Lab 7 Data Visualization SNA

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Attaching the Libraries

```
library(sna)
```

```
## Warning: package 'sna' was built under R version 4.2.2
```

```
## Loading required package: statnet.common
```

```
## Warning: package 'statnet.common' was built under R version 4.2.2
```

```
##
## Attaching package: 'statnet.common'
```

```
## The following objects are masked from 'package:base':
##
##     attr, order
```

```
## Loading required package: network
```

```
## Warning: package 'network' was built under R version 4.2.2
```

```
##
## 'network' 1.18.1 (2023-01-24), part of the Statnet Project
## * 'news(package="network")' for changes since last version
## * 'citation("network")' for citation information
## * 'https://statnet.org' for help, support, and other information
```

```
## sna: Tools for Social Network Analysis
## Version 2.7-1 created on 2023-01-24.
## copyright (c) 2005, Carter T. Butts, University of California-Irvine
##  For citation information, type citation("sna").
##  Type help(package="sna") to get started.
```

```
library(igraph)
```

```
##
## Attaching package: 'igraph'
```

```
## The following objects are masked from 'package:sna':
##
##     betweenness, bonpow, closeness, components, degree, dyad.census,
##     evcent, hierarchy, is.connected, neighborhood, triad.census
```

```
## The following objects are masked from 'package:network':
##
##     %c%, %s%, add.edges, add.vertices, delete.edges, delete.vertices,
##     get.edge.attribute, get.edges, get.vertex.attribute, is.bipartite,
##     is.directed, list.edge.attributes, list.vertex.attributes,
##     set.edge.attribute, set.vertex.attribute
```

```
## The following objects are masked from 'package:stats':
##
##     decompose, spectrum
```

```
## The following object is masked from 'package:base':
##
##     union
```

1. Import and load the dataset and view information about it using str() function.

```
df <-read.csv("~/socialnetworkdata.csv")
data <- data.frame(df$first,df$second)
str(data)
```

```
## 'data.frame':    290 obs. of  2 variables:
##  $ df.first : chr  "AA" "AB" "AF" "DD" ...
##  $ df.second: chr  "DD" "DD" "BA" "DA" ...
```

2. Create the graph network using graph.data.frame() function.

```
graph <- graph.data.frame(data)
V(graph)
```

```
## + 52/52 vertices, named, from 74589e3:
##  [1] AA AB AF DD CD BA CB CC BC ED AE CA EB BF BB AC DC BD DB CF DF BE EA CE EE
## [26] EF FF FD GB GC GD AD KA KF LC DA EC FA FB DE FC FE GA GE KB KC KD KE LB LA
## [51] LD LE
```

```
E(graph)
```

```
## + 290/290 edges from 74589e3 (vertex names):
##   [1] AA->DD AB->DD AF->BA DD->DA CD->EC DD->CE CD->FA CD->CC BA->AF CB->CA
##  [11] CC->CA CD->CA BC->CA DD->DA ED->AD AE->AC AB->BA CD->EC CA->CC EB->CC
##  [21] BF->CE BB->CD AC->AE CC->FB DC->BB BD->CF DB->DA DD->DA DB->DD BC->AF
##  [31] CF->DE DF->BF CB->CA BE->CA EA->CA CB->CA CB->CA CC->CA CD->CA BC->CA
##  [41] BF->CA CE->CA AC->AD BD->BE AE->DF CB->DF AC->DF AA->DD AA->DD AA->DD
##  [51] CD->DD AA->DD EE->DD CD->DD DB->AA AA->FC BE->CC EF->FD CF->FE BB->DD
##  [61] CD->DD BA->AB CD->EC BE->EE CE->CC CD->CC ED->CC BB->CC BE->CE DD->CE
##  [71] AC->CD ED->CD FF->CD AC->CD DD->CD DD->CD AE->GA AE->GA AE->GA AE->GA
##  [81] BA->ED BE->ED EB->ED CD->ED FD->EF FD->EF CD->BB BF->BB BC->BB BB->CF
##  [91] AE->AC DD->DA BE->CA BE->CA CB->CA CB->CA CC->CA BE->CC BE->CC DB->DD
## + ... omitted several edges
```

```
igraph::degree(graph)
```

```
## AA AB AF DD CD BA CB CC BC ED AE CA EB BF BB AC DC BD DB CF DF BE EA CE EE EF
## 18  9 23 36 40 26 24 50 21 27 15 62  7 12 23 27  2  4  8 12 23 20  8 10  6  8
## FF FD GB GC GD AD KA KF LC DA EC FA FB DE FC FE GA GE KB KC KD KE LB LA LD LE
##  1  8  1  1  1  9  3  3  1  7  3  1  1  2  1  2  5  1  1  1  1  1  1  1  1  1
```

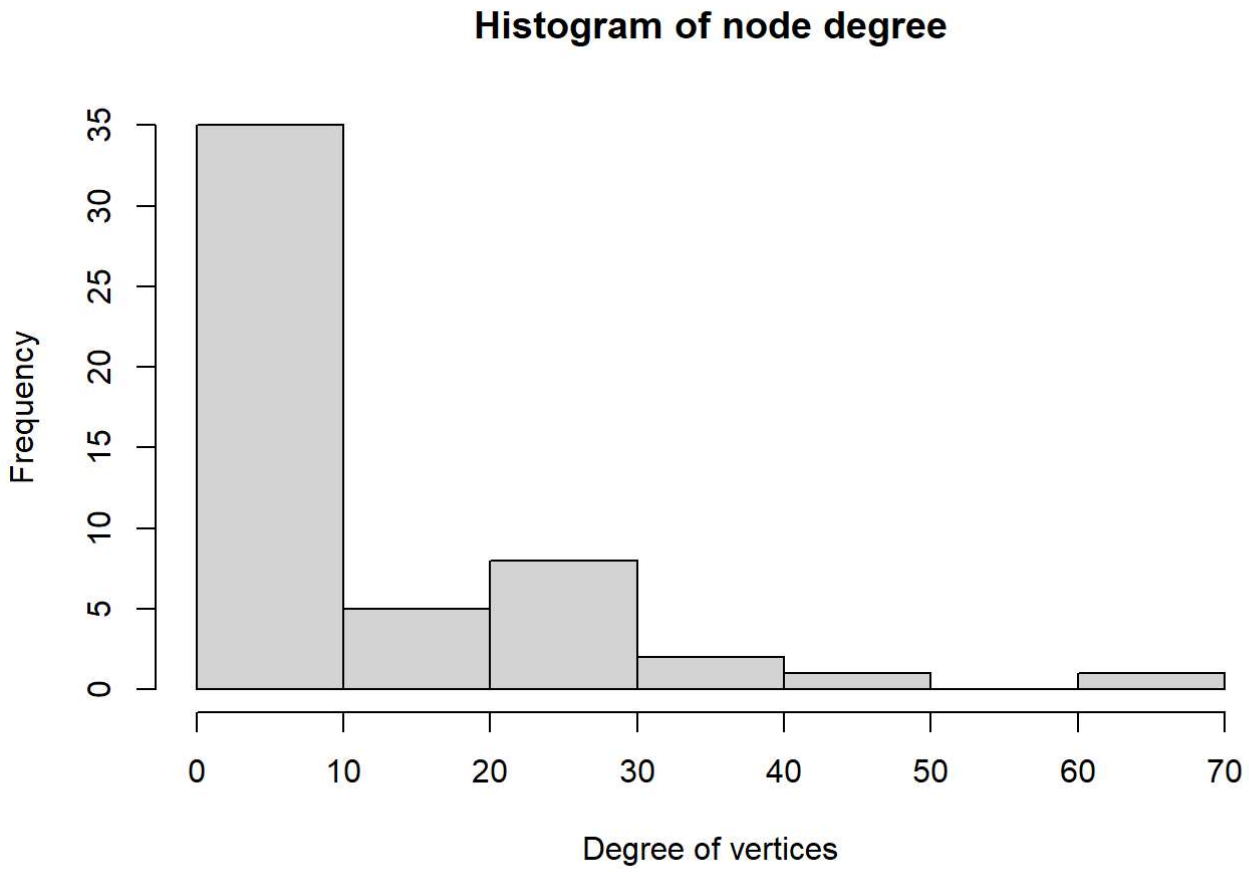
```
igraph::betweenness(graph)
```

```
##         AA         AB         AF         DD         CD         BA         CB
##  89.196239   4.564734 109.762225 162.990640 375.992047 184.496219  36.237779
##         CC         BC         ED         AE         CA         EB         BF
## 225.269107  94.821412 343.016093 105.368424 292.157605   0.000000  28.446981
##         BB         AC         DC         BD         DB         CF         DF
## 244.963181 172.427422   0.000000   5.966115   0.000000 181.814414  42.768995
##         BE         EA         CE         EE         EF         FF         FD
##  55.964872 183.604022  11.943347   4.002137   0.000000   0.000000  33.000000
##         GB         GC         GD         AD         KA         KF         LC
##   0.000000   0.000000   0.000000  48.996857   0.000000  17.229134   0.000000
##         DA         EC         FA         FB         DE         FC         FE
##   0.000000   0.000000   0.000000   0.000000   0.000000   0.000000   0.000000
##         GA         GE         KB         KC         KD         KE         LB
##   0.000000   0.000000   0.000000   0.000000   0.000000   0.000000   0.000000
##         LA         LD         LE
##   0.000000   0.000000   0.000000
```

```
V(graph)$label <- V(graph)$name
V(graph)$degree <- igraph::degree(graph)
```

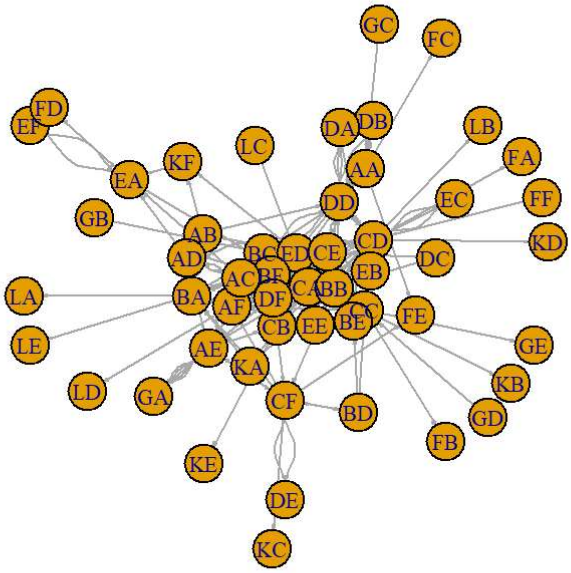
3. Plot the Histogram graph For Node Degrees.

```
hist(V(graph)$degree,main='Histogram of node degree',xlab='Degree of vertices',ylab='Frequenc
y')
```



4. Plot the Network Graph Diagram.

```
plot(graph,vertex.label.cex=0.7,vertext.size=2,edge.arrow.size=0.1)
```



5. Compute the hub and authority scores and depict the vertices with maximum hub and authority in the network diagram.

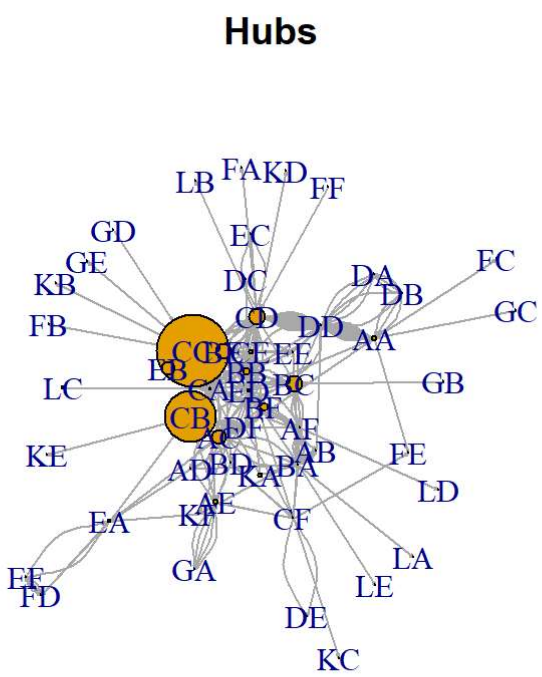
```
hs <- hub_score(graph)$vector
hs
```

```
##           AA           AB           AF           DD           CD           BA
## 8.042807e-02 1.300950e-02 4.731440e-03 1.255496e-02 2.350165e-01 3.239013e-02
##           CB           CC           BC           ED           AE           CA
## 7.145888e-01 1.000000e+00 2.321828e-01 4.858357e-02 7.949708e-02 4.494956e-02
##           EB           BF           BB           AC           DC           BD
## 1.870058e-01 1.272314e-01 1.150808e-01 2.093518e-01 7.455515e-03 1.305960e-02
##           DB           CF           DF           BE           EA           CE
## 1.738176e-02 7.102816e-03 2.505787e-02 2.195271e-01 5.693409e-02 6.319085e-02
##           EE           EF           FF           FD           GB           GC
## 1.273824e-02 1.119098e-03 4.485458e-03 4.563724e-04 3.594258e-04 2.507046e-04
##           GD           AD           KA           KF           LC           DA
## 6.374463e-03 9.643170e-03 6.276463e-02 4.418478e-04 5.681639e-02 8.403409e-17
##           EC           FA           FB           DE           FC           FE
## 3.267993e-17 1.167140e-17 1.167140e-17 2.334280e-17 1.167140e-17 2.334280e-17
##           GA           GE           KB           KC           KD           KE
## 4.668561e-17 1.167140e-17 1.167140e-17 1.167140e-17 1.167140e-17 1.167140e-17
##           LB           LA           LD           LE
## 1.167140e-17 1.167140e-17 1.167140e-17 1.167140e-17
```

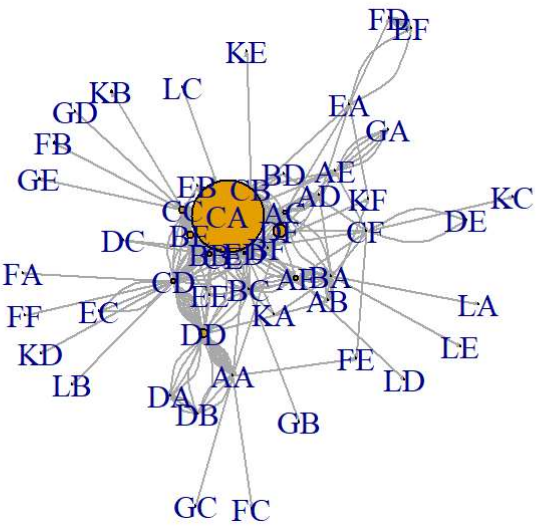
```
as <- authority.score(graph)$vector
as
```

```
##           AA           AB           AF           DD           CD           BA
## 4.412541e-03 3.968841e-03 8.375004e-02 1.409698e-01 7.894656e-02 2.146204e-02
##           CB           CC           BC           ED           AE           CA
## 3.660444e-03 1.121941e-01 6.326094e-03 4.799095e-02 1.524499e-02 1.000000e+00
##           EB           BF           BB           AC           DC           BD
## 5.863552e-17 6.072030e-03 8.323026e-02 6.262068e-02 1.832360e-17 2.486679e-04
##           DB           CF           DF           BE           EA           CE
## 7.329440e-17 8.146610e-03 1.925650e-01 1.095155e-01 7.776767e-03 2.437300e-02
##           EE           EF           FF           FD           GB           GC
## 2.419075e-02 6.390996e-05 9.161800e-18 2.071608e-03 9.161800e-18 9.161800e-18
##           GD           AD           KA           KF           LC           DA
## 9.161800e-18 1.806051e-02 2.565304e-17 2.156359e-03 9.161800e-18 3.583779e-03
##           EC           FA           FB           DE           FC           FE
## 2.468362e-02 8.227873e-03 3.500976e-02 4.973358e-04 2.815768e-03 3.064436e-03
##           GA           GE           KB           KC           KD           KE
## 1.391587e-02 3.500976e-02 3.500976e-02 2.486679e-04 8.227873e-03 2.501759e-02
##           LB           LA           LD           LE
## 8.227873e-03 1.133971e-03 1.656466e-04 1.133971e-03
```

```
plot(graph,vertex.size=hs*30,main='Hubs',edge.arrow.size=0.1,layout=layout.fruchterman.reingold)
```

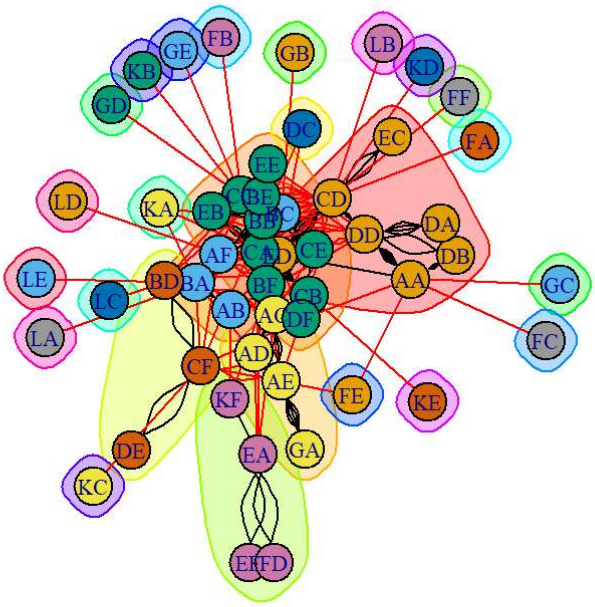



```
plot(graph,vertex.size=as*30,main='Authorities',edge.arrow.size=0.1,layout=layout.fruchterman.reingold)
```



6. Find out the communities present in the network.

```
network <- graph.data.frame(data,directed=F)
cnetwork <- cluster_edge_betweenness(network)
plot(cnetwork,network,vertex.label.cex=0.7)
```




```
# (vii) Conclusion

#In social network research, the SNA and igraph packages in R were utilized to analyze a data set with network data involving different nodes. By computing the hub and authority scores of each node, a network diagram was created. The identification of communities in the network revealed that nodes within the same group were highly connected, while nodes between different groups were only weakly connected.
```