, W	20, W		
20, B	21, W		
20, W			
21, B	24, B		
21, W	21, B	21, W	
22, B	24, B		
22, W			
23, B	23, B		
23, W	24, W	24, W	
24, B			
24, W	23, W	24, W	21, B
25, B			
25, W	24, W	23, W	

Model terms, target stats

Network phenomenon	term	target stat(s)	Formula	Notes
overall effect for forming relations	`Edges`	152	# nodes * mean degree / 2 256 * (19/16) / 2	divide by 2 to convert from tot deg to edges
degree distribution	`degree(2:3)`	80	# nodes * prop. w/ deg. > 1 256 * (5/16)	must leave 2 values out
mixing by age	`absdiff("age")`	192	# edges * avg. abs. age diff 152 * 1.263	could do diff by race if wanted
max deg of 3	`degrange(from=4)`	0		"nobody" means 0, QED
Differential mean deg by race	`nodefactor("race")`	176	# W nodes * mean deg for Ws 128 * (11/8)	Bs are ref. cat. b/c first alphabetically
Race homophily	`nodematch("race")`	120	# edges * prop. same-race 152 * (15/19)	can't do diff. homoph. b/c no d.f.

Estimating and diagnosing

```
race <- rep(c("B","W"), 128)
xtabs(~race+age)
mynet %v%'race' <- race
formation <- ~edges+concurrent+absdiff("age")+degrange(from = 4)+
              nodefactor("race")+nodematch("race")
target.stats <- c(152, 80, 192, 0, 176, 120)
myfit <- netest(mynet,
              formation=formation,
              target.stats = target.stats,
              coef.diss = dissolution_coefs(~offset(edges), 90))

mydx <- netdx(myfit, nsims=10, nsteps=100)
mydx
boxplot(mydx$stats[[1]])
```