HW3

Daniel Sinaniev and Ben Eyal

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```r
ga.data <- read.csv('ga_edgelist.csv', header=TRUE)
g <- graph.data.frame(ga.data, directed=FALSE)
```

Question 1.a

Find Biggest Component

```r
cl <- clusters(g)
to.keep <- which(cl$membership == which.max(cl$csize))
biggest_comp <- induced.subgraph(g, to.keep)
summary(biggest_comp)
```

```
## IGRAPH UN-- 24 28 --
## attr: name (v/c)
```

Closeness

```r
closeness(biggest_comp)
```

```
##        lexi         owen        sloan       torres        derek
## 0.015384615  0.011235955  0.016949153  0.017543860  0.013698630
##       karev      o'malley         yang         grey        izzie
## 0.016949153  0.015873016  0.009345794  0.012987013  0.014492754
##      altman      arizona        colin      preston       kepner
## 0.013698630  0.012658228  0.007751938  0.007751938  0.012345679
##     addison        nancy       olivia mrs. seabury         hank
## 0.016949153  0.012345679  0.013698630  0.012345679  0.010989011
##       denny         finn        steve        avery
## 0.010989011  0.010101010  0.010101010  0.011494253
```

```r
maxCloseness <- max(closeness(biggest_comp))
maxClosenessName <- V(biggest_comp)$name[closeness(biggest_comp)==max(closeness(biggest_comp))]
maxClosenessName
```

```
## [1] "torres"
```

```r
maxCloseness
```

```
## [1] 0.01754386
```

Betweeness

```r
betweenness(biggest_comp)
```

```
##         lexi        owen       sloan      torres       derek
##     36.00000    60.00000   115.36667    67.15000    17.95000
##        karev    o'malley        yang        grey       izzie
##     95.26667    54.41667    43.00000    46.86667    47.95000
##       altman     arizona       colin     preston      kepner
##     76.00000     0.00000     0.00000     0.00000     0.00000
##      addison       nancy      olivia mrs. seabury        hank
##     44.08333     0.00000     4.95000     0.00000     0.00000
##        denny        finn       steve       avery
##      0.00000     0.00000     0.00000     0.00000
```

```r
maxBetweenness <- max(betweenness(biggest_comp))
maxBetweennessName <- V(biggest_comp)$name[betweenness(biggest_comp)==max(betweenness(biggest_comp))]
maxBetweennessName
```

```
## [1] "sloan"
```

```r
maxBetweenness
```

```
## [1] 115.3667
```

Eigenvector

```r
evcent(biggest_comp)$vector
```

```
##         lexi         owen        sloan       torres        derek
##   0.525580626  0.067803814  0.641812107  0.717877288  0.250030245
##        karev     o'malley         yang         grey        izzie
##   1.000000000  0.600697535  0.023949556  0.300492721  0.565395852
##       altman      arizona        colin      preston       kepner
##   0.207702396  0.210120473  0.007009961  0.007009961  0.292696923
##      addison        nancy       olivia mrs. seabury         hank
##   0.553736435  0.187856429  0.468519243  0.292696923  0.165489626
##        denny         finn        steve        avery
##   0.165489626  0.087953295  0.087953295  0.153835832
```

```r
maxEvcent <- max(evcent(biggest_comp)$vector)
maxEvcentName <- V(biggest_comp)$name[evcent(biggest_comp)$vector==max(evcent(biggest_comp)$vector)]
maxEvcentName
```

```
## [1] "karev"
```

```
maxEvcent
```

```
## [1] 1
```

Question 1.b

## Community Detection - First Algorithm

Short Random Walks

```
RandomWalk <- walktrap.community(biggest_comp)
lay <- layout.kamada.kawai(biggest_comp)
RandomWalkMemb <- community.to.membership(biggest_comp, RandomWalk$merges, which.max(RandomWalk$modulari
RandomWalkMemb
```

```
## $membership
##  [1] 2 1 0 0 0 0 0 5 4 3 1 0 5 5 5 0 0 0 0 0 3 3 4 4 2
##
## $csize
## [1] 11  2  2  3  3  3
```

```
#num of communities = 6
#the sizes are 11  2  2  3  3  3
RandomWalk$modularity
```

```
##  [1]  0.00000000 -0.02742347  0.00318878  0.03635205  0.06951531
##  [6]  0.10204082  0.13329081  0.16390306  0.19706632  0.22959185
## [11]  0.26211736  0.29528061  0.32908165  0.36096939  0.39413267
## [16]  0.39540821  0.38329083  0.39987245  0.36670917  0.35905612
## [21]  0.38201529  0.31951532  0.23405610  0.00000000
```

```
plot(biggest_comp, layout=lay, vertex.size=5, vertex.color=RandomWalkMemb$membership+1,
     asp=FALSE)
```
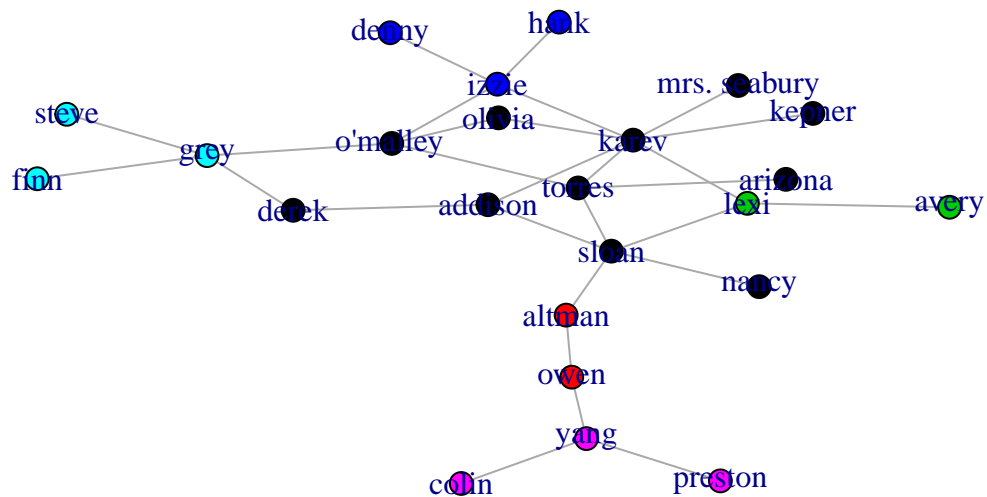
Girvan-Newman

```
GirvanNewman <- edge.betweenness.community(biggest_comp)
GirvanNewmanMemb <- community.to.membership(biggest_comp, GirvanNewman$merges, which.max(GirvanNewman$m
GirvanNewmanMemb
```

```
## $membership
##  [1] 0 1 0 2 3 0 2 1 3 4 1 2 1 1 0 0 0 2 0 4 4 3 3 0
##
## $csize
## [1] 8 5 4 4 3
```

```
#num of communities = 5
#the sizes are 8 5 4 4 3
plot(biggest_comp, layout=lay, vertex.size=5, vertex.color=GirvanNewmanMemb$membership+1, asp=FALSE)
```
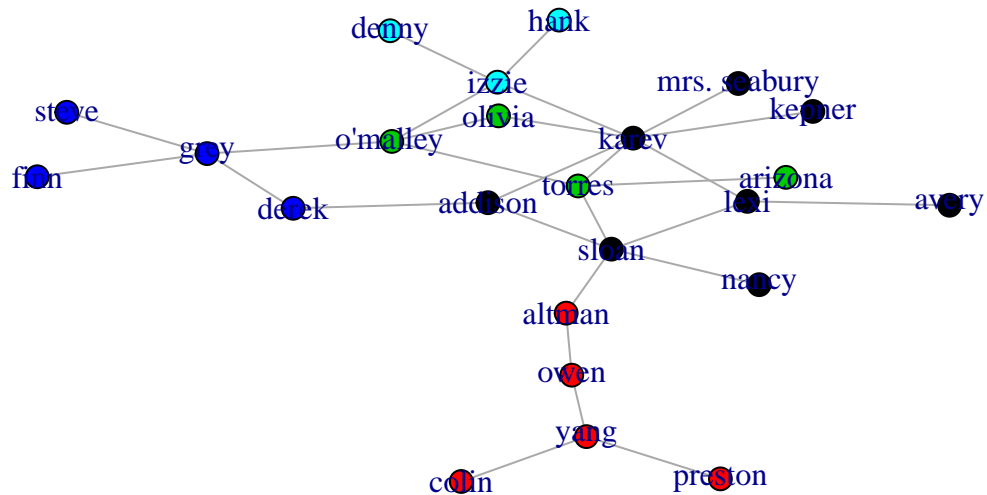
Question 2

The file dolphins.gml contains an undirected social network of frequent associations between 62 dolphins in a community living off Doubtful Sound, New Zealand, as compiled by Lusseau et al. (2003)

```
dolphinesNet <- read.graph('dolphines.gml',format = "gml")
```

Find Biggest Component

```
cl <- clusters(dolphinesNet)
to.keep <- which(cl$membership == which.max(cl$csize))
Dolphines_big_comp <- induced.subgraph(dolphinesNet, to.keep)
summary(Dolphines_big_comp)
```

```
## IGRAPH D--- 62 159 --
## attr: id (v/n), label (v/c), graphics (v/c), id (e/n), value (e/n)
```

Closeness

```
closeness(Dolphines_big_comp)
```

```
##  [1] 0.0002644104 0.0002644104 0.0002644104 0.0002644104 0.0002644104
##  [6] 0.0002644104 0.0002644104 0.0002644104 0.0002687450 0.0002732240
## [11] 0.0002732240 0.0002644104 0.0002644104 0.0002778550 0.0002732240
## [16] 0.0002687450 0.0002777006 0.0002875216 0.0002731494 0.0002732240
## [21] 0.0002976190 0.0002776235 0.0002922268 0.0002644104 0.0002874389
## [26] 0.0002922268 0.0002971768 0.0003088326 0.0003083565 0.0003087373
## [31] 0.0003258390 0.0002922268 0.0002824859 0.0003031222 0.0003083565
## [36] 0.0003137747 0.0003140704 0.0003477051 0.0003206156 0.0003191829
## [41] 0.0003628447 0.0002874389 0.0003456619 0.0003966680 0.0003397893
## [46] 0.0003878976 0.0004030633 0.0003547357 0.0002644104 0.0004111842
## [51] 0.0004498426 0.0004882812 0.0004159734 0.0004030633 0.0003033981
## [56] 0.0004970179 0.0002732240 0.0004042037 0.0003258390 0.0003958828
## [61] 0.0002871088 0.0004142502
```

```
maxCloseness <- max(closeness(Dolphines_big_comp))
maxClosenessName <- V(Dolphines_big_comp)$label[closeness(Dolphines_big_comp)==max(closeness(Dolphines_
maxClosenessName
```

```
## [1] "Vau"
```

```
maxCloseness
```

```
## [1] 0.0004970179
```

Betweeness

```
betweenness(Dolphines_big_comp)
```

```
##  [1]  0.0000000  0.0000000  0.0000000  0.0000000  0.0000000  0.0000000
##  [7]  0.0000000  0.0000000 11.0000000  6.0000000 12.6428571  0.0000000
## [13]  0.0000000  7.5000000 34.7857143  8.9285714 11.0000000 23.3333333
## [19] 23.6428571  1.3333333 52.1666667  9.5000000  0.0000000  0.0000000
## [25] 10.1190476  5.0000000  0.0000000  0.0000000 18.3333333 43.3095238
## [31] 22.6666667  0.0000000  4.0000000 30.6666667 10.6666667  0.0000000
## [37] 45.6666667 60.6666667 22.8333333 10.0000000  9.0000000  0.8333333
## [43] 16.8095238 58.1666667  0.0000000 31.9761905 13.1666667  0.0000000
## [49]  0.0000000  0.0000000 20.9523810 27.0000000  0.0000000  5.0000000
## [55]  2.3333333  0.0000000  0.0000000  0.0000000  0.0000000  0.0000000
## [61]  0.0000000  0.0000000
```

```
maxBetweenness <- max(betweenness(Dolphines_big_comp))
maxBetweennessName <- V(Dolphines_big_comp)$label[betweenness(Dolphines_big_comp)==max(betweenness(Dolph
maxBetweennessName
```

```
## [1] "SN4"
```

```
maxBetweenness
```

```
## [1] 60.66667
```

Eigenvector

```
evcent(Dolphines_big_comp)$vector
```

```
##   [1] 0.406936369 0.133243924 0.125900178 0.251231996 0.092745362
##   [6] 0.020771413 0.038606459 0.135855976 0.453166274 0.038625862
##  [11] 0.238307667 0.092745362 0.123743716 0.047515861 1.000000000
##  [16] 0.519900956 0.658662305 0.055457225 0.641246650 0.065471512
##  [21] 0.584190651 0.656626545 0.007709230 0.276652586 0.611855811
##  [26] 0.018829555 0.028323131 0.051672193 0.216045624 0.670597148
##  [31] 0.129035668 0.007709230 0.012210714 0.890164531 0.439631520
##  [36] 0.093221175 0.420422139 0.951799805 0.622635601 0.066093022
##  [41] 0.658274865 0.048272317 0.256347364 0.602753892 0.246379351
##  [46] 0.902535447 0.094104252 0.254512313 0.007649223 0.074195776
##  [51] 0.689371799 0.667174334 0.410295522 0.106677505 0.072841218
##  [56] 0.165017929 0.008254248 0.055025554 0.086553935 0.354099734
##  [61] 0.001697438 0.164642902
```

```
maxEvcent <- max(evcent(Dolphines_big_comp)$vector)
maxEvcentName <- V(Dolphines_big_comp)$label[evcent(Dolphines_big_comp)$vector==max(evcent(Dolphines_big
maxEvcentName
```

```
## [1] "Grin"
```

```
maxEvcent
```

```
## [1] 1
```