class_6_coding_v1

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1. Import iGraph, SNA, gggraph

```
#Loading the packages I need
library(sna)
library(igraph)
library(ggraph)
library(gplots)
```

2. Import Nodes and Edge Data

```
#Loading the nodes and edges I need
nodes <- read.csv("/Users/TomTheIntern/Desktop/Mendoza/Mod 4/Networks/Lab 2/nodelist.csv")
summary(nodes)
```

```
##        ID            Name                Age           Gender
##  Min.   : 1.00   Length:12          Min.   :21.00   Length:12
##  1st Qu.: 3.75   Class :character   1st Qu.:23.00   Class :character
##  Median : 6.50   Mode  :character   Median :36.50   Mode  :character
##  Mean   : 6.50                      Mean   :38.00
##  3rd Qu.: 9.25                      3rd Qu.:45.75
##  Max.   :12.00                      Max.   :65.00
```

```
edges <- read.csv('/Users/TomTheIntern/Desktop/Mendoza/Mod 4/Networks/Lab 2/edgelist.csv')
summary(edges)
```

```
##     ego_num         alter_num         ego                alter
##  Min.   : 1.000   Min.   : 1.000   Length:40          Length:40
##  1st Qu.: 2.750   1st Qu.: 2.750   Class :character   Class :character
##  Median : 5.000   Median : 5.000   Mode  :character   Mode  :character
##  Mean   : 5.575   Mean   : 5.575
##  3rd Qu.: 9.000   3rd Qu.: 9.000
##  Max.   :12.000   Max.   :12.000
##      type              strength
##  Length:40          Min.   :1.00
##  Class :character   1st Qu.:2.00
##  Mode  :character   Median :4.00
##                     Mean   :3.45
##                     3rd Qu.:4.25
##                     Max.   :5.00
```

3. Create Directed iGraph and NetSNA

```
#Making the iGraph directed
net <- graph_from_data_frame(edges, directed = T, vertices = nodes)
net
```

```
## IGRAPH a4f55a5 DN-- 12 40 --
## + attr: name (v/c), Name (v/c), Age (v/n), Gender (v/c), ego (e/c),
## | alter (e/c), type (e/c), strength (e/n)
## + edges from a4f55a5 (vertex names):
##  [1] 1 ->2  2 ->1  1 ->5  5 ->1  1 ->3  3 ->1  1 ->4  4 ->1  1 ->6  6 ->1
## [11] 1 ->7  7 ->1  1 ->10 10->1  2 ->4  4 ->2  2 ->3  3 ->2  4 ->3  3 ->4
## [21] 4 ->6  6 ->4  4 ->5  5 ->4  3 ->5  5 ->3  10->9  9 ->10 10->11 11->10
## [31] 10->12 12->10 9 ->12 12->9  11->12 12->11 6 ->7  7 ->6  7 ->8  8 ->7
```

```
#Making the iGraph un-directed
un_net <- graph_from_data_frame(edges, directed = F, vertices = nodes)
un_net
```

```
## IGRAPH 249bccd UN-- 12 40 --
## + attr: name (v/c), Name (v/c), Age (v/n), Gender (v/c), ego (e/c),
## | alter (e/c), type (e/c), strength (e/n)
## + edges from 249bccd (vertex names):
##  [1] 1 --2  1 --2  1 --5  1 --5  1 --3  1 --3  1 --4  1 --4  1 --6  1 --6
## [11] 1 --7  1 --7  1 --10 1 --10 2 --4  2 --4  2 --3  2 --3  3 --4  3 --4
## [21] 4 --6  4 --6  4 --5  4 --5  3 --5  3 --5  9 --10 9 --10 10--11 10--11
## [31] 10--12 10--12 9 --12 9 --12 11--12 11--12 6 --7  6 --7  7 --8  7 --8
```

```
s_un_net <- simplify(un_net)
s_un_net
```

```
## IGRAPH 1a5a401 UN-- 12 20 --
## + attr: name (v/c), Name (v/c), Age (v/n), Gender (v/c)
## + edges from 1a5a401 (vertex names):
##  [1] 1 --2  1 --3  1 --4  1 --5  1 --6  1 --7  1 --10 2 --3  2 --4  3 --4
## [11] 3 --5  4 --5  4 --6  6 --7  7 --8  9 --10 9 --12 10--11 10--12 11--12
```

```
is_simple(s_un_net)
```

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

```
#making the NetSNA
net_sna <- network(edges, matrix.type = "edgelist", directed = T)
net_sna
```

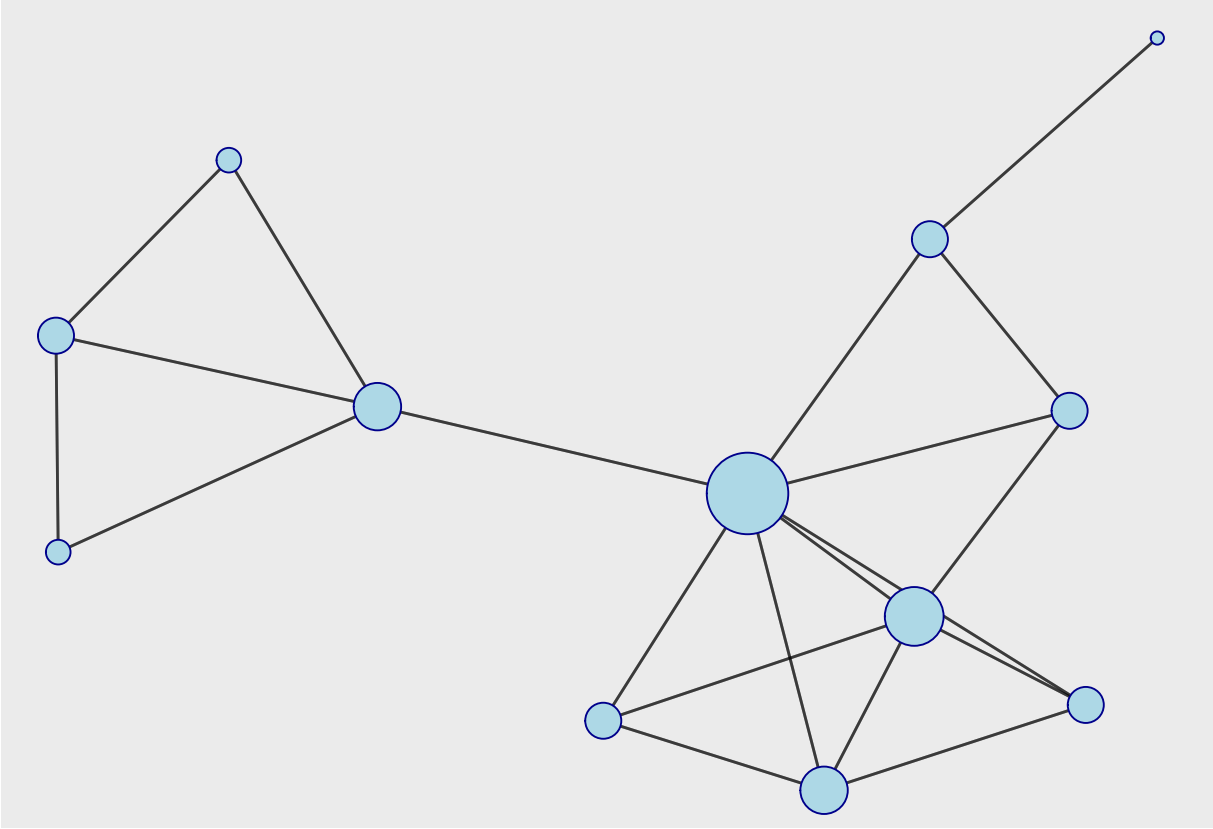
```
##  Network attributes:
##   vertices = 12
##   directed = TRUE
##   hyper = FALSE
##   loops = FALSE
##   multiple = FALSE
```

```
##   bipartite = FALSE
##   total edges= 40
##     missing edges= 0
##     non-missing edges= 40
##
##  Vertex attribute names:
##     vertex.names
##
##  Edge attribute names:
##     alter ego strength type
```

4. Graph the Network

```
#graphing the initial network
ggraph(net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(fill = "lightblue", color = "darkblue", shape = 21,
                  size = igraph::degree(net, mode = "all"))
```

```
## Using "stress" as default layout
```



5. Make 3 Community Detection Algorithms *Spin-Glass*

```r
## Spinglass####
?cluster_spinglass
#^This function has a gamma parameter that we can tweak!!
set.seed(1)
csg <- cluster_spinglass(net)
modularity(csg)
```

```
## [1] 0.2978125
```

```r
membership(csg)
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12
##  3  3  3  3  3  2  2  2  1  1  1  1
```

```r
length(csg)
```

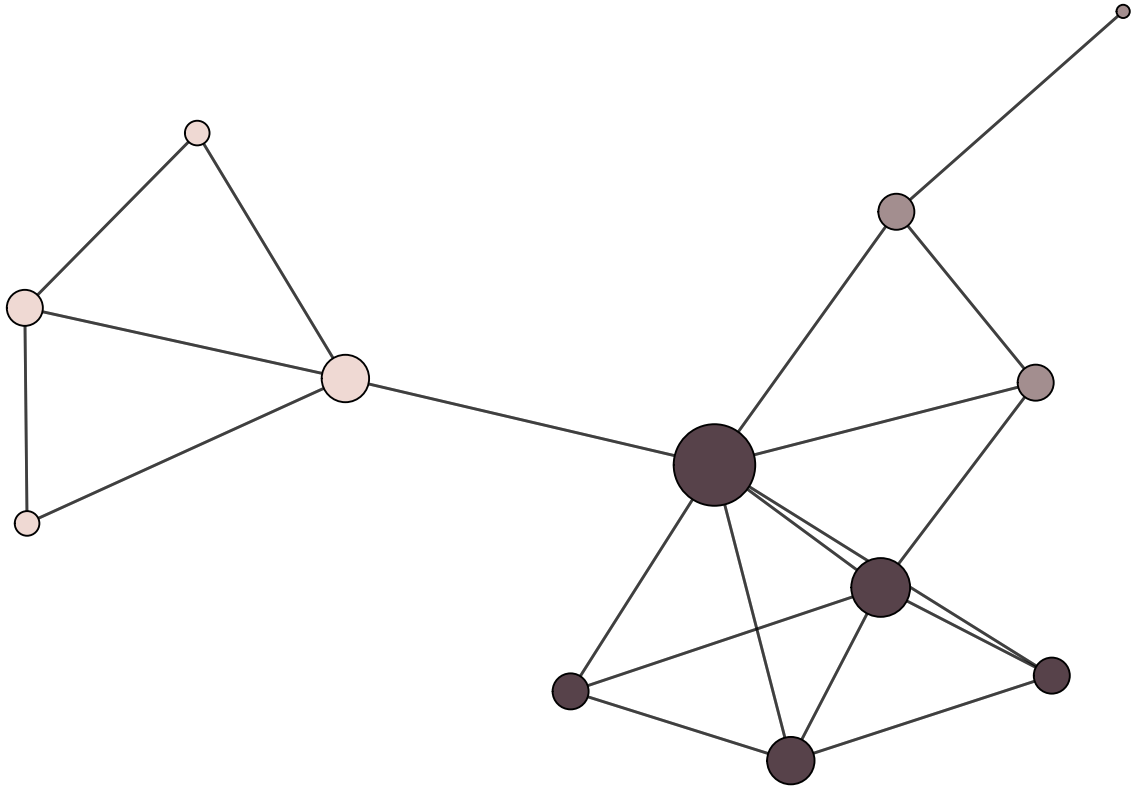
```
## [1] 3
```

```r
sizes(csg)
```

```
## Community sizes
## 1 2 3
## 4 3 5
```

```r
# plot####
colors <- colorpanel(length(csg), low = "#efd9d3", high = "#57424a")
ggraph(net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(csg))),
                  size = igraph::degree(net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```



Louvain Method

```
## Louvain method####
?cluster_louvain
# has resolution parameter we can tweak!
set.seed(1)
clv <- cluster_louvain(un_net)
modularity(clv)
```

```
## [1] 0.39125
```

```
membership(clv)
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12
##  1  1  1  1  1  2  2  2  3  3  3  3
```

```
communities(clv)
```

```
## $`1`
## [1] "1" "2" "3" "4" "5"
##
## $`2`
## [1] "6" "7" "8"
##
## $`3`
## [1] "9"  "10" "11" "12"
```

```
length(clv)
```

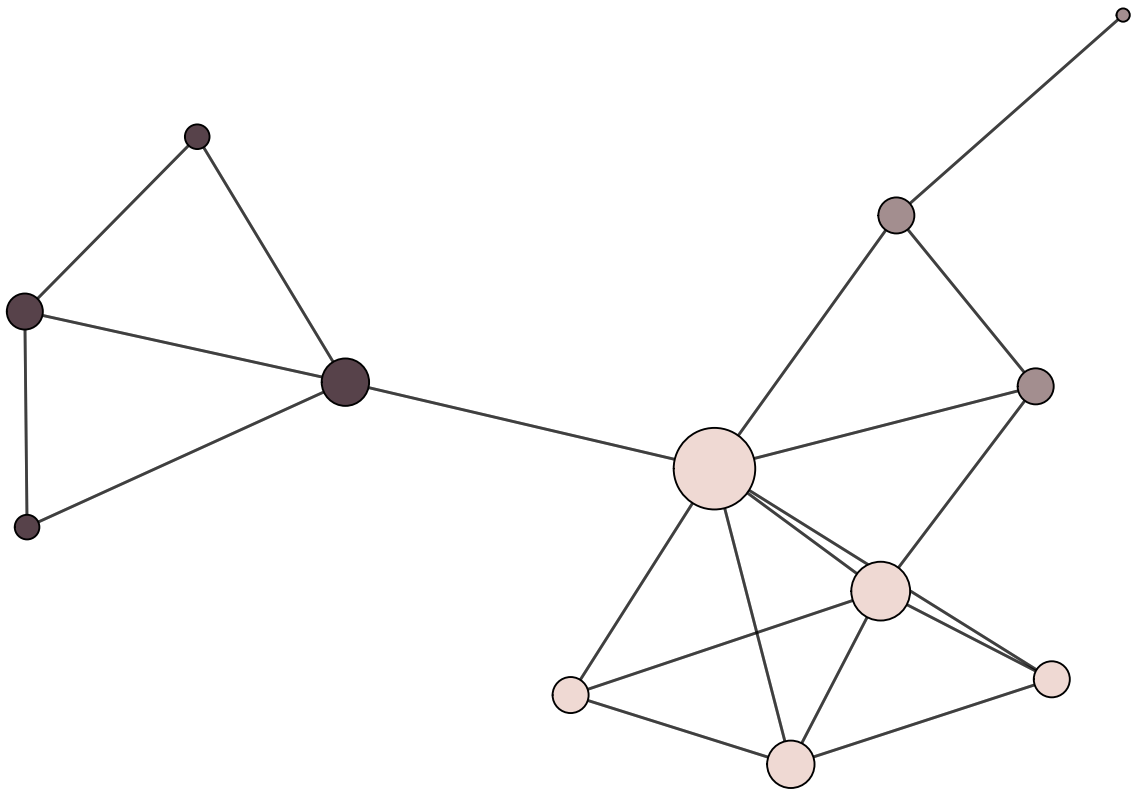
```
## [1] 3
```

```
sizes(clv)
```

```
## Community sizes
## 1 2 3
## 5 3 4
```

```
# plot####
colors <- colorpanel(length(clv), low = "#efd9d3", high = "#57424a")
ggraph(net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(clv))),
                  size = igraph::degree(net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```



```r
# tuning parameters####
set.seed(1)
clv_1 <- cluster_louvain(un_net, resolution = 0.25)
length(clv_1)
```

```
## [1] 2
```

```r
clv_2 <- cluster_louvain(un_net, resolution = 0.55)
length(clv_2)
```

```
## [1] 2
```

```r
clv_3 <- cluster_louvain(un_net, resolution = 0.75)
length(clv_3)
```

```
## [1] 2
```

```r
clv_4 <- cluster_louvain(un_net, resolution = 1)
length(clv_4)
```

```
## [1] 3
```

```r
clv_5 <- cluster_louvain(un_net, resolution = 1.25)
length(clv_5)
```

```
## [1] 3
```

```r
clv_6 <- cluster_louvain(un_net, resolution = 1.5)
length(clv_6)
```

```
## [1] 3
```

```r
colors <- colorpanel(length(clv_1), low = "#efd9d3", high = "#57424a")
clv_1_plot <- ggraph(un_net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(clv_1))),
                  size = igraph::degree(un_net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  geom_node_text(aes(label = as.factor(membership(clv_1))), repel = T) +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```

```
colors <- colorpanel(length(clv_2), low = "#efd9d3", high = "#57424a")
clv_2_plot <- ggraph(un_net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(clv_2))),
                  size = igraph::degree(un_net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  geom_node_text(aes(label = as.factor(membership(clv_2))), repel = T) +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```

```
colors <- colorpanel(length(clv_3), low = "#efd9d3", high = "#57424a")
clv_3_plot <- ggraph(un_net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(clv_3))),
                  size = igraph::degree(un_net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  geom_node_text(aes(label = as.factor(membership(clv_3))), repel = T) +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```

```
colors <- colorpanel(length(clv_4), low = "#efd9d3", high = "#57424a")
clv_4_plot <- ggraph(un_net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(clv_4))),
                  size = igraph::degree(un_net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  geom_node_text(aes(label = as.factor(membership(clv_4))), repel = T) +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```

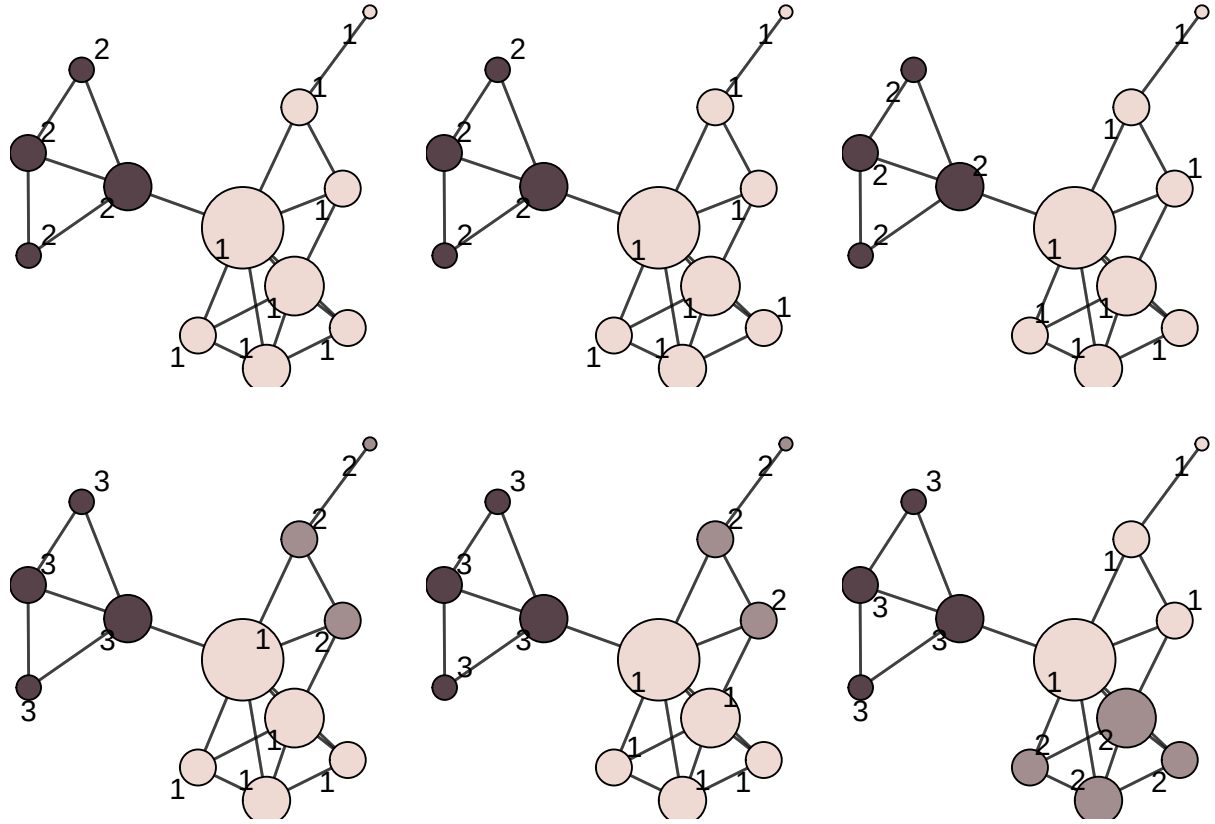
```
colors <- colorpanel(length(clv_5), low = "#efd9d3", high = "#57424a")
clv_5_plot <- ggraph(un_net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(clv_5))),
                  size = igraph::degree(un_net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  geom_node_text(aes(label = as.factor(membership(clv_5))), repel = T) +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```

```
colors <- colorpanel(length(clv_6), low = "#efd9d3", high = "#57424a")
clv_6_plot <- ggraph(un_net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(clv_6))),
                  size = igraph::degree(un_net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  geom_node_text(aes(label = as.factor(membership(clv_6))), repel = T) +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```

```
library(ggpubr)
ggarrange(clv_1_plot, clv_2_plot, clv_3_plot, clv_4_plot, clv_5_plot, clv_6_plot,
          nrow = 2, ncol = 3)
```



Info Map

```
## InfoMAP####
?cluster_infomap
set.seed(1)
cim <- cluster_infomap(net)
modularity(cim)
```

```
## [1] 0.34875
```

```r
membership(cim)
```

```
##  1  2  3  4  5  6  7  8  9 10 11 12
##  1  1  1  1  1  1  1  1  2  2  2  2
```

```r
length(cim)
```

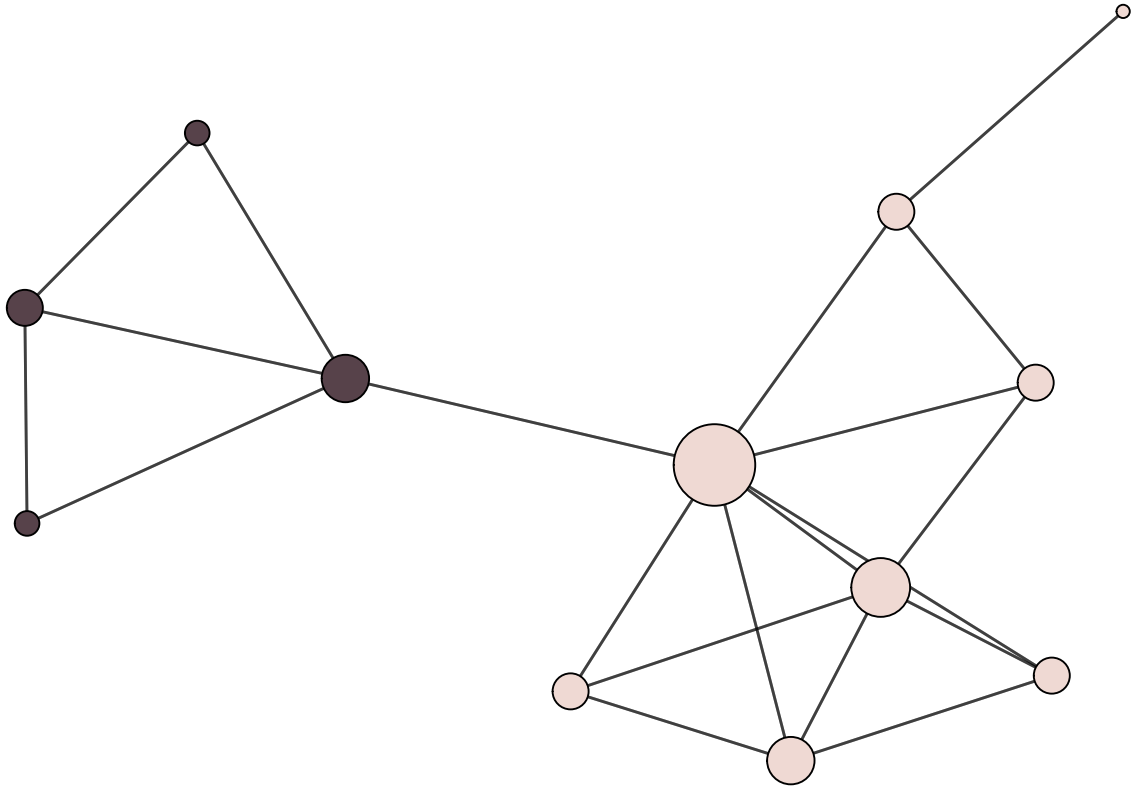
```
## [1] 2
```

```r
sizes(cim)
```

```
## Community sizes
## 1 2
## 8 4
```

```r
# plot####
colors <- colorpanel(length(cim), low = "#efd9d3", high = "#57424a")
ggraph(net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(cim))),
                  size = igraph::degree(net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```



7. Best Fitting Algorithm

I started by removing the Info-Map from contention as it only divided the network into two communities when there should have been three communities.

Originally, I ended up settling on Spin-Glass because it seemed to be the best at deciding where the central node (myself) should go.

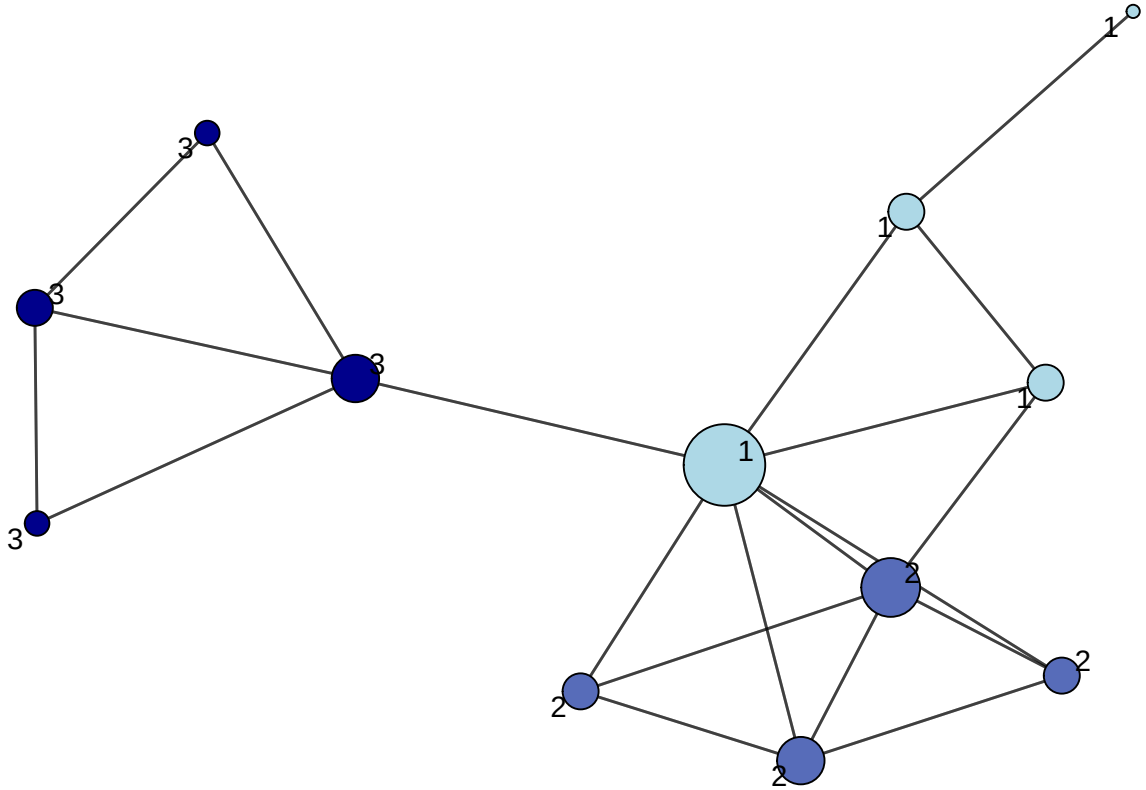
However, the Louvian method scored a 0.39125 Modularity, which was the best of the three, and was my final selection.

8. Plot the Final

```
colors <- colorpanel(length(clv_6), low = "lightblue", high = "darkblue")
clv_6_plot <- ggraph(un_net) +
  geom_edge_link0(color = "black", alpha = .5) +
  geom_node_point(aes(fill = as.factor(membership(clv_6))),
                  size = igraph::degree(un_net, mode = "all"),
                  color = "black", shape = 21) +
  scale_fill_manual(values = c(colors)) +
  ggnetwork::theme_blank() +
  geom_node_text(aes(label = as.factor(membership(clv_6))), repel = T) +
  theme(legend.position = "none")
```

```
## Using "stress" as default layout
```

```
library(ggpubr)
ggarrange(clv_6_plot, nrow = 1, ncol = 1)
```


1
3
1
3
3
1
1
3
2
2
2
2