SNA Tech Managers

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```r
library(igraph)
library(ggplot2)
library(tidyverse)
library(ggthemes)
library(knitr)
library(dplyr)
```

```r
# analyzing friendship relationships between 21 managers at a tech company
# loading data from http://moreno.ss.uci.edu/data.html
man_tech <- as.matrix(read.table("http://moreno.ss.uci.edu/krackht.dat", skip = 8))
friend_tech <- man_tech[22:42, ]
att_tech <-  as.data.frame(read.table("http://moreno.ss.uci.edu/krackht_att.dat",
                                      skip = 9), header = F)
colnames(friend_tech) <- 1:dim(friend_tech)[2]
att_tech_cnames <- c("Age",
                     "Tenure",
                     "Level",
                     "Department")
colnames(att_tech) <- att_tech_cnames
att_tech$ID <- 1:dim(att_tech)[1]
```

```r
# distribution of attributes
att_tech[ , 1:4] %>%
  gather() %>%
  ggplot(aes(value)) +
  facet_wrap(~ key, scales = "free") +
  geom_bar()
```
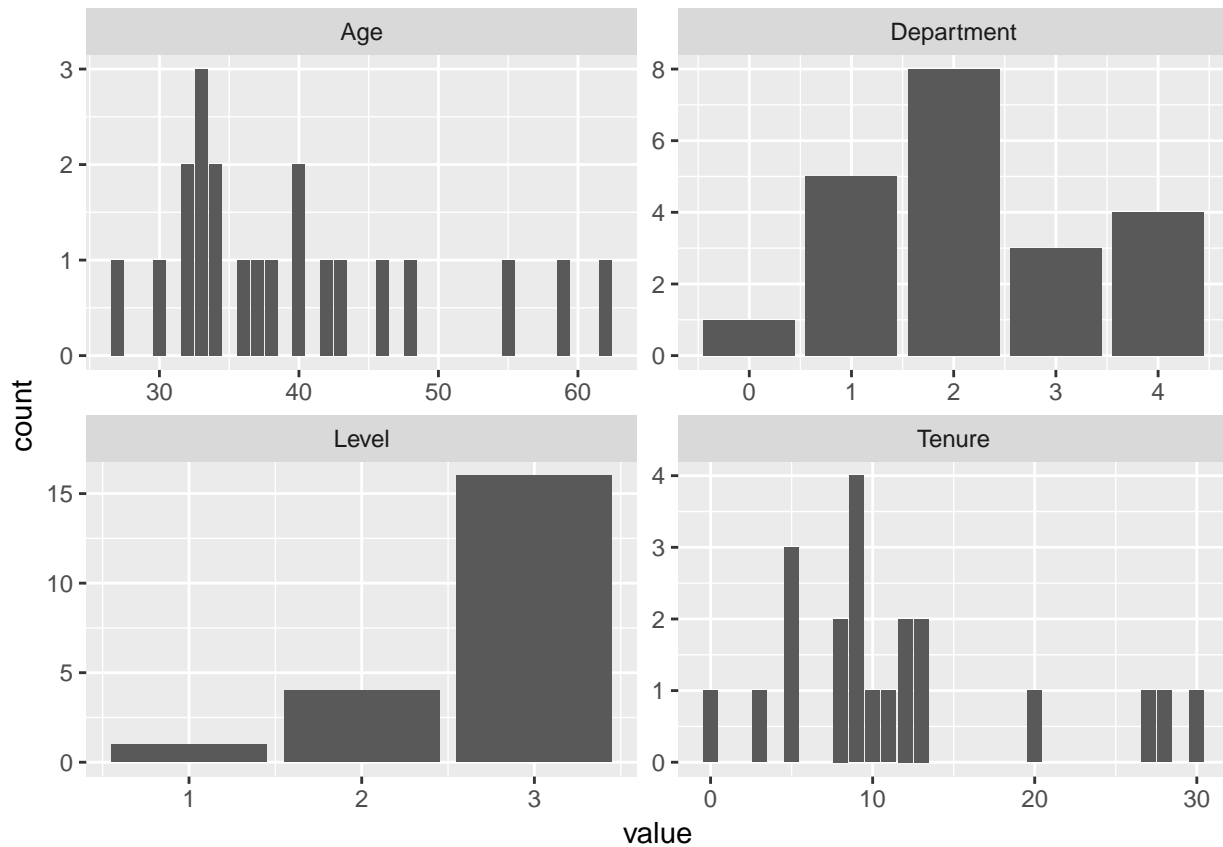
```r
# SNA measures
phys_network_graph <- graph.adjacency(friend_tech, mode = "directed",
                                      weighted = NULL, diag = F)

vertex_attr(phys_network_graph, index = att_tech$ID) <- att_tech

graph.density(phys_network_graph)
```

```
## [1] 0.2428571
```

```r
phys_att <- merge(att_tech, data.frame(
                          ID = V(phys_network_graph)$ID,
                          degree = degree(phys_network_graph, normalized = F),
                          in_deg = degree(phys_network_graph, mode = c("in"),
                                          loops = TRUE, normalized = F),
                          out_deg = degree(phys_network_graph, mode = c("out"),
                                           loops = TRUE, normalized = F),
                          btwn = betweenness(phys_network_graph, directed = T,
                                             normalized = T),
                          close = closeness(phys_network_graph, mode = c("all"),
                                            normalized = T)),
                  by='ID')
```

```r
kable(phys_att)
```

ID	Age	Tenure	Level	Department	degree	in_deg	out_deg	btwn	close
1	33	9	3	4	13	8	5	0.0764912	0.6451613
2	42	20	2	4	13	10	3	0.0881140	0.6666667

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| ID	Age	Tenure	Level	Department	degree	in_deg	out_deg	btwn	close
3	40	13	3	2	7	5	2	0.0050000	0.5882353
4	33	8	3	4	11	5	6	0.0833333	0.6060606
5	32	3	3	2	13	6	7	0.0458333	0.6666667
6	59	28	3	1	8	2	6	0.0098246	0.5882353
7	55	30	1	0	3	3	0	0.0000000	0.5128205
8	34	11	3	1	6	5	1	0.0013158	0.5714286
9	62	5	3	2	6	6	0	0.0000000	0.5882353
10	37	9	3	3	8	1	7	0.0000000	0.6250000
11	46	27	3	3	19	6	13	0.1538158	0.7692308
12	34	9	3	1	12	8	4	0.0517325	0.6250000
13	48	0	3	2	3	1	2	0.0000000	0.4878049
14	43	10	2	2	7	5	2	0.0146930	0.5714286
15	40	8	3	2	12	4	8	0.0593860	0.6451613
16	27	5	3	4	6	4	2	0.0026316	0.5555556
17	30	12	3	1	24	6	18	0.3537719	0.9090909
18	33	9	2	3	5	4	1	0.0018421	0.5263158
19	32	5	3	2	14	5	9	0.0575877	0.6666667
20	38	12	3	2	5	3	2	0.0080044	0.5714286
21	36	13	2	1	9	5	4	0.0892544	0.5882353

```r
# graphing SNA relationships
V(phys_network_graph)$color <- vector(length = dim(att_tech)[1])
V(phys_network_graph)[V(phys_network_graph)$Level == 1]$color <- "red"
V(phys_network_graph)[V(phys_network_graph)$Level == 2]$color <- "lightgreen"
V(phys_network_graph)[V(phys_network_graph)$Level == 3]$color <- "lightblue"


V(phys_network_graph)$size <- 100 * betweenness(phys_network_graph, normalized = T)

l <- layout.kamada.kawai(phys_network_graph)
sna_plot <- plot(phys_network_graph, layout = l, edge.arrow.size=.1)
```

```r
# color by level
# size by betweenness centrality
```
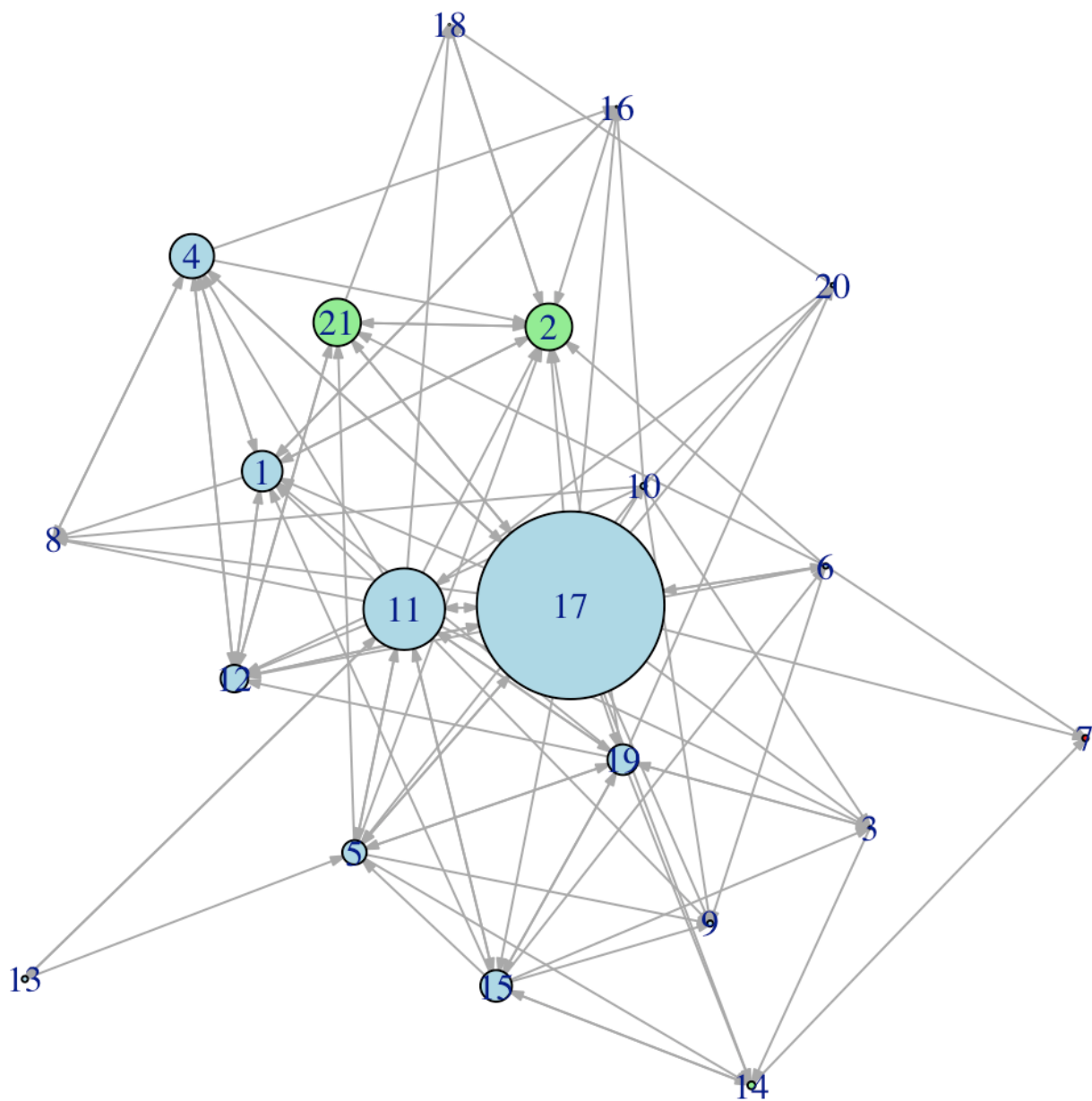
```
# finding groups with top-down methods
phys_network_graph2 <- graph.adjacency(friend_tech, mode="min", weighted=NULL)
graph.density(phys_network_graph2)
```

```
## [1] 0.1095238
```

```
# Girvan Newman algorithm
friend_gn <- edge.betweenness.community(phys_network_graph2,
                                         directed = TRUE, edge.betweenness = TRUE,
                                         merges = TRUE, bridges = TRUE,
                                         modularity = TRUE, membership = TRUE)
# random walk algorithm
friend_rw <- walktrap.community(phys_network_graph2, steps=200, modularity=TRUE)
```

```
# group memberships
friend_gn_memb <- data.frame(friend_gn$membership)
friend_rw_memb <- data.frame(friend_rw$membership)
# seven groups from Girvan Newman
table(friend_gn_memb)
```

```
## friend_gn_memb
## 1 2 3 4 5 6 7
## 8 2 7 1 1 1 1
```

```
# six groups from random walk
table(friend_rw_memb)
```

```
## friend_rw_memb
##  1  2  3  4  5  6
## 10  7  1  1  1  1
```

```
group_compare <- cbind(friend_gn_memb, friend_rw_memb)
colnames(group_compare) <- c("girvan_newman", "random_walk")
group_compare <- cbind(group_compare, att_tech)
group_compare <- group_compare %>%
  select(ID, everything())
```
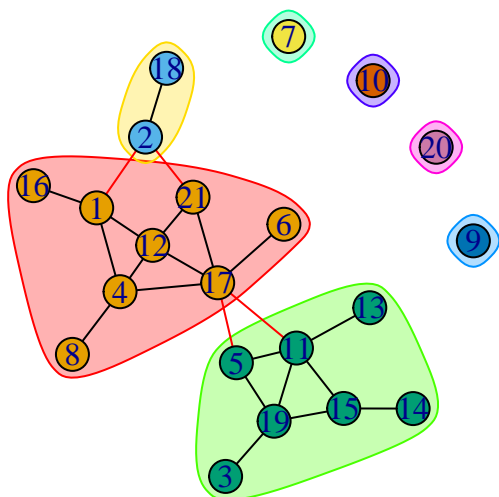
```
kable(group_compare)
```

ID	girvan_newman	random_walk	Age	Tenure	Level	Department
1	1	1	33	9	3	4
2	2	1	42	20	2	4
3	3	2	40	13	3	2
4	1	1	33	8	3	4
5	3	2	32	3	3	2
6	1	1	59	28	3	1
7	4	3	55	30	1	0
8	1	1	34	11	3	1
9	5	4	62	5	3	2
10	6	5	37	9	3	3
11	3	2	46	27	3	3
12	1	1	34	9	3	1
13	3	2	48	0	3	2
14	3	2	43	10	2	2
15	3	2	40	8	3	2
16	1	1	27	5	3	4
17	1	1	30	12	3	1
18	2	1	33	9	2	3
19	3	2	32	5	3	2
20	7	6	38	12	3	2
21	1	1	36	13	2	1

```
## plot Girvan-Newman
plot(friend_gn, phys_network_graph2)
```

```
## plot random walk
plot(friend_rw, phys_network_graph2)
```