Midterm

2024-05

Midterm:

note: there will be few comments until the discussion section. the discussion section will include plots and descriptive statistics derived in the analysis section.

Analysis

creating calculation of total degree, indegree, outdegree, dyad and edge counts, density, transitivity, and reciprocity of Nexus company before merger:

```
edge_listW_mod <- read.csv("EdgeListWork_mod.csv")

node_list <- read.csv('HW2_attr.csv')

graphW_mod <- graph_from_data_frame(edge_listW_mod, directed = TRUE, vertices = node_list)

adj_matrix_mod <- as_adjacency_matrix(graphW_mod, type = "both", attr = "weight", sparse = FALSE)

write.csv(as.data.frame(adj_matrix_mod), "AdjMtxW_HW2_mod.csv", row.names = TRUE)


WorkShipNetwork_mod <- xCreateProject(
  GeneralDescription = "Work Relationship Network Modified",
  NetworkName = "WorkRelationships",
  NETFILE = "AdjMtxW_HW2_mod.csv",
  FileType = "csv",
  InFormatType = "AdjMat",
  NetworkDescription = "WorkRel network",
  Mode = c("People"),
  Directed = TRUE,
  Loops = FALSE,
  Values = "Ordinal",
  Class = "matrix",
  References = "No references"
)
```

```
##
##  ------ FUNCTION: xCreateProject ----------------------------
##
##
##  - Basic checks performed on the argument for "xCreateProject".
##
##  - Data imported: [ AdjMtxW_HW2_mod.csv ] and named as: [ WorkRelationships ]
##  ----------------------------------------------------------------
```

```
WorkShipNetwork_mod
```

```
## $ProjectInfo
## $ProjectInfo$GeneralDescription
## [1] "Work Relationship Network Modified"
##
## $ProjectInfo$Modes
## [1] "People"
##
## $ProjectInfo$AttributesDescription
##   Variable   Mode                            Details
## 1 NodeName People Names of the nodes for mode People
##
## $ProjectInfo$NetworksDescription
##         NetworkName         Details
## 1 WorkRelationships WorkRel network
##
## $ProjectInfo$References
## [1] "No references"
##
##
## $Attributes
##    NodeName
## 1        D1
## 2        E1
## 3        E2
## 4        E3
## 5        F1
## 6        F2
## 7        H1
## 8        H2
## 9        M1
## 10       M2
## 11       M3
## 12       M4
## 13       O1
## 14       O2
## 15       R1
## 16       R2
## 17       R3
## 18       R4
## 19       R5
## 20       S1
## 21       S3
## 22       S4
## 23     Sec1
## 24     Sec2
##
## $NetworkInfo
##         NetworkName ModeSender ModeReceiver Directed Loops  Values  Class
## 1 WorkRelationships     People       People     TRUE FALSE Ordinal matrix
##
## $WorkRelationships
##      D1 E1 E2 E3 F1 F2 H1 H2 M1 M2 M3 M4 O1 O2 R1 R2 R3 R4 R5 S1 S3 S4 Sec1
```

```
## D1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## E1    2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  1  0  0  0    0
## E2    1  2  0  1  0  1  2  0  0  0  0  0  0  0  0  0  1  0  0  0  0  2    0
## E3    0  1  0  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1    0
## F1    0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0    0
## F2    0  0  0  0  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## H1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  1  0  0  0    0
## H2    0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0  0  0    0
## M1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## M2    1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## M3    0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  2  2    0
## M4    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  2    0
## O1    0  0  0  0  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## O2    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## R1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0    1
## R2    0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0    0
## R3    0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0    1
## R4    0  1  0  0  0  0  0  0  0  0  0  0  0  0  1  0  1  0  0  0  0  0    1
## R5    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0    0
## S1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## S3    0  0  0  0  0  0  0  0  0  0  2  0  0  0  0  0  0  0  0  0  0  2    0
## S4    0  0  0  0  0  0  0  0  0  0  4  2  0  0  0  0  0  0  0  0  2  0    0
## Sec1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## Sec2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
##      Sec2
## D1      0
## E1      2
## E2      0
## E3      1
## F1      0
## F2      2
## H1      1
## H2      0
## M1      0
## M2      0
## M3      2
## M4      0
## O1      2
## O2      0
## R1      0
## R2      0
## R3      0
## R4      0
## R5      0
## S1      0
## S3      2
## S4      2
## Sec1    1
## Sec2    0
```

```
WorkShipNetwork_mod<-xAddAttributesToProject(ProjectName=WorkShipNetwork_mod,
                                             ATTFILE1="HW2_attr.csv",
                                             FileType="csv",
                                             Mode=c("People"),
```

```
                                        AttributesDescription=c("ID","Name","Department","Age","Gender
```

```
##
##  ------ FUNCTION: xAddAttributesToProject ----------------------------
##
##  Getting "dataproject" with name [WorkShipNetwork_mod].
##
##  Attribute file ["HW2_attr.csv"] imported
```

```
WorkShipNetwork_mod
```

```
## $ProjectInfo
## $ProjectInfo$GeneralDescription
## [1] "Work Relationship Network Modified"
##
## $ProjectInfo$Modes
## [1] "People"
##
## $ProjectInfo$AttributesDescription
##     Variable   Mode                              Details
## 1   NodeName People Names of the nodes for mode People
## 2       Name People                                 ID
## 3 Department People                               Name
## 4        Age People                         Department
## 5     Gender People                                Age
## 6      Title People                             Gender
##
## $ProjectInfo$NetworksDescription
##         NetworkName         Details
## 1 WorkRelationships WorkRel network
##
## $ProjectInfo$References
## [1] "No references"
##
##
## $Attributes
##    NodeName      Name Department Age Gender                     Title
## 1        D1     Pat L     Design  30      M
## 2        E1   Chris T       Exec  37      M                       CTO
## 3        E2     Art Y       Exec  27      M                       CEO
## 4        E3  Briley H       Exec  27      F                       COO
## 5        F1     Lee Y    Finance  38      F
## 6        F2 Wyndham R    Finance  48      M            VP of Finance
## 7        H1     Sam J         HR  41      M                 VP of HR
## 8        H2   Nikki C         HR  40      F
## 9        M1  Oliver H  Marketing  30      M
## 10       M2  Taylor S  Marketing  40      F
## 11       M3     Ivy S  Marketing  29      F
## 12       M4   Quinn R  Marketing  37      F
## 13       O1  Morgan F Operations  36      M
## 14       O2   Jesse M Operations  48      M
## 15       R1    Alex M        R&D  35      M
## 16       R2   Jamie W        R&D  40      M
## 17       R3     Kim K        R&D  38      F
```

```
## 18       R4    Erin B        R&D  35      F
## 19       R5   Robin K        R&D  29      F
## 20       S1    Dana P      Sales  28      F
## 21       S3     Eva D      Sales  27      F
## 22       S4   Casey S      Sales  33      M VP of Sales and Marketing
## 23     Sec1  Jordan D   Security  44      M
## 24     Sec2     Max T   Security  35      M                      A Spy
##
## $NetworkInfo
##         NetworkName ModeSender ModeReceiver Directed Loops  Values  Class
## 1 WorkRelationships     People       People     TRUE FALSE Ordinal matrix
##
## $WorkRelationships
##      D1 E1 E2 E3 F1 F2 H1 H2 M1 M2 M3 M4 O1 O2 R1 R2 R3 R4 R5 S1 S3 S4 Sec1
## D1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## E1    2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  1  0  0  0    0
## E2    1  2  0  1  0  1  2  0  0  0  0  0  0  0  0  0  1  0  0  0  0  2    0
## E3    0  1  0  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1    0
## F1    0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0    0
## F2    0  0  0  0  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## H1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  1  0  0  0    0
## H2    0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0  0    0
## M1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## M2    1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## M3    0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  2  2    0
## M4    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  2    0
## O1    0  0  0  0  2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## O2    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## R1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0    1
## R2    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0    0
## R3    0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0    1
## R4    0  1  0  0  0  0  0  0  0  0  0  0  0  0  1  0  1  0  0  0  0  0    1
## R5    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0    0
## S1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## S3    0  0  0  0  0  0  0  0  0  0  2  0  0  0  0  0  0  0  0  0  0  2    0
## S4    0  0  0  0  0  0  0  0  0  0  4  2  0  0  0  0  0  0  0  0  2  0    0
## Sec1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## Sec2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
##      Sec2
## D1      0
## E1      2
## E2      0
## E3      1
## F1      0
## F2      2
## H1      1
## H2      0
## M1      0
## M2      0
## M3      2
## M4      0
## O1      2
## O2      0
## R1      0
```

```
## R2      0
## R3      0
## R4      0
## R5      0
## S1      0
## S3      2
## S4      2
## Sec1    1
## Sec2    0
```

```
#dichotomizing and symmetrizing into new projects
dichotomizedWNetwork_mod <- xDichotomize(WorkShipNetwork_mod$WorkRelationships,Value=.99)
dichotomizedWNetwork_mod
```

```
##      D1 E1 E2 E3 F1 F2 H1 H2 M1 M2 M3 M4 O1 O2 R1 R2 R3 R4 R5 S1 S3 S4 Sec1
## D1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## E1    1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  1  0  0  0    0
## E2    1  1  0  1  0  1  1  0  0  0  0  0  0  0  0  0  1  0  0  0  0  1    0
## E3    0  1  0  0  0  1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1    0
## F1    0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0    0
## F2    0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## H1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  1  0  0  0    0
## H2    0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0  0  0    0
## M1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## M2    1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## M3    0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  1  1    0
## M4    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1    0
## O1    0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## O2    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## R1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0    1
## R2    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0    0
## R3    0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0    1
## R4    0  1  0  0  0  0  0  0  0  0  0  0  0  0  1  0  1  0  0  0  0  0    1
## R5    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0    0
## S1    0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## S3    0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  1    0
## S4    0  0  0  0  0  0  0  0  0  0  1  1  0  0  0  0  0  0  0  0  1  0    0
## Sec1  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
## Sec2  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    0
##      Sec2
## D1      0
## E1      1
## E2      0
## E3      1
## F1      0
## F2      1
## H1      1
## H2      0
## M1      0
## M2      0
## M3      1
## M4      0
## O1      1
## O2      0
## R1      0
```

```
## R2      0
## R3      0
## R4      0
## R5      0
## S1      0
## S3      1
## S4      1
## Sec1    1
## Sec2    0
```

```
#symmetrizedWNetwork <- xSymmetrize(dichotomizedWNetwork) #not sure why but it give me all 0s
symmetrizedWNetwork_mod <- symmetrize(dichotomizedWNetwork_mod, rule="weak", return.as.edgelist=FALSE)
symmetrizedWNetwork_mod
```

```
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##  [1,]    0    1    1    0    0    0    0    0    0     1     0     0     0
##  [2,]    1    0    1    1    0    0    0    0    0     0     0     0     0
##  [3,]    1    1    0    1    0    1    1    0    0     0     0     0     0
##  [4,]    0    1    1    0    0    1    1    0    0     0     0     0     0
##  [5,]    0    0    0    0    0    1    0    0    0     0     0     0     1
##  [6,]    0    0    1    1    1    0    0    0    0     0     0     0     0
##  [7,]    0    0    1    1    0    0    0    0    0     0     0     0     0
##  [8,]    0    0    0    0    0    0    0    0    0     0     0     0     0
##  [9,]    0    0    0    0    0    0    0    0    0     0     1     0     0
## [10,]    1    0    0    0    0    0    0    0    0     0     0     0     0
## [11,]    0    0    0    0    0    0    0    0    1     0     0     0     0
## [12,]    0    0    0    0    0    0    0    0    0     0     0     0     0
## [13,]    0    0    0    0    1    0    0    0    0     0     0     0     0
## [14,]    0    0    0    0    0    0    0    1    0     0     0     0     0
## [15,]    0    0    0    0    0    0    0    1    0     0     0     0     0
## [16,]    0    1    0    0    0    0    1    0    0     0     0     0     0
## [17,]    0    0    1    0    0    0    0    0    0     0     0     0     1
## [18,]    0    1    0    0    0    0    0    0    0     0     0     0     0
## [19,]    0    1    0    0    0    0    1    0    0     0     0     0     0
## [20,]    0    0    0    0    0    0    0    0    0     0     0     0     0
## [21,]    0    0    0    0    0    0    0    0    0     0     1     0     0
## [22,]    0    0    1    1    0    0    0    0    0     0     1     1     0
## [23,]    0    1    0    0    0    0    0    0    0     0     0     0     0
## [24,]    0    1    0    1    0    1    1    0    0     0     1     0     1
##       [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24]
##  [1,]     0     0     0     0     0     0     0     0     0     0     0
##  [2,]     0     0     1     0     1     1     0     0     0     1     1
##  [3,]     0     0     0     1     0     0     0     0     1     0     0
##  [4,]     0     0     0     0     0     0     0     0     1     0     1
##  [5,]     0     0     0     0     0     0     0     0     0     0     0
##  [6,]     0     0     0     0     0     0     0     0     0     0     1
##  [7,]     0     0     1     0     0     1     0     0     0     0     1
##  [8,]     1     1     0     0     0     0     0     0     0     0     0
##  [9,]     0     0     0     0     0     0     0     0     0     0     0
## [10,]     0     0     0     0     0     0     0     0     0     0     0
## [11,]     0     0     0     0     0     0     0     1     1     0     1
## [12,]     0     0     0     0     0     0     0     0     1     0     0
## [13,]     0     0     0     1     0     0     0     0     0     0     1
## [14,]     0     0     0     0     0     0     0     0     0     0     0
## [15,]     0     0     1     1     1     0     0     0     0     1     0
```

```
## [16,]     0     1     0     0     0     1     0     0     0     0     0
## [17,]     0     1     0     0     1     0     0     0     0     1     0
## [18,]     0     1     0     1     0     0     0     0     0     1     0
## [19,]     0     0     1     0     0     0     0     0     0     0     0
## [20,]     0     0     0     0     0     0     0     0     0     0     0
## [21,]     0     0     0     0     0     0     0     0     1     0     1
## [22,]     0     0     0     0     0     0     0     1     0     0     1
## [23,]     0     1     0     1     1     0     0     0     0     0     1
## [24,]     0     0     0     0     0     0     0     1     1     1     0
```

```
#workrel modified net
WorkNet_mod <- symmetrizedWNetwork_mod %*% symmetrizedWNetwork_mod

WorkNet_mod
```

```
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##  [1,]    3    1    1    2    0    1    1    0    0     0     0     0     0
##  [2,]    1    8    2    2    0    3    5    0    0     1     1     0     1
##  [3,]    1    2    7    4    1    1    1    0    0     1     1     1     1
##  [4,]    2    2    4    6    1    2    2    0    0     0     2     1     1
##  [5,]    0    0    1    1    2    0    0    0    0     0     0     0     0
##  [6,]    1    3    1    2    0    4    3    0    0     0     1     0     2
##  [7,]    1    5    1    2    0    3    5    0    0     0     1     0     1
##  [8,]    0    0    0    0    0    0    0    2    0     0     0     0     0
##  [9,]    0    0    0    0    0    0    0    0    1     0     0     0     0
## [10,]    0    1    1    0    0    0    0    0    0     1     0     0     0
## [11,]    0    1    1    2    0    1    1    0    0     0     4     1     1
## [12,]    0    0    1    1    0    0    0    0    0     0     1     1     0
## [13,]    0    1    1    1    0    2    1    0    0     0     1     0     3
## [14,]    0    0    0    0    0    0    0    0    0     0     0     0     0
## [15,]    0    3    1    0    0    0    1    0    0     0     0     0     1
## [16,]    1    1    2    2    0    0    1    1    0     0     0     0     0
## [17,]    1    3    0    1    1    1    1    1    0     0     0     0     0
## [18,]    1    1    2    1    0    0    0    1    0     0     0     0     1
## [19,]    1    1    2    2    0    0    1    0    0     0     0     0     0
## [20,]    0    0    0    0    0    0    0    0    0     0     0     0     0
## [21,]    0    1    1    2    0    1    1    0    1     0     2     1     1
## [22,]    1    3    1    2    0    3    3    0    1     0     2     0     1
## [23,]    1    2    2    2    0    1    1    1    0     0     1     0     2
## [24,]    1    2    5    4    2    1    1    0    1     0     2     1     0
##       [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24]
##  [1,]     0     0     1     1     1     1     0     0     1     1     1
##  [2,]     0     3     1     3     1     1     0     1     3     2     2
##  [3,]     0     1     2     0     2     2     0     1     1     2     5
##  [4,]     0     0     2     1     1     2     0     2     2     2     4
##  [5,]     0     0     0     1     0     0     0     0     0     0     2
##  [6,]     0     0     0     1     0     0     0     1     3     1     1
##  [7,]     0     1     1     1     0     1     0     1     3     1     1
##  [8,]     0     0     1     1     1     0     0     0     0     1     0
##  [9,]     0     0     0     0     0     0     0     1     1     0     1
## [10,]     0     0     0     0     0     0     0     0     0     0     0
## [11,]     0     0     0     0     0     0     0     2     2     1     2
## [12,]     0     0     0     0     0     0     0     1     0     0     1
## [13,]     0     1     0     0     1     0     0     1     1     2     0
## [14,]     1     1     0     0     0     0     0     0     0     0     0
```

```
## [15,]     1     5     0     2     2     1     0     0     0     2     1
## [16,]     0     0     4     1     2     2     0     0     0     2     2
## [17,]     0     2     1     5     2     0     0     0     1     2     2
## [18,]     0     2     2     2     4     1     0     0     0     3     2
## [19,]     0     1     2     0     1     3     0     0     0     1     2
## [20,]     0     0     0     0     0     0     0     0     0     0     0
## [21,]     0     0     0     0     0     0     0     3     2     1     2
## [22,]     0     0     0     1     0     0     0     2     6     1     3
## [23,]     0     2     2     2     3     1     0     1     1     5     1
## [24,]     0     1     2     2     2     2     0     2     3     1     9
```

```
WorkNet2_mod <- symmetrizedWNetwork_mod %*% WorkNet_mod

WorkNet2_mod
```

```
##       [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11] [,12] [,13]
##  [1,]    2   11   10    6    1    4    6    0    0     3     2     1     2
##  [2,]   11   12   25   23    4    6    8    3    1     1     6     3     5
##  [3,]   10   25   10   17    2   17   20    1    1     1     7     1     6
##  [4,]    6   23   17   16    3   15   18    0    2     2     8     2     6
##  [5,]    1    4    2    3    0    6    4    0    0     0     2     0     5
##  [6,]    4    6   17   15    6    4    4    0    1     1     5     3     2
##  [7,]    6    8   20   18    4    4    6    1    1     1     5     3     2
##  [8,]    0    3    1    0    0    0    1    0    0     0     0     0     1
##  [9,]    0    1    1    2    0    1    1    0    0     0     4     1     1
## [10,]    3    1    1    2    0    1    1    0    0     0     0     0     0
## [11,]    2    6    7    8    2    5    5    0    4     0     6     2     2
## [12,]    1    3    1    2    0    3    3    0    1     0     2     0     1
## [13,]    2    5    6    6    5    2    2    1    1     0     2     1     0
## [14,]    0    0    0    0    0    0    0    2    0     0     0     0     0
## [15,]    4    7    6    6    1    2    3    6    0     0     1     0     3
## [16,]    3   17    6    6    0    6   12    0    0     1     2     0     3
## [17,]    3    9   13    8    1    4    4    2    0     1     3     1     8
## [18,]    3   16    5    5    1    5    8    2    0     1     2     0     4
## [19,]    3   14    5    6    0    6   11    1    0     1     2     0     2
## [20,]    0    0    0    0    0    0    0    0    0     0     0     0     0
## [21,]    2    6    7    8    2    5    5    0    2     0     8     2     2
## [22,]    4    8   19   19    4    6    6    0    2     1    12     6     4
## [23,]    4   17   10    8    3    5    8    2    1     1     3     1     3
## [24,]    7   26   14   21    1   20   22    1    2     1    15     3    13
##       [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24]
##  [1,]     0     4     3     3     3     3     0     2     4     4     7
##  [2,]     0     7    17     9    16    14     0     6     8    17    26
##  [3,]     0     6     6    13     5     5     0     7    19    10    14
##  [4,]     0     6     6     8     5     6     0     8    19     8    21
##  [5,]     0     1     0     1     1     0     0     2     4     3     1
##  [6,]     0     2     6     4     5     6     0     5     6     5    20
##  [7,]     0     3    12     4     8    11     0     5     6     8    22
##  [8,]     2     6     0     2     2     1     0     0     0     2     1
##  [9,]     0     0     0     0     0     0     0     2     2     1     2
## [10,]     0     0     1     1     1     1     0     0     1     1     1
## [11,]     0     1     2     3     2     2     0     8    12     3    15
## [12,]     0     0     0     1     0     0     0     2     6     1     3
## [13,]     0     3     3     8     4     2     0     2     4     3    13
## [14,]     0     0     1     1     1     0     0     0     0     1     0
```

```
## [15,]     0     6    10    11    12     4     0     1     2    13     7
## [16,]     1    10     4     6     4     6     0     2     6     6     6
## [17,]     1    11     6     6    12     5     0     3     3    14     9
## [18,]     1    12     4    12     8     3     0     2     5    11     6
## [19,]     0     4     6     5     3     4     0     2     6     5     5
## [20,]     0     0     0     0     0     0     0     0     0     0     0
## [21,]     0     1     2     3     2     2     0     6    11     3    14
## [22,]     0     2     6     3     5     6     0    11    10     7    23
## [23,]     1    13     6    14    11     5     0     3     7    10    16
## [24,]     0     7     6     9     6     5     0    14    23    16    16
```

```
# Calculate degree, indegree, and outdegree
total_degree <- igraph::degree(graphW_mod, mode = "total")
indegree <- igraph::degree(graphW_mod, mode = "in")
outdegree <- igraph::degree(graphW_mod, mode = "out")

print("Total Degree:")
```

```
## [1] "Total Degree:"
```

```
print(total_degree)
```

```
##   D1   E1   E2   E3   F1   F2   H1   H2   M1   M2   M3   M4   O1   O2   R1   R2
##    3    8    7    6    3    4    5    2    1    1    6    2    4    1    6    5
##   R3   R4   R5   S1   S3   S4 Sec1 Sec2
##    5    4    3    0    5    9    5    9
```

```
print("Indegree:")
```

```
## [1] "Indegree:"
```

```
print(indegree)
```

```
##   D1   E1   E2   E3   F1   F2   H1   H2   M1   M2   M3   M4   O1   O2   R1   R2
##    3    4    0    1    2    2    2    0    1    0    2    1    2    1    3    4
##   R3   R4   R5   S1   S3   S4 Sec1 Sec2
##    3    0    2    0    2    5    3    9
```

```
print("Outdegree:")
```

```
## [1] "Outdegree:"
```

```
print(outdegree)
```

```
##   D1   E1   E2   E3   F1   F2   H1   H2   M1   M2   M3   M4   O1   O2   R1   R2
##    0    4    7    5    1    2    3    2    0    1    4    1    2    0    3    1
##   R3   R4   R5   S1   S3   S4 Sec1 Sec2
##    2    4    1    0    3    4    2    0
```

```
# Calculate dyad triad and edge counts on directed network
dyad_count <- igraph::dyad.census(graphW_mod)
```

```
## Warning: `dyad.census()` was deprecated in igraph 2.0.0.
## i Please use `dyad_census()` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```r
triad_count <- igraph::triad.census(graphW_mod)
```

```
## Warning: `triad.census()` was deprecated in igraph 2.0.0.
## i Please use `triad_census()` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```r
edge_count <- gsize(graphW_mod)

print("Dyad Count:")
```

```
## [1] "Dyad Count:"
```

```r
print(dyad_count)
```

```
## $mut
## [1] 6
##
## $asym
## [1] 40
##
## $null
## [1] 230
```

```r
print("Triad count:")
```

```
## [1] "Triad count:"
```

```r
print(triad_count)
```

```
##  [1] 1184  586  103   35   39   35   13    6   17    0    2    0    3    0    0
## [16]    1
```

```r
print("Edge Count:")
```

```
## [1] "Edge Count:"
```

```r
print(edge_count)
```

```
## [1] 52
```

```r
# Censuses after dichot. and symmetrized network
dyad_census_after <- sna::dyad.census(symmetrizedWNetwork_mod)
triad_census_after <- sna::triad.census(symmetrizedWNetwork_mod)
print("Dyadic Census :")
```

```
## [1] "Dyadic Census :"
```

```r
print(dyad_census_after)
```

```
##      Mut Asym Null
## [1,]  46    0  230
```

```r
print("Triadic Census :")
```

```
## [1] "Triadic Census :"
```

```r
print(triad_census_after)
```

```
##       003 012 102 021D 021U 021C 111D 111U 030T 030C 201 120D 120U 120C 210 300
```

```
## [1,] 1184   0 689    0    0    0    0    0    0    0 130    0    0    0   0  21
```

```
# Calculate density
density <- graph.density(graphW_mod)
```

```
## Warning: `graph.density()` was deprecated in igraph 2.0.0.
## i Please use `edge_density()` instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```

```
print("Density:")
```

```
## [1] "Density:"
```

```
print(density)
```

```
## [1] 0.0942029
```

```
# Calculate transitivity (global clustering coefficient)
transitivity_global <- transitivity(graphW_mod, type = "global")

print("Transitivity (Global Clustering Coefficient):")
```

```
## [1] "Transitivity (Global Clustering Coefficient):"
```

```
print(transitivity_global)
```

```
## [1] 0.3264249
```

```
# Calculate reciprocity
reciprocity_value <- reciprocity(graphW_mod)

print("Reciprocity:")
```

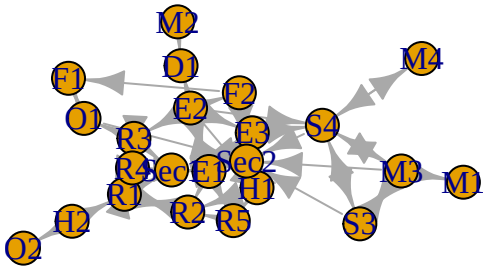
```
## [1] "Reciprocity:"
```

```
print(reciprocity_value)
```

```
## [1] 0.2307692
```

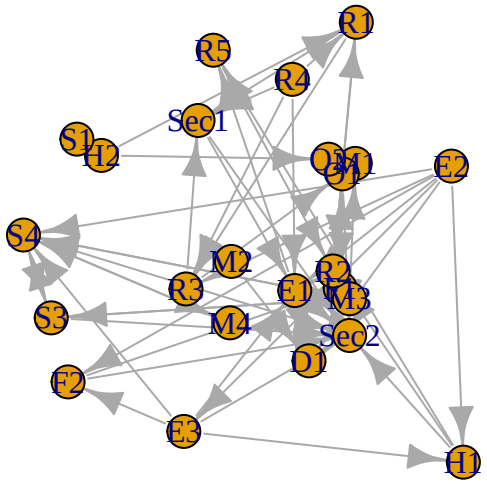
```
# Plotting various network layouts
plot(graphW_mod, layout = layout.kamada.kawai, vertex.label = V(graphW_mod)$name, main = "Kamada-Kawai
```

Kamada−Kawai Layout



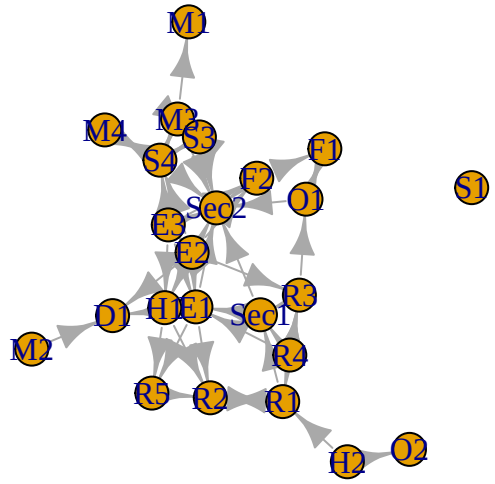

```
#plot(graphW_mod, layout = layout.eigen, vertex.label = V(graphW_mod)$name, main = "Eigen Layout")
plot(graphW_mod, layout = layout.random, vertex.label = V(graphW_mod)$name, main = "Random Layout")
```

Random Layout



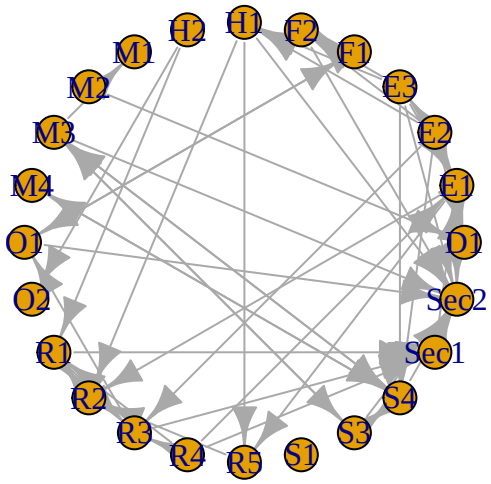

```
#plot(graphW_mod, layout = layout.spring, vertex.label = V(graphW_mod)$name, main = "Spring Layout")
plot(graphW_mod, layout = layout.fruchterman.reingold, vertex.label = V(graphW_mod)$name, main = "Fruch
```

Fruchterman−Reingold Layout



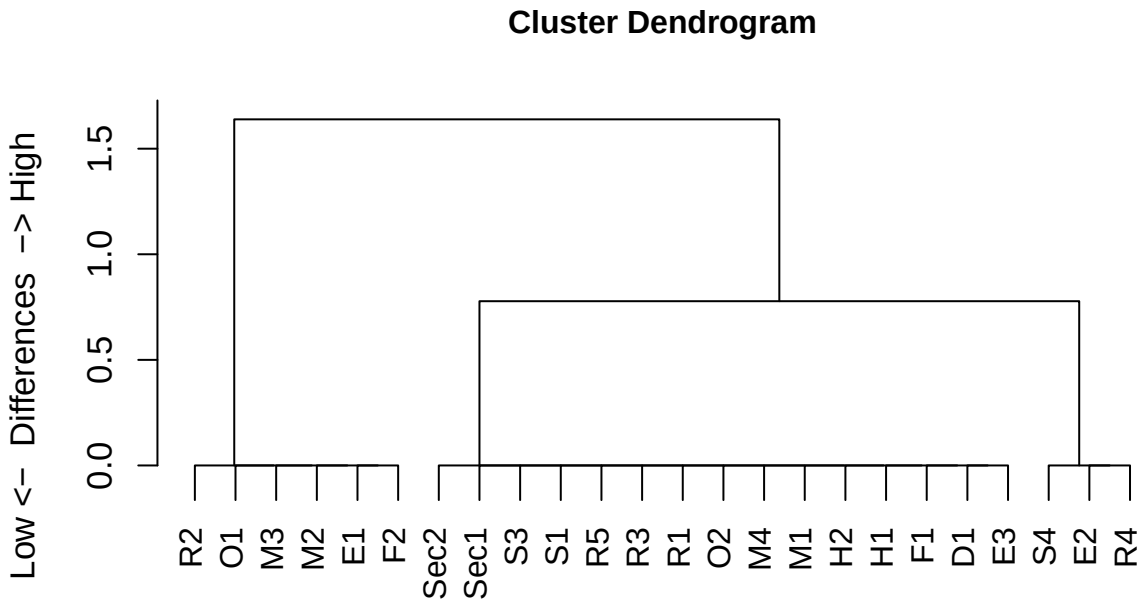

```
plot(graphW_mod, layout = layout.circle, vertex.label = V(graphW_mod)$name, main = "Circle Layout")
```

Circle Layout




```
#plot(graphW_mod, layout = layout_with_drl, vertex.label = V(graphW_mod)$name, main = "DrL Layout")
#plot(graphW_mod, layout = layout_with_lgl, vertex.label = V(graphW_mod)$name, main = "Large Graph Layo
```

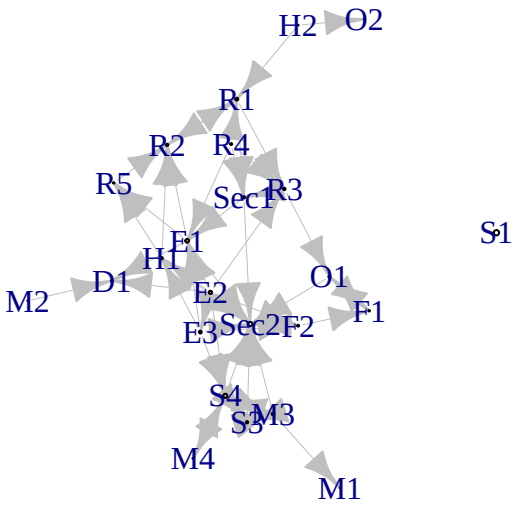
```
# Perform hierarchical clustering
ddgm1 <- xHierarchicalClustering(adj_matrix_mod, Input="Differences", Method="ward.D")
```



MAT1

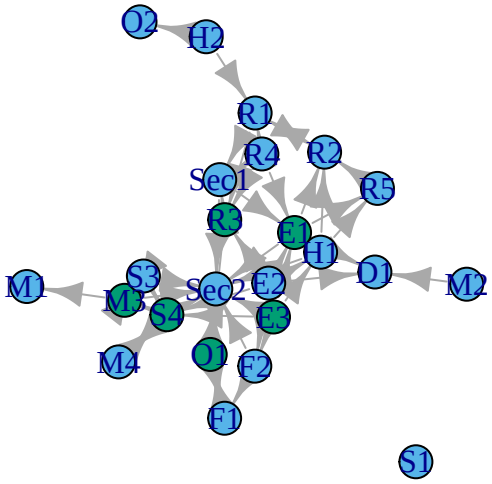
```
# Degree distribution plot
deg <- igraph::degree(graphW_mod)
rolecat <- V(graphW_mod)$name
my_pal <- brewer.pal(7, "Set2")

plot(graphW_mod, vertex.size = deg / 5, vertex.color = my_pal[as.factor(rolecat)], edge.width = 0.5, edg
```

Network with Vertex Size Proportional to Degree




```
# find cutpoints and visualize
xnet <- cutpoints(adj_matrix_mod, mode = "graph", return.indicator = TRUE)
plot(graphW_mod, vertex.color = xnet + 2, vertex.label = V(graphW_mod)$name, main = "Network with Cutpo
```

Network with Cutpoints



Reading the two mode network of NexusOko.AI (New company name)

New IDs are NOW included!!!

```
nxs_edge_list <- read.csv("NexusEdgeList.csv")

oko_edge_list <- read.csv("Oko2MdEdgeList.csv")

NexusOko_nodeLst <- read.csv("NexusOko_attr.csv")

#just nexus

graphNexus <- graph_from_data_frame(nxs_edge_list, directed = TRUE, vertices = NexusOko_nodeLst)

NexusAdjMxt <- as_adjacency_matrix(graphNexus, type = "both", attr = "weight", sparse = FALSE)

#write.csv(as.data.frame(NexusAdjMxt), "NexusAdjMxt.csv", row.names = TRUE)



#loading in (reading in) two mode network of oko+nexus (to be transposed)

graphOko <- graph_from_data_frame(oko_edge_list, directed = FALSE)

# Set the 'type' attribute: TRUE for events, FALSE for individuals
V(graphOko)$type <- V(graphOko)$name %in% unique(oko_edge_list$Event)

# Create a bipartite adjacency matrix (sorry i foudn this was of doing in documentation i was confused)
OkoAdjMxt <- as_biadjacency_matrix(graphOko, attr = "weight", sparse = FALSE)

#write.csv(as.data.frame(OkoAdjMxt), "OkoAdjMxt.csv", row.names = TRUE)
```

```
graphNexus
```

```
## IGRAPH 7f2b135 DNW- 39 52 --
## + attr: name (v/c), Name (v/c), Department (v/c), Age (v/n), Gender
## | (v/c), Title (v/c), weight (e/n)
## + edges from 7f2b135 (vertex names):
##  [1] E1_nxs->D1_nxs   E1_nxs->R5_nxs   E1_nxs->R2_nxs   E1_nxs->Sec2_nxs
##  [5] E2_nxs->E1_nxs   E2_nxs->F2_nxs   E2_nxs->H1_nxs   E2_nxs->S4_nxs
##  [9] E2_nxs->D1_nxs   E2_nxs->R3_nxs   E2_nxs->E3_nxs   E3_nxs->E1_nxs
## [13] E3_nxs->F2_nxs   E3_nxs->H1_nxs   E3_nxs->S4_nxs   E3_nxs->Sec2_nxs
## [17] F1_nxs->O1_nxs   H1_nxs->R5_nxs   H1_nxs->R2_nxs   H1_nxs->Sec2_nxs
## [21] H2_nxs->R1_nxs   H2_nxs->O2_nxs   M2_nxs->D1_nxs   M3_nxs->M1_nxs
## [25] R1_nxs->R2_nxs   R1_nxs->R3_nxs   R1_nxs->Sec1_nxs R2_nxs->R1_nxs
## + ... omitted several edges
```

```
NexusAdjMxt
```

```
##          D1_nxs E1_nxs E2_nxs E3_nxs F1_nxs F2_nxs H1_nxs H2_nxs M1_nxs M2_nxs
## D1_nxs        0      0      0      0      0      0      0      0      0      0
## E1_nxs        2      0      0      0      0      0      0      0      0      0
## E2_nxs        1      2      0      1      0      1      2      0      0      0
## E3_nxs        0      1      0      0      0      1      1      0      0      0
## F1_nxs        0      0      0      0      0      0      0      0      0      0
## F2_nxs        0      0      0      0      2      0      0      0      0      0
## H1_nxs        0      0      0      0      0      0      0      0      0      0
## H2_nxs        0      0      0      0      0      0      0      0      0      0
## M1_nxs        0      0      0      0      0      0      0      0      0      0
## M2_nxs        1      0      0      0      0      0      0      0      0      0
## M3_nxs        0      0      0      0      0      0      0      0      1      0
## M4_nxs        0      0      0      0      0      0      0      0      0      0
## O1_nxs        0      0      0      0      2      0      0      0      0      0
## O2_nxs        0      0      0      0      0      0      0      0      0      0
## R1_nxs        0      0      0      0      0      0      0      0      0      0
## R2_nxs        0      0      0      0      0      0      0      0      0      0
## R3_nxs        0      0      0      0      0      0      0      0      0      0
## R4_nxs        0      1      0      0      0      0      0      0      0      0
## R5_nxs        0      0      0      0      0      0      0      0      0      0
## S1_nxs        0      0      0      0      0      0      0      0      0      0
## S3_nxs        0      0      0      0      0      0      0      0      0      0
## S4_nxs        0      0      0      0      0      0      0      0      0      0
## Sec1_nxs      0      1      0      0      0      0      0      0      0      0
## Sec2_nxs      0      0      0      0      0      0      0      0      0      0
## Ex1_oko       0      0      0      0      0      0      0      0      0      0
## Ex2_oko       0      0      0      0      0      0      0      0      0      0
## Ex3_oko       0      0      0      0      0      0      0      0      0      0
## R1_oko        0      0      0      0      0      0      0      0      0      0
## R2_oko        0      0      0      0      0      0      0      0      0      0
## Sec1_oko      0      0      0      0      0      0      0      0      0      0
## M1_oko        0      0      0      0      0      0      0      0      0      0
## S1_oko        0      0      0      0      0      0      0      0      0      0
## M2_oko        0      0      0      0      0      0      0      0      0      0
## D1_oko        0      0      0      0      0      0      0      0      0      0
## D2_oko        0      0      0      0      0      0      0      0      0      0
## R3_oko        0      0      0      0      0      0      0      0      0      0
## S2_oko        0      0      0      0      0      0      0      0      0      0
```

```
## S3_oko        0      0      0      0      0      0      0      0      0      0
## M3_oko        0      0      0      0      0      0      0      0      0      0
##          M3_nxs M4_nxs O1_nxs O2_nxs R1_nxs R2_nxs R3_nxs R4_nxs R5_nxs S1_nxs
## D1_nxs        0      0      0      0      0      0      0      0      0      0
## E1_nxs        0      0      0      0      0      1      0      0      1      0
## E2_nxs        0      0      0      0      0      0      1      0      0      0
## E3_nxs        0      0      0      0      0      0      0      0      0      0
## F1_nxs        0      0      1      0      0      0      0      0      0      0
## F2_nxs        0      0      0      0      0      0      0      0      0      0
## H1_nxs        0      0      0      0      0      1      0      0      1      0
## H2_nxs        0      0      0      1      1      0      0      0      0      0
## M1_nxs        0      0      0      0      0      0      0      0      0      0
## M2_nxs        0      0      0      0      0      0      0      0      0      0
## M3_nxs        0      0      0      0      0      0      0      0      0      0
## M4_nxs        0      0      0      0      0      0      0      0      0      0
## O1_nxs        0      0      0      0      0      0      0      0      0      0
## O2_nxs        0      0      0      0      0      0      0      0      0      0
## R1_nxs        0      0      0      0      0      1      1      0      0      0
## R2_nxs        0      0      0      0      1      0      0      0      0      0
## R3_nxs        0      0      1      0      0      0      0      0      0      0
## R4_nxs        0      0      0      0      1      0      1      0      0      0
## R5_nxs        0      0      0      0      0      1      0      0      0      0
## S1_nxs        0      0      0      0      0      0      0      0      0      0
## S3_nxs        2      0      0      0      0      0      0      0      0      0
## S4_nxs        4      2      0      0      0      0      0      0      0      0
## Sec1_nxs      0      0      0      0      0      0      0      0      0      0
## Sec2_nxs      0      0      0      0      0      0      0      0      0      0
## Ex1_oko       0      0      0      0      0      0      0      0      0      0
## Ex2_oko       0      0      0      0      0      0      0      0      0      0
## Ex3_oko       0      0      0      0      0      0      0      0      0      0
## R1_oko        0      0      0      0      0      0      0      0      0      0
## R2_oko        0      0      0      0      0      0      0      0      0      0
## Sec1_oko      0      0      0      0      0      0      0      0      0      0
## M1_oko        0      0      0      0      0      0      0      0      0      0
## S1_oko        0      0      0      0      0      0      0      0      0      0
## M2_oko        0      0      0      0      0      0      0      0      0      0
## D1_oko        0      0      0      0      0      0      0      0      0      0
## D2_oko        0      0      0      0      0      0      0      0      0      0
## R3_oko        0      0      0      0      0      0      0      0      0      0
## S2_oko        0      0      0      0      0      0      0      0      0      0
## S3_oko        0      0      0      0      0      0      0      0      0      0
## M3_oko        0      0      0      0      0      0      0      0      0      0
##          S3_nxs S4_nxs Sec1_nxs Sec2_nxs Ex1_oko Ex2_oko Ex3_oko R1_oko R2_oko
## D1_nxs        0      0        0        0       0       0       0      0      0
## E1_nxs        0      0        0        2       0       0       0      0      0
## E2_nxs        0      2        0        0       0       0       0      0      0
## E3_nxs        0      1        0        1       0       0       0      0      0
## F1_nxs        0      0        0        0       0       0       0      0      0
## F2_nxs        0      0        0        2       0       0       0      0      0
## H1_nxs        0      0        0        1       0       0       0      0      0
## H2_nxs        0      0        0        0       0       0       0      0      0
## M1_nxs        0      0        0        0       0       0       0      0      0
## M2_nxs        0      0        0        0       0       0       0      0      0
## M3_nxs        2      2        0        2       0       0       0      0      0
```

```
## M4_nxs        0      2        0        0       0       0       0      0      0
## O1_nxs        0      0        0        2       0       0       0      0      0
## O2_nxs        0      0        0        0       0       0       0      0      0
## R1_nxs        0      0        1        0       0       0       0      0      0
## R2_nxs        0      0        0        0       0       0       0      0      0
## R3_nxs        0      0        1        0       0       0       0      0      0
## R4_nxs        0      0        1        0       0       0       0      0      0
## R5_nxs        0      0        0        0       0       0       0      0      0
## S1_nxs        0      0        0        0       0       0       0      0      0
## S3_nxs        0      2        0        2       0       0       0      0      0
## S4_nxs        2      0        0        2       0       0       0      0      0
## Sec1_nxs      0      0        0        1       0       0       0      0      0
## Sec2_nxs      0      0        0        0       0       0       0      0      0
## Ex1_oko       0      0        0        0       0       0       0      0      0
## Ex2_oko       0      0        0        0       0       0       0      0      0
## Ex3_oko       0      0        0        0       0       0       0      0      0
## R1_oko        0      0        0        0       0       0       0      0      0
## R2_oko        0      0        0        0       0       0       0      0      0
## Sec1_oko      0      0        0        0       0       0       0      0      0
## M1_oko        0      0        0        0       0       0       0      0      0
## S1_oko        0      0        0        0       0       0       0      0      0
## M2_oko        0      0        0        0       0       0       0      0      0
## D1_oko        0      0        0        0       0       0       0      0      0
## D2_oko        0      0        0        0       0       0       0      0      0
## R3_oko        0      0        0        0       0       0       0      0      0
## S2_oko        0      0        0        0       0       0       0      0      0
## S3_oko        0      0        0        0       0       0       0      0      0
## M3_oko        0      0        0        0       0       0       0      0      0
##          Sec1_oko M1_oko S1_oko M2_oko D1_oko D2_oko R3_oko S2_oko S3_oko
## D1_nxs          0      0      0      0      0      0      0      0      0
## E1_nxs          0      0      0      0      0      0      0      0      0
## E2_nxs          0      0      0      0      0      0      0      0      0
## E3_nxs          0      0      0      0      0      0      0      0      0
## F1_nxs          0      0      0      0      0      0      0      0      0
## F2_nxs          0      0      0      0      0      0      0      0      0
## H1_nxs          0      0      0      0      0      0      0      0      0
## H2_nxs          0      0      0      0      0      0      0      0      0
## M1_nxs          0      0      0      0      0      0      0      0      0
## M2_nxs          0      0      0      0      0      0      0      0      0
## M3_nxs          0      0      0      0      0      0      0      0      0
## M4_nxs          0      0      0      0      0      0      0      0      0
## O1_nxs          0      0      0      0      0      0      0      0      0
## O2_nxs          0      0      0      0      0      0      0      0      0
## R1_nxs          0      0      0      0      0      0      0      0      0
## R2_nxs          0      0      0      0      0      0      0      0      0
## R3_nxs          0      0      0      0      0      0      0      0      0
## R4_nxs          0      0      0      0      0      0      0      0      0
## R5_nxs          0      0      0      0      0      0      0      0      0
## S1_nxs          0      0      0      0      0      0      0      0      0
## S3_nxs          0      0      0      0      0      0      0      0      0
## S4_nxs          0      0      0      0      0      0      0      0      0
## Sec1_nxs        0      0      0      0      0      0      0      0      0
## Sec2_nxs        0      0      0      0      0      0      0      0      0
## Ex1_oko         0      0      0      0      0      0      0      0      0
```

```
## Ex2_oko         0      0      0      0      0      0      0      0      0
## Ex3_oko         0      0      0      0      0      0      0      0      0
## R1_oko          0      0      0      0      0      0      0      0      0
## R2_oko          0      0      0      0      0      0      0      0      0
## Sec1_oko        0      0      0      0      0      0      0      0      0
## M1_oko          0      0      0      0      0      0      0      0      0
## S1_oko          0      0      0      0      0      0      0      0      0
## M2_oko          0      0      0      0      0      0      0      0      0
## D1_oko          0      0      0      0      0      0      0      0      0
## D2_oko          0      0      0      0      0      0      0      0      0
## R3_oko          0      0      0      0      0      0      0      0      0
## S2_oko          0      0      0      0      0      0      0      0      0
## S3_oko          0      0      0      0      0      0      0      0      0
## M3_oko          0      0      0      0      0      0      0      0      0
##          M3_oko
## D1_nxs        0
## E1_nxs        0
## E2_nxs        0
## E3_nxs        0
## F1_nxs        0
## F2_nxs        0
## H1_nxs        0
## H2_nxs        0
## M1_nxs        0
## M2_nxs        0
## M3_nxs        0
## M4_nxs        0
## O1_nxs        0
## O2_nxs        0
## R1_nxs        0
## R2_nxs        0
## R3_nxs        0
## R4_nxs        0
## R5_nxs        0
## S1_nxs        0
## S3_nxs        0
## S4_nxs        0
## Sec1_nxs      0
## Sec2_nxs      0
## Ex1_oko       0
## Ex2_oko       0
## Ex3_oko       0
## R1_oko        0
## R2_oko        0
## Sec1_oko      0
## M1_oko        0
## S1_oko        0
## M2_oko        0
## D1_oko        0
## D2_oko        0
## R3_oko        0
## S2_oko        0
## S3_oko        0
## M3_oko        0
```

```
graphOko
```

```
## IGRAPH 41de702 UNWB 38 53 --
## + attr: name (v/c), type (v/l), weight (e/n)
## + edges from 41de702 (vertex names):
##  [1] E2_nxs  --E1 E3_nxs  --E1 E1_nxs  --E1 F2_nxs  --E1 Ex2_oko --E1
##  [6] Ex1_oko --E1 Ex3_oko --E1 E1_nxs  --E2 R3_nxs  --E2 E2_nxs  --E2
## [11] R1_oko  --E2 R2_oko  --E2 Sec1_oko--E2 E3_nxs  --E3 S4_nxs  --E3
## [16] Ex1_oko --E3 M1_oko  --E3 E2_nxs  --E3 E2_nxs  --E4 E3_nxs  --E4
## [21] F2_nxs  --E4 F1_nxs  --E4 Ex2_oko --E4 E2_nxs  --E5 S4_nxs  --E5
## [26] M1_oko  --E5 S1_oko  --E5 M2_oko  --E5 H1_nxs  --E6 H2_nxs  --E6
## [31] E2_nxs  --E6 Ex1_oko --E6 Ex1_oko --E7 D1_oko  --E7 D2_oko  --E7
## [36] R3_oko  --E7 R5_nxs  --E7 E2_nxs  --E8 Sec2_nxs--E8 Ex1_oko --E8
## + ... omitted several edges
```

```
OkoAdjMxt
```

```
##          E1 E2 E3 E4 E5 E6 E7 E8 E9 E10
## E2_nxs    1  1  1  1  1  1  0  1  0   0
## E3_nxs    1  0  1  1  0  0  0  0  0   0
## E1_nxs    1  1  0  0  0  0  0  0  0   1
## F2_nxs    1  0  0  1  0  0  0  0  0   0
## Ex2_oko   1  0  0  1  0  0  0  0  0   0
## Ex1_oko   1  0  1  0  0  1  1  1  0   0
## Ex3_oko   1  0  0  0  0  0  0  0  0   1
## R3_nxs    0  1  0  0  0  0  0  0  0   1
## R1_oko    0  1  0  0  0  0  0  0  0   1
## R2_oko    0  1  0  0  0  0  0  0  0   0
## Sec1_oko  0  1  0  0  0  0  0  0  0   0
## S4_nxs    0  0  1  0  1  0  0  0  1   0
## M1_oko    0  0  1  0  1  0  0  0  1   0
## F1_nxs    0  0  0  1  0  0  0  0  0   0
## S1_oko    0  0  0  0  1  0  0  0  0   0
## M2_oko    0  0  0  0  1  0  0  0  0   0
## H1_nxs    0  0  0  0  0  1  0  0  0   0
## H2_nxs    0  0  0  0  0  1  0  0  0   0
## D1_oko    0  0  0  0  0  0  1  0  0   0
## D2_oko    0  0  0  0  0  0  1  0  0   1
## R3_oko    0  0  0  0  0  0  1  0  0   0
## R5_nxs    0  0  0  0  0  0  1  0  0   1
## Sec2_nxs  0  0  0  0  0  0  0  1  0   0
## S3_nxs    0  0  0  0  0  0  0  0  1   0
## M3_nxs    0  0  0  0  0  0  0  0  1   0
## S2_oko    0  0  0  0  0  0  0  0  1   0
## S3_oko    0  0  0  0  0  0  0  0  1   0
## M3_oko    0  0  0  0  0  0  0  0  1   0
```

Transposing the 2-mode network to 1-mode network

```
#Transpose the two-mode network to create a one-mode network

OkoAdjMxt_transpose <- t(OkoAdjMxt)

Oko_one_mode <- OkoAdjMxt %*% OkoAdjMxt_transpose
```

```r
diag(Oko_one_mode) <- 0

Oko_one_mode
```

```
##          E2_nxs E3_nxs E1_nxs F2_nxs Ex2_oko Ex1_oko Ex3_oko R3_nxs R1_oko
## E2_nxs        0      3      2      2       2       4       1      1      1
## E3_nxs        3      0      1      2       2       2       1      0      0
## E1_nxs        2      1      0      1       1       1       2      2      2
## F2_nxs        2      2      1      0       2       1       1      0      0
## Ex2_oko       2      2      1      2       0       1       1      0      0
## Ex1_oko       4      2      1      1       1       0       1      0      0
## Ex3_oko       1      1      2      1       1       1       0      1      1
## R3_nxs        1      0      2      0       0       0       1      0      2
## R1_oko        1      0      2      0       0       0       1      2      0
## R2_oko        1      0      1      0       0       0       0      1      1
## Sec1_oko      1      0      1      0       0       0       0      1      1
## S4_nxs        2      1      0      0       0       1       0      0      0
## M1_oko        2      1      0      0       0       1       0      0      0
## F1_nxs        1      1      0      1       1       0       0      0      0
## S1_oko        1      0      0      0       0       0       0      0      0
## M2_oko        1      0      0      0       0       0       0      0      0
## H1_nxs        1      0      0      0       0       1       0      0      0
## H2_nxs        1      0      0      0       0       1       0      0      0
## D1_oko        0      0      0      0       0       1       0      0      0
## D2_oko        0      0      1      0       0       1       1      1      1
## R3_oko        0      0      0      0       0       1       0      0      0
## R5_nxs        0      0      1      0       0       1       1      1      1
## Sec2_nxs      1      0      0      0       0       1       0      0      0
## S3_nxs        0      0      0      0       0       0       0      0      0
## M3_nxs        0      0      0      0       0       0       0      0      0
## S2_oko        0      0      0      0       0       0       0      0      0
## S3_oko        0      0      0      0       0       0       0      0      0
## M3_oko        0      0      0      0       0       0       0      0      0
##          R2_oko Sec1_oko S4_nxs M1_oko F1_nxs S1_oko M2_oko H1_nxs H2_nxs
## E2_nxs        1        1      2      2      1      1      1      1      1
## E3_nxs        0        0      1      1      1      0      0      0      0
## E1_nxs        1        1      0      0      0      0      0      0      0
## F2_nxs        0        0      0      0      1      0      0      0      0
## Ex2_oko       0        0      0      0      1      0      0      0      0
## Ex1_oko       0        0      1      1      0      0      0      1      1
## Ex3_oko       0        0      0      0      0      0      0      0      0
## R3_nxs        1        1      0      0      0      0      0      0      0
## R1_oko        1        1      0      0      0      0      0      0      0
## R2_oko        0        1      0      0      0      0      0      0      0
## Sec1_oko      1        0      0      0      0      0      0      0      0
## S4_nxs        0        0      0      3      0      1      1      0      0
## M1_oko        0        0      3      0      0      1      1      0      0
## F1_nxs        0        0      0      0      0      0      0      0      0
## S1_oko        0        0      1      1      0      0      1      0      0
## M2_oko        0        0      1      1      0      1      0      0      0
## H1_nxs        0        0      0      0      0      0      0      0      1
## H2_nxs        0        0      0      0      0      0      0      1      0
## D1_oko        0        0      0      0      0      0      0      0      0
```

```
## D2_oko        0        0      0      0      0      0      0      0      0
## R3_oko        0        0      0      0      0      0      0      0      0
## R5_nxs        0        0      0      0      0      0      0      0      0
## Sec2_nxs      0        0      0      0      0      0      0      0      0
## S3_nxs        0        0      1      1      0      0      0      0      0
## M3_nxs        0        0      1      1      0      0      0      0      0
## S2_oko        0        0      1      1      0      0      0      0      0
## S3_oko        0        0      1      1      0      0      0      0      0
## M3_oko        0        0      1      1      0      0      0      0      0
##          D1_oko D2_oko R3_oko R5_nxs Sec2_nxs S3_nxs M3_nxs S2_oko S3_oko
## E2_nxs        0      0      0      0        1      0      0      0      0
## E3_nxs        0      0      0      0        0      0      0      0      0
## E1_nxs        0      1      0      1        0      0      0      0      0
## F2_nxs        0      0      0      0        0      0      0      0      0
## Ex2_oko       0      0      0      0        0      0      0      0      0
## Ex1_oko       1      1      1      1        1      0      0      0      0
## Ex3_oko       0      1      0      1        0      0      0      0      0
## R3_nxs        0      1      0      1        0      0      0      0      0
## R1_oko        0      1      0      1        0      0      0      0      0
## R2_oko        0      0      0      0        0      0      0      0      0
## Sec1_oko      0      0      0      0        0      0      0      0      0
## S4_nxs        0      0      0      0        0      1      1      1      1
## M1_oko        0      0      0      0        0      1      1      1      1
## F1_nxs        0      0      0      0        0      0      0      0      0
## S1_oko        0      0      0      0        0      0      0      0      0
## M2_oko        0      0      0      0        0      0      0      0      0
## H1_nxs        0      0      0      0        0      0      0      0      0
## H2_nxs        0      0      0      0        0      0      0      0      0
## D1_oko        0      1      1      1        0      0      0      0      0
## D2_oko        1      0      1      2        0      0      0      0      0
## R3_oko        1      1      0      1        0      0      0      0      0
## R5_nxs        1      2      1      0        0      0      0      0      0
## Sec2_nxs      0      0      0      0        0      0      0      0      0
## S3_nxs        0      0      0      0        0      0      1      1      1
## M3_nxs        0      0      0      0        0      1      0      1      1
## S2_oko        0      0      0      0        0      1      1      0      1
## S3_oko        0      0      0      0        0      1      1      1      0
## M3_oko        0      0      0      0        0      1      1      1      1
##          M3_oko
## E2_nxs        0
## E3_nxs        0
## E1_nxs        0
## F2_nxs        0
## Ex2_oko       0
## Ex1_oko       0
## Ex3_oko       0
## R3_nxs        0
## R1_oko        0
## R2_oko        0
## Sec1_oko      0
## S4_nxs        1
## M1_oko        1
## F1_nxs        0
## S1_oko        0
```

```
## M2_oko        0
## H1_nxs        0
## H2_nxs        0
## D1_oko        0
## D2_oko        0
## R3_oko        0
## R5_nxs        0
## Sec2_nxs      0
## S3_nxs        1
## M3_nxs        1
## S2_oko        1
## S3_oko        1
## M3_oko        0
```

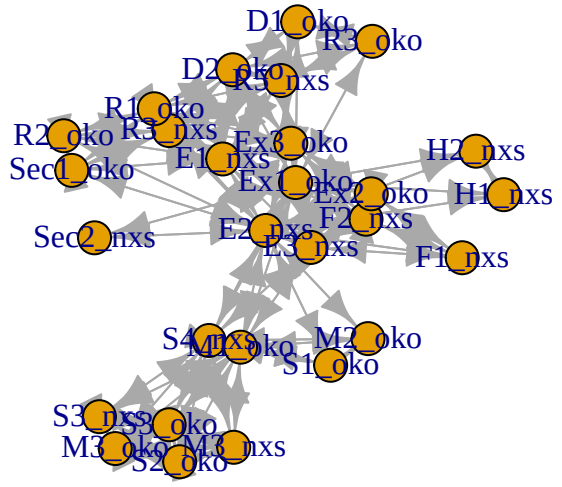
plotting the post-merger network (without original Nexus.AI network)

```r
# Convert the matrix to a graph object
Oko_one_mode_graph <- graph_from_adjacency_matrix(Oko_one_mode, mode = "directed", weighted = TRUE)

print(Oko_one_mode_graph)
```

```
## IGRAPH 213cba7 DNW- 28 200 --
## + attr: name (v/c), weight (e/n)
## + edges from 213cba7 (vertex names):
##  [1] E2_nxs->E3_nxs   E2_nxs->E1_nxs   E2_nxs->F2_nxs   E2_nxs->Ex2_oko
##  [5] E2_nxs->Ex1_oko  E2_nxs->Ex3_oko  E2_nxs->R3_nxs   E2_nxs->R1_oko
##  [9] E2_nxs->R2_oko   E2_nxs->Sec1_oko E2_nxs->S4_nxs   E2_nxs->M1_oko
## [13] E2_nxs->F1_nxs   E2_nxs->S1_oko   E2_nxs->M2_oko   E2_nxs->H1_nxs
## [17] E2_nxs->H2_nxs   E2_nxs->Sec2_nxs E3_nxs->E2_nxs   E3_nxs->E1_nxs
## [21] E3_nxs->F2_nxs   E3_nxs->Ex2_oko  E3_nxs->Ex1_oko  E3_nxs->Ex3_oko
## [25] E3_nxs->S4_nxs   E3_nxs->M1_oko   E3_nxs->F1_nxs   E1_nxs->E2_nxs
## [29] E1_nxs->E3_nxs   E1_nxs->F2_nxs   E1_nxs->Ex2_oko  E1_nxs->Ex1_oko
## + ... omitted several edges
```

```r
# Plot the one-mode network
plot(Oko_one_mode_graph, vertex.label = V(Oko_one_mode_graph)$name, main = "One-Mode Network of Individu
```

One−Mode Network of Individuals



What fascinating network on its own already! so much more interesting than the original nexus network! Lets...

Combining the two networks (aka NexusOko.AI network)

```
NexusAdjMxtSym <- NexusAdjMxt + t(NexusAdjMxt)  # Symmetrize by adding the matrix to its transpose
OkoAdjMxt <- as_adjacency_matrix(Oko_one_mode_graph, type = "both", attr = "weight", sparse = FALSE)

# Ensure both adjacency matrices have the same dimension and ordering of nodes
all_nodes <- union(rownames(NexusAdjMxt), rownames(OkoAdjMxt))

# Initialize combined matrices with zeros
combined_NexusAdjMxt <- matrix(0, nrow = length(all_nodes), ncol = length(all_nodes), dimnames = list(al
combined_OkoAdjMxt <- matrix(0, nrow = length(all_nodes), ncol = length(all_nodes), dimnames = list(all_

# Fill in the values from the original matrices
combined_NexusAdjMxt[rownames(NexusAdjMxtSym), colnames(NexusAdjMxtSym)] <- NexusAdjMxtSym
combined_OkoAdjMxt[rownames(OkoAdjMxt), colnames(OkoAdjMxt)] <- OkoAdjMxt

# Combine the adjacency matrices by adding them
combinedAdjMxt <- combined_NexusAdjMxt + combined_OkoAdjMxt

# Create a combined graph from the combined adjacency matrix
combined_graph <- graph_from_adjacency_matrix(combinedAdjMxt, mode = "directed", weighted = TRUE)
```

```
print(combinedAdjMxt)
```

```
##          D1_nxs E1_nxs E2_nxs E3_nxs F1_nxs F2_nxs H1_nxs H2_nxs M1_nxs M2_nxs
## D1_nxs        0      2      1      0      0      0      0      0      0      1
## E1_nxs        2      0      4      2      0      1      0      0      0      0
## E2_nxs        1      4      0      4      1      3      3      1      0      0
## E3_nxs        0      2      4      0      1      3      1      0      0      0
## F1_nxs        0      0      1      1      0      3      0      0      0      0
## F2_nxs        0      1      3      3      3      0      0      0      0      0
## H1_nxs        0      0      3      1      0      0      0      1      0      0
```

```
## H2_nxs        0      0      1      0      0      0      1      0      0      0
## M1_nxs        0      0      0      0      0      0      0      0      0      0
## M2_nxs        1      0      0      0      0      0      0      0      0      0
## M3_nxs        0      0      0      0      0      0      0      0      1      0
## M4_nxs        0      0      0      0      0      0      0      0      0      0
## O1_nxs        0      0      0      0      3      0      0      0      0      0
## O2_nxs        0      0      0      0      0      0      0      1      0      0
## R1_nxs        0      0      0      0      0      0      0      1      0      0
## R2_nxs        0      1      0      0      0      0      1      0      0      0
## R3_nxs        0      2      2      0      0      0      0      0      0      0
## R4_nxs        0      1      0      0      0      0      0      0      0      0
## R5_nxs        0      2      0      0      0      0      1      0      0      0
## S1_nxs        0      0      0      0      0      0      0      0      0      0
## S3_nxs        0      0      0      0      0      0      0      0      0      0
## S4_nxs        0      0      4      2      0      0      0      0      0      0
## Sec1_nxs      0      1      0      0      0      0      0      0      0      0
## Sec2_nxs      0      2      1      1      0      2      1      0      0      0
## Ex1_oko       0      1      4      2      0      1      1      1      0      0
## Ex2_oko       0      1      2      2      1      2      0      0      0      0
## Ex3_oko       0      2      1      1      0      1      0      0      0      0
## R1_oko        0      2      1      0      0      0      0      0      0      0
## R2_oko        0      1      1      0      0      0      0      0      0      0
## Sec1_oko      0      1      1      0      0      0      0      0      0      0
## M1_oko        0      0      2      1      0      0      0      0      0      0
## S1_oko        0      0      1      0      0      0      0      0      0      0
## M2_oko        0      0      1      0      0      0      0      0      0      0
## D1_oko        0      0      0      0      0      0      0      0      0      0
## D2_oko        0      1      0      0      0      0      0      0      0      0
## R3_oko        0      0      0      0      0      0      0      0      0      0
## S2_oko        0      0      0      0      0      0      0      0      0      0
## S3_oko        0      0      0      0      0      0      0      0      0      0
## M3_oko        0      0      0      0      0      0      0      0      0      0
##          M3_nxs M4_nxs O1_nxs O2_nxs R1_nxs R2_nxs R3_nxs R4_nxs R5_nxs S1_nxs
## D1_nxs        0      0      0      0      0      0      0      0      0      0
## E1_nxs        0      0      0      0      0      1      2      1      2      0
## E2_nxs        0      0      0      0      0      0      2      0      0      0
## E3_nxs        0      0      0      0      0      0      0      0      0      0
## F1_nxs        0      0      3      0      0      0      0      0      0      0
## F2_nxs        0      0      0      0      0      0      0      0      0      0
## H1_nxs        0      0      0      0      0      1      0      0      1      0
## H2_nxs        0      0      0      1      1      0      0      0      0      0
## M1_nxs        1      0      0      0      0      0      0      0      0      0
## M2_nxs        0      0      0      0      0      0      0      0      0      0
## M3_nxs        0      0      0      0      0      0      0      0      0      0
## M4_nxs        0      0      0      0      0      0      0      0      0      0
## O1_nxs        0      0      0      0      0      0      1      0      0      0
## O2_nxs        0      0      0      0      0      0      0      0      0      0
## R1_nxs        0      0      0      0      0      2      1      1      0      0
## R2_nxs        0      0      0      0      2      0      0      0      1      0
## R3_nxs        0      0      1      0      1      0      0      1      1      0
## R4_nxs        0      0      0      0      1      0      1      0      0      0
## R5_nxs        0      0      0      0      0      1      1      0      0      0
## S1_nxs        0      0      0      0      0      0      0      0      0      0
## S3_nxs        5      0      0      0      0      0      0      0      0      0
```

```
## S4_nxs        7      4      0      0      0      0      0      0      0      0
## Sec1_nxs      0      0      0      0      1      0      1      1      0      0
## Sec2_nxs      2      0      2      0      0      0      0      0      0      0
## Ex1_oko       0      0      0      0      0      0      0      0      1      0
## Ex2_oko       0      0      0      0      0      0      0      0      0      0
## Ex3_oko       0      0      0      0      0      0      1      0      1      0
## R1_oko        0      0      0      0      0      0      2      0      1      0
## R2_oko        0      0      0      0      0      0      1      0      0      0
## Sec1_oko      0      0      0      0      0      0      1      0      0      0
## M1_oko        1      0      0      0      0      0      0      0      0      0
## S1_oko        0      0      0      0      0      0      0      0      0      0
## M2_oko        0      0      0      0      0      0      0      0      0      0
## D1_oko        0      0      0      0      0      0      0      0      1      0
## D2_oko        0      0      0      0      0      0      1      0      2      0
## R3_oko        0      0      0      0      0      0      0      0      1      0
## S2_oko        1      0      0      0      0      0      0      0      0      0
## S3_oko        1      0      0      0      0      0      0      0      0      0
## M3_oko        1      0      0      0      0      0      0      0      0      0
##          S3_nxs S4_nxs Sec1_nxs Sec2_nxs Ex1_oko Ex2_oko Ex3_oko R1_oko R2_oko
## D1_nxs        0      0        0        0       0       0       0      0      0
## E1_nxs        0      0        1        2       1       1       2      2      1
## E2_nxs        0      4        0        1       4       2       1      1      1
## E3_nxs        0      2        0        1       2       2       1      0      0
## F1_nxs        0      0        0        0       0       1       0      0      0
## F2_nxs        0      0        0        2       1       2       1      0      0
## H1_nxs        0      0        0        1       1       0       0      0      0
## H2_nxs        0      0        0        0       1       0       0      0      0
## M1_nxs        0      0        0        0       0       0       0      0      0
## M2_nxs        0      0        0        0       0       0       0      0      0
## M3_nxs        5      7        0        2       0       0       0      0      0
## M4_nxs        0      4        0        0       0       0       0      0      0
## O1_nxs        0      0        0        2       0       0       0      0      0
## O2_nxs        0      0        0        0       0       0       0      0      0
## R1_nxs        0      0        1        0       0       0       0      0      0
## R2_nxs        0      0        0        0       0       0       0      0      0
## R3_nxs        0      0        1        0       0       0       1      2      1
## R4_nxs        0      0        1        0       0       0       0      0      0
## R5_nxs        0      0        0        0       1       0       1      1      0
## S1_nxs        0      0        0        0       0       0       0      0      0
## S3_nxs        0      5        0        2       0       0       0      0      0
## S4_nxs        5      0        0        2       1       0       0      0      0
## Sec1_nxs      0      0        0        1       0       0       0      0      0
## Sec2_nxs      2      2        1        0       1       0       0      0      0
## Ex1_oko       0      1        0        1       0       1       1      0      0
## Ex2_oko       0      0        0        0       1       0       1      0      0
## Ex3_oko       0      0        0        0       1       1       0      1      0
## R1_oko        0      0        0        0       0       0       1      0      1
## R2_oko        0      0        0        0       0       0       0      1      0
## Sec1_oko      0      0        0        0       0       0       0      1      1
## M1_oko        1      3        0        0       1       0       0      0      0
## S1_oko        0      1        0        0       0       0       0      0      0
## M2_oko        0      1        0        0       0       0       0      0      0
## D1_oko        0      0        0        0       1       0       0      0      0
## D2_oko        0      0        0        0       1       0       1      1      0
```

```
## R3_oko        0      0        0        0       1       0       0      0      0
## S2_oko        1      1        0        0       0       0       0      0      0
## S3_oko        1      1        0        0       0       0       0      0      0
## M3_oko        1      1        0        0       0       0       0      0      0
##          Sec1_oko M1_oko S1_oko M2_oko D1_oko D2_oko R3_oko S2_oko S3_oko
## D1_nxs          0      0      0      0      0      0      0      0      0
## E1_nxs          1      0      0      0      0      1      0      0      0
## E2_nxs          1      2      1      1      0      0      0      0      0
## E3_nxs          0      1      0      0      0      0      0      0      0
## F1_nxs          0      0      0      0      0      0      0      0      0
## F2_nxs          0      0      0      0      0      0      0      0      0
## H1_nxs          0      0      0      0      0      0      0      0      0
## H2_nxs          0      0      0      0      0      0      0      0      0
## M1_nxs          0      0      0      0      0      0      0      0      0
## M2_nxs          0      0      0      0      0      0      0      0      0
## M3_nxs          0      1      0      0      0      0      0      1      1
## M4_nxs          0      0      0      0      0      0      0      0      0
## O1_nxs          0      0      0      0      0      0      0      0      0
## O2_nxs          0      0      0      0      0      0      0      0      0
## R1_nxs          0      0      0      0      0      0      0      0      0
## R2_nxs          0      0      0      0      0      0      0      0      0
## R3_nxs          1      0      0      0      0      1      0      0      0
## R4_nxs          0      0      0      0      0      0      0      0      0
## R5_nxs          0      0      0      0      1      2      1      0      0
## S1_nxs          0      0      0      0      0      0      0      0      0
## S3_nxs          0      1      0      0      0      0      0      1      1
## S4_nxs          0      3      1      1      0      0      0      1      1
## Sec1_nxs        0      0      0      0      0      0      0      0      0
## Sec2_nxs        0      0      0      0      0      0      0      0      0
## Ex1_oko         0      1      0      0      1      1      1      0      0
## Ex2_oko         0      0      0      0      0      0      0      0      0
## Ex3_oko         0      0      0      0      0      1      0      0      0
## R1_oko          1      0      0      0      0      1      0      0      0
## R2_oko          1      0      0      0      0      0      0      0      0
## Sec1_oko        0      0      0      0      0      0      0      0      0
## M1_oko          0      0      1      1      0      0      0      1      1
## S1_oko          0      1      0      1      0      0      0      0      0
## M2_oko          0      1      1      0      0      0      0      0      0
## D1_oko          0      0      0      0      0      1      1      0      0
## D2_oko          0      0      0      0      1      0      1      0      0
## R3_oko          0      0      0      0      1      1      0      0      0
## S2_oko          0      1      0      0      0      0      0      0      1
## S3_oko          0      1      0      0      0      0      0      1      0
## M3_oko          0      1      0      0      0      0      0      1      1
##          M3_oko
## D1_nxs        0
## E1_nxs        0
## E2_nxs        0
## E3_nxs        0
## F1_nxs        0
## F2_nxs        0
## H1_nxs        0
## H2_nxs        0
## M1_nxs        0
```

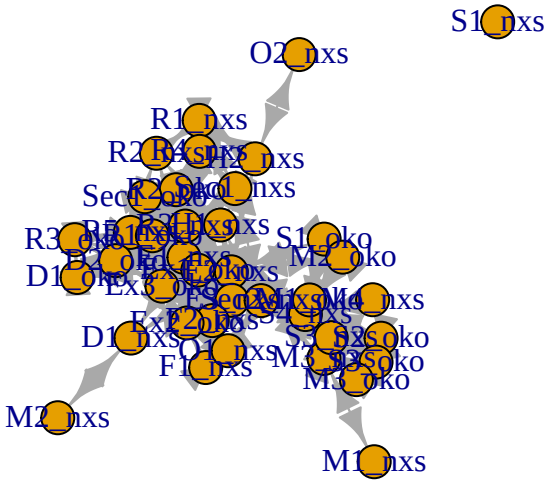
```
## M2_nxs        0
## M3_nxs        1
## M4_nxs        0
## O1_nxs        0
## O2_nxs        0
## R1_nxs        0
## R2_nxs        0
## R3_nxs        0
## R4_nxs        0
## R5_nxs        0
## S1_nxs        0
## S3_nxs        1
## S4_nxs        1
## Sec1_nxs      0
## Sec2_nxs      0
## Ex1_oko       0
## Ex2_oko       0
## Ex3_oko       0
## R1_oko        0
## R2_oko        0
## Sec1_oko      0
## M1_oko        1
## S1_oko        0
## M2_oko        0
## D1_oko        0
## D2_oko        0
## R3_oko        0
## S2_oko        1
## S3_oko        1
## M3_oko        0
```

```
print(combined_graph)
```

```
## IGRAPH 248b86d DNW- 39 264 --
## + attr: name (v/c), weight (e/n)
## + edges from 248b86d (vertex names):
##  [1] D1_nxs->E1_nxs   D1_nxs->E2_nxs   D1_nxs->M2_nxs   E1_nxs->D1_nxs
##  [5] E1_nxs->E2_nxs   E1_nxs->E3_nxs   E1_nxs->F2_nxs   E1_nxs->R2_nxs
##  [9] E1_nxs->R3_nxs   E1_nxs->R4_nxs   E1_nxs->R5_nxs   E1_nxs->Sec1_nxs
## [13] E1_nxs->Sec2_nxs E1_nxs->Ex1_oko  E1_nxs->Ex2_oko  E1_nxs->Ex3_oko
## [17] E1_nxs->R1_oko   E1_nxs->R2_oko   E1_nxs->Sec1_oko E1_nxs->D2_oko
## [21] E2_nxs->D1_nxs   E2_nxs->E1_nxs   E2_nxs->E3_nxs   E2_nxs->F1_nxs
## [25] E2_nxs->F2_nxs   E2_nxs->H1_nxs   E2_nxs->H2_nxs   E2_nxs->R3_nxs
## [29] E2_nxs->S4_nxs   E2_nxs->Sec2_nxs E2_nxs->Ex1_oko  E2_nxs->Ex2_oko
## + ... omitted several edges
```

```
plot(combined_graph, vertex.label = V(combined_graph)$name, main = "Combined Nexus and Oko One-Mode Netw
```

Combined Nexus and Oko One−Mode Network



This is very exciting. dive deeper.

running descriptive statistics and graphs on the merged, NexusOko.AI, network

```
NexusOkoGraph <- combined_graph
NexusOkoAdjMtx <- combinedAdjMxt
```

```
total_degree_undir <- igraph::degree(NexusOkoGraph, mode = "total")
indegree_undir <- igraph::degree(NexusOkoGraph, mode = "in")
outdegree_undir <- igraph::degree(NexusOkoGraph, mode = "out")

print("Total Degree:")
```

```
## [1] "Total Degree:"
```

```
print(total_degree_undir)
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
##        6       34       38       22       10       16       14       10
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
##        2        2       16        2        6        2       10        8
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##       24        8       20        0       14       26       10       22
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       30       14       20       16       10       10       22        8
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        8        8       16        8       12       12       12
```

```
print("Indegree:")
```

```
## [1] "Indegree:"
```

```
print(indegree_undir)
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
```

```
##        3       17       19       11        5        8        7        5
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
##        1        1        8        1        3        1        5        4
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##       12        4       10        0        7       13        5       11
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       15        7       10        8        5        5       11        4
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        4        4        8        4        6        6        6
```

```
print("Outdegree:")
```

```
## [1] "Outdegree:"
```

```
print(outdegree_undir)
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
##        3       17       19       11        5        8        7        5
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
##        1        1        8        1        3        1        5        4
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##       12        4       10        0        7       13        5       11
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       15        7       10        8        5        5       11        4
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        4        4        8        4        6        6        6
```

```
dyad_count_undir <- dyad_census(NexusOkoGraph)
triad_count_undir <- triad_census(NexusOkoGraph)
edge_count_undir <- gsize(NexusOkoGraph)

print("Dyad Count:")
```

```
## [1] "Dyad Count:"
```

```
print(dyad_count_undir)
```

```
## $mut
## [1] 132
##
## $asym
## [1] 0
##
## $null
## [1] 609
```

```
print("triad count:")
```

```
## [1] "triad count:"
```

```
print(triad_count_undir)
```

```
##  [1] 5202    0 3176    0    0    0    0    0    0    0  575    0    0    0    0
## [16]  186
```

```
print("Edge Count:")
```

```
## [1] "Edge Count:"
```

```r
print(edge_count_undir)
```

```
## [1] 264
```

```r
density_undir <- graph.density(NexusOkoGraph)

print("Density:")
```

```
## [1] "Density:"
```

```r
print(density_undir)
```

```
## [1] 0.1781377
```

```r
transitivity_global_undir <- transitivity(NexusOkoGraph, type = "global")

print("Transitivity (Global Clustering Coefficient):")
```

```
## [1] "Transitivity (Global Clustering Coefficient):"
```

```r
print(transitivity_global_undir)
```

```
## [1] 0.4924978
```

```r
reciprocity_value_undir <- reciprocity(NexusOkoGraph)

print("Reciprocity:")
```

```
## [1] "Reciprocity:"
```

```r
print(reciprocity_value_undir)
```

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

```r
dyad_census_result_undir <- sna::dyad.census(as.matrix(as_adjacency_matrix(NexusOkoGraph)))
triad_census_result_undir <- sna::triad.census(as.matrix(as_adjacency_matrix(NexusOkoGraph)))

print("Dyadic Census:")
```

```
## [1] "Dyadic Census:"
```

```r
print(dyad_census_result_undir)
```

```
##      Mut Asym Null
## [1,] 132    0  609
```

```r
print("Triadic Census:")
```

```
## [1] "Triadic Census:"
```

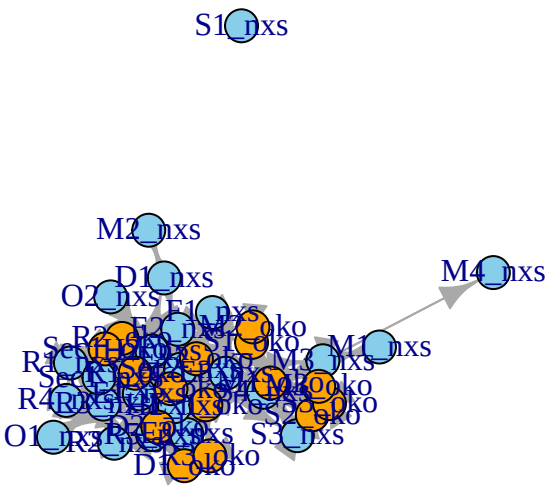
```r
print(triad_census_result_undir)
```

```
##       003 012  102 021D 021U 021C 111D 111U 030T 030C 201 120D 120U 120C 210
## [1,] 5202   0 3176    0    0    0    0    0    0    0 575    0    0    0   0
##      300
## [1,] 186
```

```r
# Set colors based on the group (Nexus or Oko)
vertex_colors <- ifelse(grepl("_nxs$", V(NexusOkoGraph)$name), "skyblue", "orange")
```

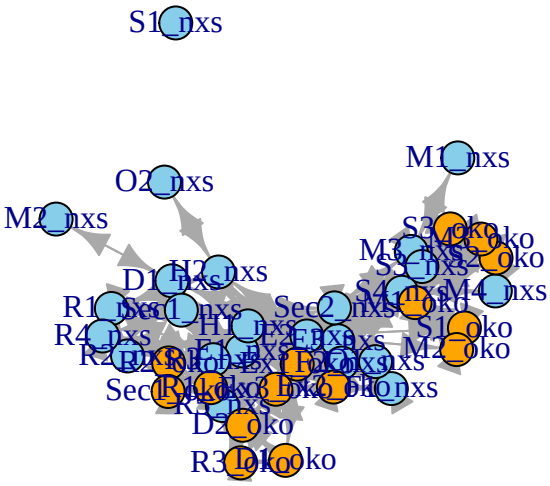
```
plot(NexusOkoGraph, layout = layout_with_kk, vertex.color = vertex_colors, vertex.label = V(NexusOkoGra
```

Kamada−Kawai Layout



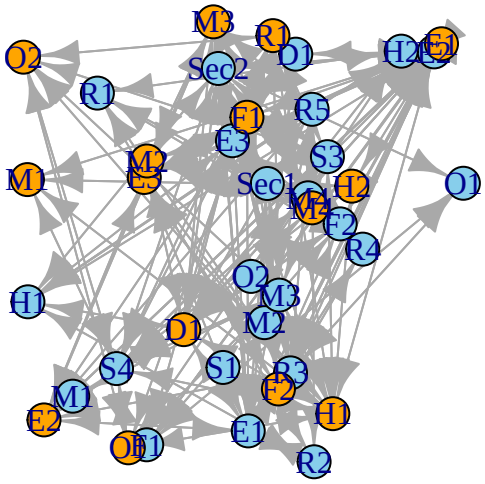

```
plot(NexusOkoGraph, layout = layout_with_fr, vertex.color = vertex_colors,vertex.label = V(NexusOkoGrapl
```

Fruchterman−Reingold Layout



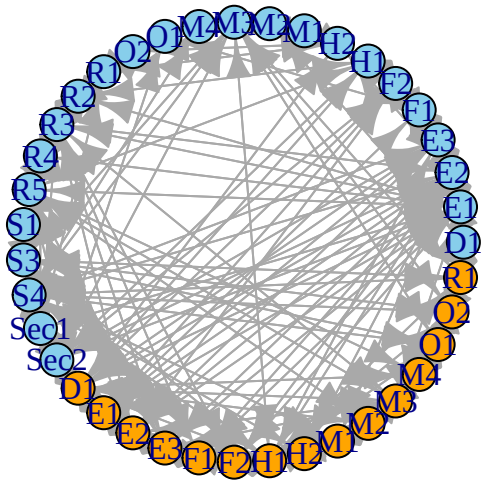

```
plot(NexusOkoGraph, layout = layout.random,vertex.color = vertex_colors, vertex.label = V(graphW_mod)$na
```

Random Layout

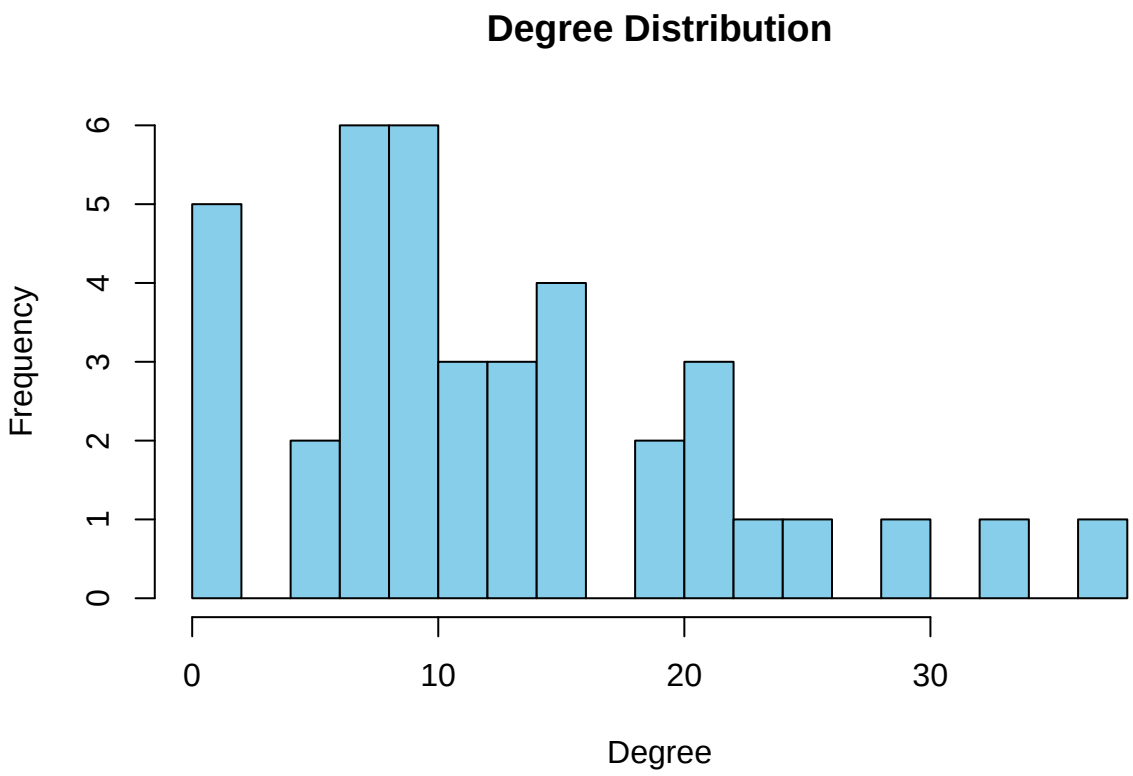



```
#plot(NexusOkoGraph, layout = layout.spring,vertex.color = vertex_colors, vertex.label = V(graphW_mod)$
plot(NexusOkoGraph, layout = layout.circle,vertex.color = vertex_colors, vertex.label = V(graphW_mod)$na
```

Circle Layout

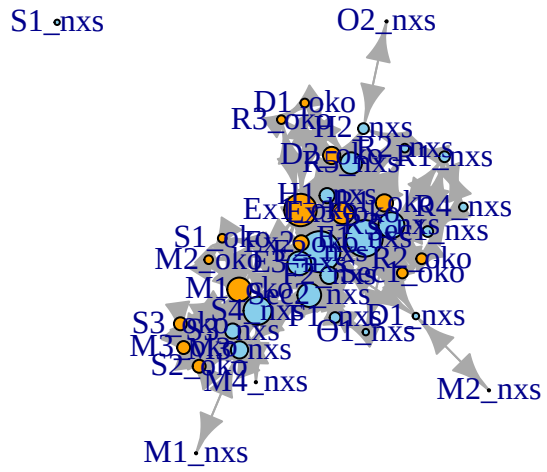



```
# Visualize degree distribution
deg <- igraph::degree(NexusOkoGraph)
hist(deg, breaks = 20, col = "skyblue", main = "Degree Distribution", xlab = "Degree", ylab = "Frequency
```

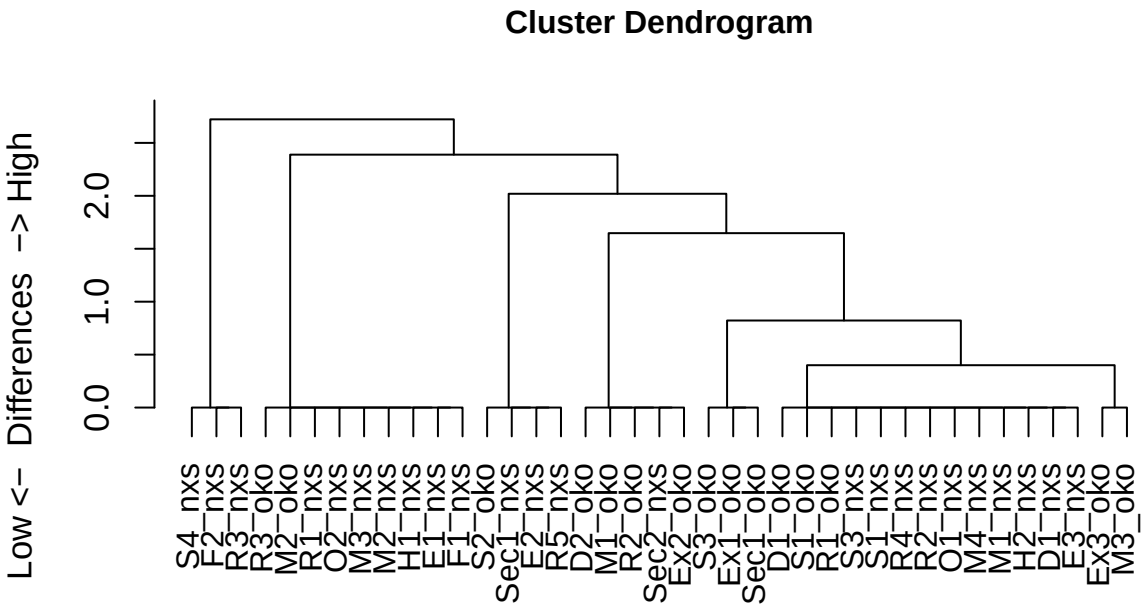



```
# Plot the network with different vertex sizes based on degree
plot(NexusOkoGraph, vertex.size = deg/2,vertex.color = vertex_colors, vertex.label = V(NexusOkoGraph)$na
```

Network with Vertex Size Proportional to Degree




```
ddgm1 <- xHierarchicalClustering(NexusOkoAdjMtx, Input="Differences", Method="ward.D")
```



just curious...

Due to the fact that we can't convert a 2 mode network to a directional graph because... by definition, does not inherently have directional edges, but the assignment asks us to have directional data I made a 1 mode directional edge list... 189 edges.

```
oko_edge_list_dir <- read.csv("OkoEdgeList.csv")

graphOko_dir <- graph_from_data_frame(oko_edge_list_dir, directed = TRUE, vertices = NexusOko_nodeLst)

OkoAdjMxt_dir <- as_adjacency_matrix(graphOko_dir, type = "both", attr = "weight", sparse = FALSE)
#graphOko_dir
OkoAdjMxt_dir
```

```
##          D1_nxs E1_nxs E2_nxs E3_nxs F1_nxs F2_nxs H1_nxs H2_nxs M1_nxs M2_nxs
## D1_nxs        0      0      0      0      0      0      0      0      0      0
## E1_nxs        0      0      2      1      0      1      0      0      0      0
## E2_nxs        0      1      0      2      1      2      0      0      0      0
## E3_nxs        0      1      3      0      1      2      0      0      0      0
## F1_nxs        0      0      1      1      0      1      0      0      0      0
## F2_nxs        0      1      2      2      1      0      0      0      0      0
## H1_nxs        0      0      0      0      0      0      0      0      0      0
## H2_nxs        0      0      0      0      0      0      0      0      0      0
## M1_nxs        0      0      0      0      0      0      0      0      0      0
## M2_nxs        0      0      0      0      0      0      0      0      0      0
## M3_nxs        0      0      0      0      0      0      0      0      0      0
## M4_nxs        0      0      0      0      0      0      0      0      0      0
## O1_nxs        0      0      0      0      0      0      0      0      0      0
## O2_nxs        0      0      0      0      0      0      0      0      0      0
```

```
## R1_nxs        0      0      0      0      0      0      0      0      0      0
## R2_nxs        0      0      0      0      0      0      0      0      0      0
## R3_nxs        0      1      1      0      0      0      0      0      0      0
## R4_nxs        0      0      0      0      0      0      0      0      0      0
## R5_nxs        0      0      0      0      0      0      0      0      0      0
## S1_nxs        0      0      0      0      0      0      0      0      0      0
## S3_nxs        0      0      0      0      0      0      0      0      0      0
## S4_nxs        0      0      1      1      0      0      0      0      0      0
## Sec1_nxs      0      0      0      0      0      0      0      0      0      0
## Sec2_nxs      0      0      1      0      0      0      0      0      0      0
## Ex1_oko       0      1      1      2      0      1      0      0      0      0
## Ex2_oko       0      1      2      2      1      2      0      0      0      0
## Ex3_oko       0      1      1      1      0      1      0      0      0      0
## R1_oko        0      1      0      0      0      0      0      0      0      0
## R2_oko        0      1      0      0      0      0      0      0      0      0
## Sec1_oko      0      1      0      0      0      0      0      0      0      0
## M1_oko        0      0      1      1      0      0      0      0      0      0
## S1_oko        0      0      1      0      0      0      0      0      0      0
## M2_oko        0      0      1      0      0      0      0      0      0      0
## D1_oko        0      0      0      0      0      0      0      0      0      0
## D2_oko        0      0      0      0      0      0      0      0      0      0
## R3_oko        0      0      0      0      0      0      0      0      0      0
## S2_oko        0      0      0      0      0      0      0      0      0      0
## S3_oko        0      0      0      0      0      0      0      0      0      0
## M3_oko        0      0      0      0      0      0      0      0      0      0
##          M3_nxs M4_nxs O1_nxs O2_nxs R1_nxs R2_nxs R3_nxs R4_nxs R5_nxs S1_nxs
## D1_nxs        0      0      0      0      0      0      0      0      0      0
## E1_nxs        0      0      0      0      0      0      1      0      0      0
## E2_nxs        0      0      0      0      0      0      0      0      0      0
## E3_nxs        0      0      0      0      0      0      0      0      0      0
## F1_nxs        0      0      0      0      0      0      0      0      0      0
## F2_nxs        0      0      0      0      0      0      0      0      0      0
## H1_nxs        0      0      0      0      0      0      0      0      0      0
## H2_nxs        0      0      0      0      0      0      0      0      0      0
## M1_nxs        0      0      0      0      0      0      0      0      0      0
## M2_nxs        0      0      0      0      0      0      0      0      0      0
## M3_nxs        0      0      0      0      0      0      0      0      0      0
## M4_nxs        0      0      0      0      0      0      0      0      0      0
## O1_nxs        0      0      0      0      0      0      0      0      0      0
## O2_nxs        0      0      0      0      0      0      0      0      0      0
## R1_nxs        0      0      0      0      0      0      0      0      0      0
## R2_nxs        0      0      0      0      0      0      0      0      0      0
## R3_nxs        0      0      0      0      0      0      0      0      0      0
## R4_nxs        0      0      0      0      0      0      0      0      0      0
## R5_nxs        0      0      0      0      0      0      0      0      0      0
## S1_nxs        0      0      0      0      0      0      0      0      0      0
## S3_nxs        0      0      0      0      0      0      0      0      0      0
## S4_nxs        0      0      0      0      0      0      0      0      0      0
## Sec1_nxs      0      0      0      0      0      0      0      0      0      0
## Sec2_nxs      0      0      0      0      0      0      0      0      0      0
## Ex1_oko       0      0      0      0      0      0      0      0      1      0
## Ex2_oko       0      0      0      0      0      0      0      0      0      0
## Ex3_oko       0      0      0      0      0      0      0      0      0      0
## R1_oko        0      0      0      0      0      0      1      0      0      0
```

```
## R2_oko        0      0      0      0      0      0      1      0      0      0
## Sec1_oko      0      0      0      0      0      0      1      0      0      0
## M1_oko        0      0      0      0      0      0      0      0      0      0
## S1_oko        0      0      0      0      0      0      0      0      0      0
## M2_oko        0      0      0      0      0      0      0      0      0      0
## D1_oko        0      0      0      0      0      0      0      0      0      0
## D2_oko        0      0      0      0      0      0      0      0      0      0
## R3_oko        0      0      0      0      0      0      0      0      0      0
## S2_oko        0      0      0      0      0      0      0      0      0      0
## S3_oko        0      0      0      0      0      0      0      0      0      0
## M3_oko        0      0      0      0      0      0      0      0      0      0
##          S3_nxs S4_nxs Sec1_nxs Sec2_nxs Ex1_oko Ex2_oko Ex3_oko R1_oko R2_oko
## D1_nxs        0      0        0        0       0       0       0      0      0
## E1_nxs        0      0        0        0       1       1       2      2      1
## E2_nxs        0      0        0        1       2       2       1      0      0
## E3_nxs        0      1        0        0       2       2       1      0      0
## F1_nxs        0      0        0        0       0       1       0      0      0
## F2_nxs        0      0        0        0       1       2       1      0      0
## H1_nxs        0      0        0        0       1       0       0      0      0
## H2_nxs        0      0        0        0       1       0       0      0      0
## M1_nxs        0      0        0        0       0       0       0      0      0
## M2_nxs        0      0        0        0       0       0       0      0      0
## M3_nxs        0      0        0        0       0       0       0      0      0
## M4_nxs        0      0        0        0       0       0       0      0      0
## O1_nxs        0      0        0        0       0       0       0      0      0
## O2_nxs        0      0        0        0       0       0       0      0      0
## R1_nxs        0      0        0        0       0       0       0      0      0
## R2_nxs        0      0        0        0       0       0       0      0      0
## R3_nxs        0      0        0        0       0       0       1      2      1
## R4_nxs        0      0        0        0       0       0       0      0      0
## R5_nxs        0      0        0        0       0       0       1      1      0
## S1_nxs        0      0        0        0       0       0       0      0      0
## S3_nxs        0      0        0        0       0       0       0      0      0
## S4_nxs        0      0        0        0       1       0       0      0      0
## Sec1_nxs      0      0        0        0       0       0       0      0      0
## Sec2_nxs      0      0        0        0       1       0       0      0      0
## Ex1_oko       0      1        0        1       0       1       1      0      0
## Ex2_oko       0      0        0        0       1       0       1      0      0
## Ex3_oko       0      0        0        0       1       1       0      0      0
## R1_oko        0      0        0        0       0       0       0      0      1
## R2_oko        0      0        0        0       0       0       0      1      0
## Sec1_oko      0      0        0        0       0       0       0      1      1
## M1_oko        0      2        0        0       1       0       0      0      0
## S1_oko        0      1        0        0       0       0       0      0      0
## M2_oko        0      1        0        0       0       0       0      0      0
## D1_oko        0      0        0        0       0       0       0      0      0
## D2_oko        0      0        0        0       0       0       0      0      0
## R3_oko        0      0        0        0       0       0       0      0      0
## S2_oko        0      0        0        0       0       0       0      0      0
## S3_oko        0      0        0        0       0       0       0      0      0
## M3_oko        0      0        0        0       0       0       0      0      0
##          Sec1_oko M1_oko S1_oko M2_oko D1_oko D2_oko R3_oko S2_oko S3_oko
## D1_nxs          0      0      0      0      0      0      0      0      0
## E1_nxs          1      0      0      0      0      1      0      0      0
```

```
## E2_nxs          0      0      0      0      0      0      0      0      0
## E3_nxs          0      1      0      0      0      0      0      0      0
## F1_nxs          0      0      0      0      0      0      0      0      0
## F2_nxs          0      0      0      0      0      0      0      0      0
## H1_nxs          0      0      0      0      0      0      0      0      0
## H2_nxs          0      0      0      0      0      0      0      0      0
## M1_nxs          0      0      0      0      0      0      0      0      0
## M2_nxs          0      0      0      0      0      0      0      0      0
## M3_nxs          0      1      0      0      0      0      0      1      1
## M4_nxs          0      0      0      0      0      0      0      0      0
## O1_nxs          0      0      0      0      0      0      0      0      0
## O2_nxs          0      0      0      0      0      0      0      0      0
## R1_nxs          0      0      0      0      0      0      0      0      0
## R2_nxs          0      0      0      0      0      0      0      0      0
## R3_nxs          1      0      0      0      0      1      0      0      0
## R4_nxs          0      0      0      0      0      0      0      0      0
## R5_nxs          0      0      0      0      0      1      0      0      0
## S1_nxs          0      0      0      0      0      0      0      0      0
## S3_nxs          0      1      0      0      0      0      0      1      1
## S4_nxs          0      2      0      0      0      0      0      1      1
## Sec1_nxs        0      0      0      0      0      0      0      0      0
## Sec2_nxs        0      0      0      0      0      0      0      0      0
## Ex1_oko         0      1      0      0      1      1      1      0      0
## Ex2_oko         0      0      0      0      0      0      0      0      0
## Ex3_oko         0      0      0      0      0      0      0      0      0
## R1_oko          1      0      0      0      0      0      0      0      0
## R2_oko          1      0      0      0      0      0      0      0      0
## Sec1_oko        0      0      0      0      0      0      0      0      0
## M1_oko          0      0      0      0      0      0      0      0      0
## S1_oko          0      0      0      0      0      0      0      0      0
## M2_oko          0      0      0      0      0      0      0      0      0
## D1_oko          0      0      0      0      0      0      0      0      0
## D2_oko          0      0      0      0      0      0      0      0      0
## R3_oko          0      0      0      0      0      0      0      0      0
## S2_oko          0      0      0      0      0      0      0      0      0
## S3_oko          0      0      0      0      0      0      0      0      0
## M3_oko          0      0      0      0      0      0      0      0      0
##          M3_oko
## D1_nxs        0
## E1_nxs        0
## E2_nxs        0
## E3_nxs        0
## F1_nxs        0
## F2_nxs        0
## H1_nxs        0
## H2_nxs        0
## M1_nxs        0
## M2_nxs        0
## M3_nxs        1
## M4_nxs        0
## O1_nxs        0
## O2_nxs        0
## R1_nxs        0
## R2_nxs        0
```

```
## R3_nxs        0
## R4_nxs        0
## R5_nxs        0
## S1_nxs        0
## S3_nxs        1
## S4_nxs        1
## Sec1_nxs      0
## Sec2_nxs      0
## Ex1_oko       0
## Ex2_oko       0
## Ex3_oko       0
## R1_oko        0
## R2_oko        0
## Sec1_oko      0
## M1_oko        0
## S1_oko        0
## M2_oko        0
## D1_oko        0
## D2_oko        0
## R3_oko        0
## S2_oko        0
## S3_oko        0
## M3_oko        0
```

```
all_nodes <- union(rownames(NexusAdjMxt), rownames(OkoAdjMxt_dir))

combined_NexusAdjMxt <- matrix(0, nrow = length(all_nodes), ncol = length(all_nodes), dimnames = list(al
combined_OkoAdjMxt_dir <- matrix(0, nrow = length(all_nodes), ncol = length(all_nodes), dimnames = list

combined_NexusAdjMxt[rownames(NexusAdjMxt), colnames(NexusAdjMxt)] <- NexusAdjMxt
combined_OkoAdjMxt_dir[rownames(OkoAdjMxt_dir), colnames(OkoAdjMxt_dir)] <- OkoAdjMxt_dir

combinedAdjMxt_dir <- combined_NexusAdjMxt + combined_OkoAdjMxt_dir

combined_graph_dir <- graph_from_adjacency_matrix(combinedAdjMxt_dir, mode = "directed", weighted = TRU

print(combinedAdjMxt_dir)
```

```
##          D1_nxs E1_nxs E2_nxs E3_nxs F1_nxs F2_nxs H1_nxs H2_nxs M1_nxs M2_nxs
## D1_nxs        0      0      0      0      0      0      0      0      0      0
## E1_nxs        2      0      2      1      0      1      0      0      0      0
## E2_nxs        1      3      0      3      1      3      2      0      0      0
## E3_nxs        0      2      3      0      1      3      1      0      0      0
## F1_nxs        0      0      1      1      0      1      0      0      0      0
## F2_nxs        0      1      2      2      3      0      0      0      0      0
## H1_nxs        0      0      0      0      0      0      0      0      0      0
## H2_nxs        0      0      0      0      0      0      0      0      0      0
## M1_nxs        0      0      0      0      0      0      0      0      0      0
## M2_nxs        1      0      0      0      0      0      0      0      0      0
## M3_nxs        0      0      0      0      0      0      0      0      1      0
## M4_nxs        0      0      0      0      0      0      0      0      0      0
## O1_nxs        0      0      0      0      2      0      0      0      0      0
## O2_nxs        0      0      0      0      0      0      0      0      0      0
## R1_nxs        0      0      0      0      0      0      0      0      0      0
## R2_nxs        0      0      0      0      0      0      0      0      0      0
```

```
## R3_nxs        0      1      1      0      0      0      0      0      0      0
## R4_nxs        0      1      0      0      0      0      0      0      0      0
## R5_nxs        0      0      0      0      0      0      0      0      0      0
## S1_nxs        0      0      0      0      0      0      0      0      0      0
## S3_nxs        0      0      0      0      0      0      0      0      0      0
## S4_nxs        0      0      1      1      0      0      0      0      0      0
## Sec1_nxs      0      1      0      0      0      0      0      0      0      0
## Sec2_nxs      0      0      1      0      0      0      0      0      0      0
## Ex1_oko       0      1      1      2      0      1      0      0      0      0
## Ex2_oko       0      1      2      2      1      2      0      0      0      0
## Ex3_oko       0      1      1      1      0      1      0      0      0      0
## R1_oko        0      1      0      0      0      0      0      0      0      0
## R2_oko        0      1      0      0      0      0      0      0      0      0
## Sec1_oko      0      1      0      0      0      0      0      0      0      0
## M1_oko        0      0      1      1      0      0      0      0      0      0
## S1_oko        0      0      1      0      0      0      0      0      0      0
## M2_oko        0      0      1      0      0      0      0      0      0      0
## D1_oko        0      0      0      0      0      0      0      0      0      0
## D2_oko        0      0      0      0      0      0      0      0      0      0
## R3_oko        0      0      0      0      0      0      0      0      0      0
## S2_oko        0      0      0      0      0      0      0      0      0      0
## S3_oko        0      0      0      0      0      0      0      0      0      0
## M3_oko        0      0      0      0      0      0      0      0      0      0
##          M3_nxs M4_nxs O1_nxs O2_nxs R1_nxs R2_nxs R3_nxs R4_nxs R5_nxs S1_nxs
## D1_nxs        0      0      0      0      0      0      0      0      0      0
## E1_nxs        0      0      0      0      0      1      1      0      1      0
## E2_nxs        0      0      0      0      0      0      1      0      0      0
## E3_nxs        0      0      0      0      0      0      0      0      0      0
## F1_nxs        0      0      1      0      0      0      0      0      0      0
## F2_nxs        0      0      0      0      0      0      0      0      0      0
## H1_nxs        0      0      0      0      0      1      0      0      1      0
## H2_nxs        0      0      0      1      1      0      0      0      0      0
## M1_nxs        0      0      0      0      0      0      0      0      0      0
## M2_nxs        0      0      0      0      0      0      0      0      0      0
## M3_nxs        0      0      0      0      0      0      0      0      0      0
## M4_nxs        0      0      0      0      0      0      0      0      0      0
## O1_nxs        0      0      0      0      0      0      0      0      0      0
## O2_nxs        0      0      0      0      0      0      0      0      0      0
## R1_nxs        0      0      0      0      0      1      1      0      0      0
## R2_nxs        0      0      0      0      1      0      0      0      0      0
## R3_nxs        0      0      1      0      0      0      0      0      0      0
## R4_nxs        0      0      0      0      1      0      1      0      0      0
## R5_nxs        0      0      0      0      0      1      0      0      0      0
## S1_nxs        0      0      0      0      0      0      0      0      0      0
## S3_nxs        2      0      0      0      0      0      0      0      0      0
## S4_nxs        4      2      0      0      0      0      0      0      0      0
## Sec1_nxs      0      0      0      0      0      0      0      0      0      0
## Sec2_nxs      0      0      0      0      0      0      0      0      0      0
## Ex1_oko       0      0      0      0      0      0      0      0      1      0
## Ex2_oko       0      0      0      0      0      0      0      0      0      0
## Ex3_oko       0      0      0      0      0      0      0      0      0      0
## R1_oko        0      0      0      0      0      0      1      0      0      0
## R2_oko        0      0      0      0      0      0      1      0      0      0
## Sec1_oko      0      0      0      0      0      0      1      0      0      0
```

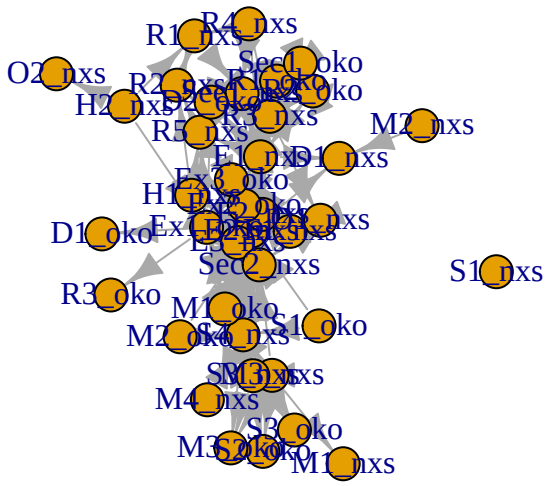
```
## M1_oko        0      0      0      0      0      0      0      0      0      0
## S1_oko        0      0      0      0      0      0      0      0      0      0
## M2_oko        0      0      0      0      0      0      0      0      0      0
## D1_oko        0      0      0      0      0      0      0      0      0      0
## D2_oko        0      0      0      0      0      0      0      0      0      0
## R3_oko        0      0      0      0      0      0      0      0      0      0
## S2_oko        0      0      0      0      0      0      0      0      0      0
## S3_oko        0      0      0      0      0      0      0      0      0      0
## M3_oko        0      0      0      0      0      0      0      0      0      0
##          S3_nxs S4_nxs Sec1_nxs Sec2_nxs Ex1_oko Ex2_oko Ex3_oko R1_oko R2_oko
## D1_nxs        0      0        0        0       0       0       0      0      0
## E1_nxs        0      0        0        2       1       1       2      2      1
## E2_nxs        0      2        0        1       2       2       1      0      0
## E3_nxs        0      2        0        1       2       2       1      0      0
## F1_nxs        0      0        0        0       0       1       0      0      0
## F2_nxs        0      0        0        2       1       2       1      0      0
## H1_nxs        0      0        0        1       1       0       0      0      0
## H2_nxs        0      0        0        0       1       0       0      0      0
## M1_nxs        0      0        0        0       0       0       0      0      0
## M2_nxs        0      0        0        0       0       0       0      0      0
## M3_nxs        2      2        0        2       0       0       0      0      0
## M4_nxs        0      2        0        0       0       0       0      0      0
## O1_nxs        0      0        0        2       0       0       0      0      0
## O2_nxs        0      0        0        0       0       0       0      0      0
## R1_nxs        0      0        1        0       0       0       0      0      0
## R2_nxs        0      0        0        0       0       0       0      0      0
## R3_nxs        0      0        1        0       0       0       1      2      1
## R4_nxs        0      0        1        0       0       0       0      0      0
## R5_nxs        0      0        0        0       0       0       1      1      0
## S1_nxs        0      0        0        0       0       0       0      0      0
## S3_nxs        0      2        0        2       0       0       0      0      0
## S4_nxs        2      0        0        2       1       0       0      0      0
## Sec1_nxs      0      0        0        1       0       0       0      0      0
## Sec2_nxs      0      0        0        0       1       0       0      0      0
## Ex1_oko       0      1        0        1       0       1       1      0      0
## Ex2_oko       0      0        0        0       1       0       1      0      0
## Ex3_oko       0      0        0        0       1       1       0      0      0
## R1_oko        0      0        0        0       0       0       0      0      1
## R2_oko        0      0        0        0       0       0       0      1      0
## Sec1_oko      0      0        0        0       0       0       0      1      1
## M1_oko        0      2        0        0       1       0       0      0      0
## S1_oko        0      1        0        0       0       0       0      0      0
## M2_oko        0      1        0        0       0       0       0      0      0
## D1_oko        0      0        0        0       0       0       0      0      0
## D2_oko        0      0        0        0       0       0       0      0      0
## R3_oko        0      0        0        0       0       0       0      0      0
## S2_oko        0      0        0        0       0       0       0      0      0
## S3_oko        0      0        0        0       0       0       0      0      0
## M3_oko        0      0        0        0       0       0       0      0      0
##          Sec1_oko M1_oko S1_oko M2_oko D1_oko D2_oko R3_oko S2_oko S3_oko
## D1_nxs          0      0      0      0      0      0      0      0      0
## E1_nxs          1      0      0      0      0      1      0      0      0
## E2_nxs          0      0      0      0      0      0      0      0      0
## E3_nxs          0      1      0      0      0      0      0      0      0
```

```
## F1_nxs          0      0      0      0      0      0      0      0      0
## F2_nxs          0      0      0      0      0      0      0      0      0
## H1_nxs          0      0      0      0      0      0      0      0      0
## H2_nxs          0      0      0      0      0      0      0      0      0
## M1_nxs          0      0      0      0      0      0      0      0      0
## M2_nxs          0      0      0      0      0      0      0      0      0
## M3_nxs          0      1      0      0      0      0      0      1      1
## M4_nxs          0      0      0      0      0      0      0      0      0
## O1_nxs          0      0      0      0      0      0      0      0      0
## O2_nxs          0      0      0      0      0      0      0      0      0
## R1_nxs          0      0      0      0      0      0      0      0      0
## R2_nxs          0      0      0      0      0      0      0      0      0
## R3_nxs          1      0      0      0      0      1      0      0      0
## R4_nxs          0      0      0      0      0      0      0      0      0
## R5_nxs          0      0      0      0      0      1      0      0      0
## S1_nxs          0      0      0      0      0      0      0      0      0
## S3_nxs          0      1      0      0      0      0      0      1      1
## S4_nxs          0      2      0      0      0      0      0      1      1
## Sec1_nxs        0      0      0      0      0      0      0      0      0
## Sec2_nxs        0      0      0      0      0      0      0      0      0
## Ex1_oko         0      1      0      0      1      1      1      0      0
## Ex2_oko         0      0      0      0      0      0      0      0      0
## Ex3_oko         0      0      0      0      0      0      0      0      0
## R1_oko          1      0      0      0      0      0      0      0      0
## R2_oko          1      0      0      0      0      0      0      0      0
## Sec1_oko        0      0      0      0      0      0      0      0      0
## M1_oko          0      0      0      0      0      0      0      0      0
## S1_oko          0      0      0      0      0      0      0      0      0
## M2_oko          0      0      0      0      0      0      0      0      0
## D1_oko          0      0      0      0      0      0      0      0      0
## D2_oko          0      0      0      0      0      0      0      0      0
## R3_oko          0      0      0      0      0      0      0      0      0
## S2_oko          0      0      0      0      0      0      0      0      0
## S3_oko          0      0      0      0      0      0      0      0      0
## M3_oko          0      0      0      0      0      0      0      0      0
##          M3_oko
## D1_nxs        0
## E1_nxs        0
## E2_nxs        0
## E3_nxs        0
## F1_nxs        0
## F2_nxs        0
## H1_nxs        0
## H2_nxs        0
## M1_nxs        0
## M2_nxs        0
## M3_nxs        1
## M4_nxs        0
## O1_nxs        0
## O2_nxs        0
## R1_nxs        0
## R2_nxs        0
## R3_nxs        0
## R4_nxs        0
```

```
## R5_nxs        0
## S1_nxs        0
## S3_nxs        1
## S4_nxs        1
## Sec1_nxs      0
## Sec2_nxs      0
## Ex1_oko       0
## Ex2_oko       0
## Ex3_oko       0
## R1_oko        0
## R2_oko        0
## Sec1_oko      0
## M1_oko        0
## S1_oko        0
## M2_oko        0
## D1_oko        0
## D2_oko        0
## R3_oko        0
## S2_oko        0
## S3_oko        0
## M3_oko        0
```

```
plot(combined_graph_dir, vertex.label = V(combined_graph_dir)$name, main = "Combined Nexus and Oko Direc
```

Combined Nexus and Oko Directed Network




```
total_degree_dir <- igraph::degree(combined_graph_dir, mode = "total")
indegree_dir <- igraph::degree(combined_graph_dir, mode = "in")
outdegree_dir <- igraph::degree(combined_graph_dir, mode = "out")
```

```
print("Combined Directed Network - Total Degree:")
```

```
## [1] "Combined Directed Network - Total Degree:"
```

```
print(total_degree_dir)
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
##        3       27       25       20       10       15        6        3
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
```

```
##        1        1       10        2        4        1        6        5
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##       16        4        7        0        9       20        5       13
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       24       14       14        9        8        8        9        2
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        2        1        4        1        3        3        3
```

```
print("Combined Directed Network - Indegree:")
```

```
## [1] "Combined Directed Network - Indegree:"
```

```
print(indegree_dir)
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
##        3       12       13        9        5        7        2        0
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
##        1        0        2        1        2        1        3        4
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##        7        0        3        0        2        9        3       11
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       11        7        8        5        4        4        5        0
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        0        1        4        1        3        3        3
```

```
print("Combined Directed Network - Outdegree:")
```

```
## [1] "Combined Directed Network - Outdegree:"
```

```
print(outdegree_dir)
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
##        0       15       12       11        5        8        4        3
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
##        0        1        8        1        2        0        3        1
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##        9        4        4        0        7       11        2        2
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       13        7        6        4        4        4        4        2
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        2        0        0        0        0        0        0
```

```
dyad_count_dir <- igraph::dyad.census(combined_graph_dir)
triad_count_dir <- igraph::triad.census(combined_graph_dir)
edge_count_dir <- gsize(combined_graph_dir)
```

```
print("Combined Directed Network - Dyad Count:")
```

```
## [1] "Combined Directed Network - Dyad Count:"
```

```
print(dyad_count_dir)
```

```
## $mut
## [1] 50
##
## $asym
## [1] 59
##
## $null
```

```
## [1] 632
```

```
print("Combined Directed Network - Triad Count:")
```

```
## [1] "Combined Directed Network - Triad Count:"
```

```
print(triad_count_dir)
```

```
##  [1] 5842 1501 1180   64   40   54  108  141   12    0   89    4   22    7   15
## [16]   60
```

```
print("Combined Directed Network - Edge Count:")
```

```
## [1] "Combined Directed Network - Edge Count:"
```

```
print(edge_count_dir)
```

```
## [1] 159
```

```
density_dir <- graph.density(combined_graph_dir)
```

```
print("Combined Directed Network - Density:")
```

```
## [1] "Combined Directed Network - Density:"
```

```
print(density_dir)
```

```
## [1] 0.1072874
```

```
transitivity_global_dir <- transitivity(combined_graph_dir, type = "global")
```

```
print("Combined Directed Network - Transitivity (Global Clustering Coefficient):")
```

```
## [1] "Combined Directed Network - Transitivity (Global Clustering Coefficient):"
```

```
print(transitivity_global_dir)
```

```
## [1] 0.4205607
```

```
reciprocity_value_dir <- reciprocity(combined_graph_dir)
```

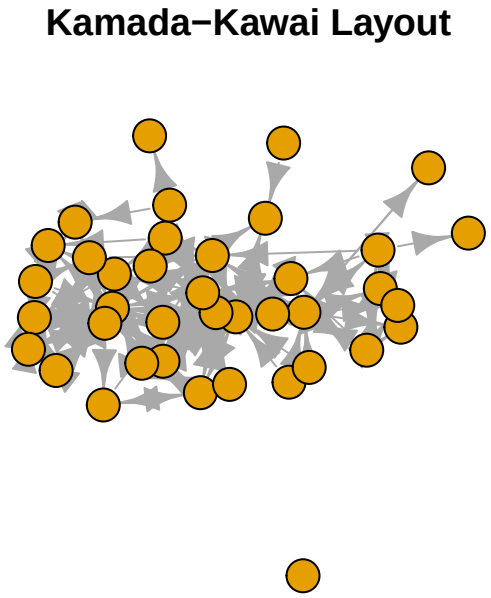
```
print("Combined Directed Network - Reciprocity:")
```

```
## [1] "Combined Directed Network - Reciprocity:"
```

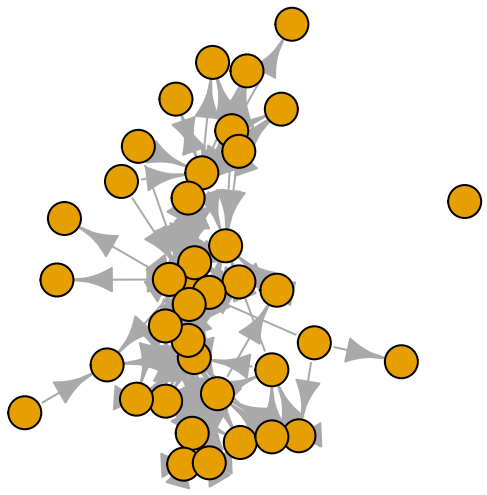
```
print(reciprocity_value_dir)
```

```
## [1] 0.6289308
```

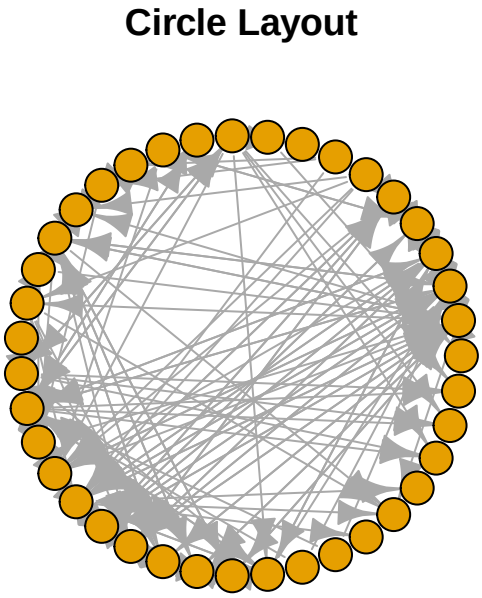
```
plot(combined_graph_dir, layout = layout_with_kk, vertex.label = NA, main = "Kamada-Kawai Layout",
     vertex.color = V(combined_graph_dir)$color, vertex.size = V(combined_graph_dir)$size)
```



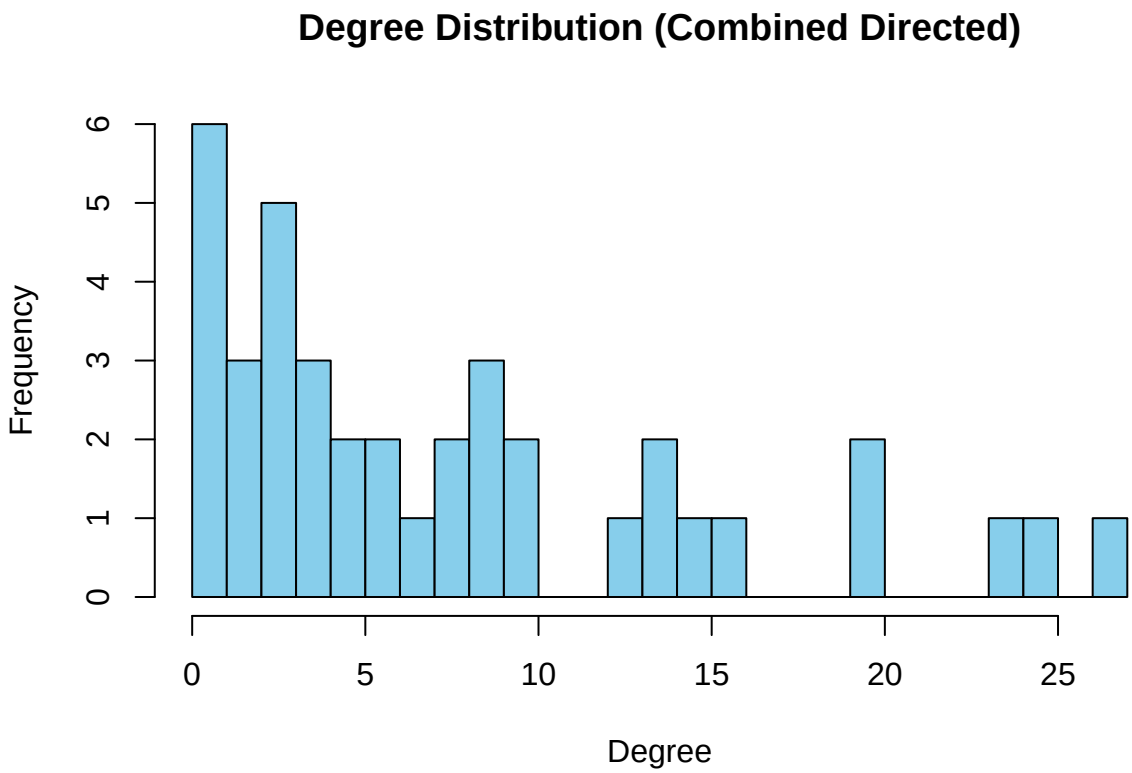

```
plot(combined_graph_dir, layout = layout_with_fr, vertex.label = NA, main = "Fruchterman-Reingold Layou
     vertex.color = V(combined_graph_dir)$color, vertex.size = V(combined_graph_dir)$size)
```




```
plot(combined_graph_dir, layout = layout_in_circle, vertex.label = NA, main = "Circle Layout",
     vertex.color = V(combined_graph_dir)$color, vertex.size = V(combined_graph_dir)$size)
```

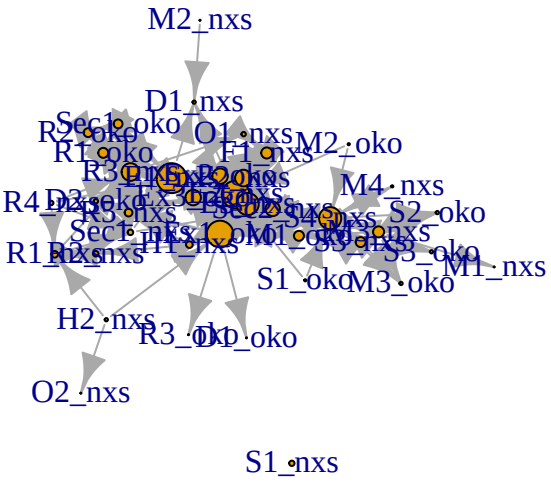



```
# Visualize degree distribution for the combined directed network
deg_dir <- igraph::degree(combined_graph_dir)
hist(deg_dir, breaks = 20, col = "skyblue", main = "Degree Distribution (Combined Directed)", xlab = "D
```



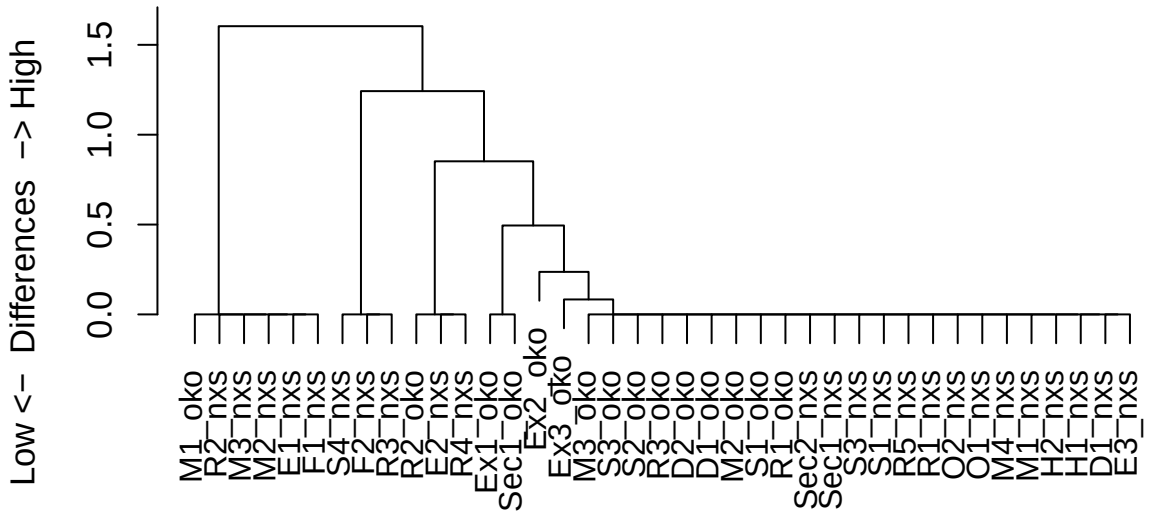

```
# Plot the combined directed network with vertex sizes proportional to degree
plot(combined_graph_dir, vertex.size = deg_dir/2, vertex.label = V(combined_graph_dir)$name, main = "Co
```

Combined Directed Network with Vertex Size Proportional to Degre




```
ddgm1 <- xHierarchicalClustering(combinedAdjMxt_dir, Input="Differences", Method="ward.D")
```

Cluster Dendrogram



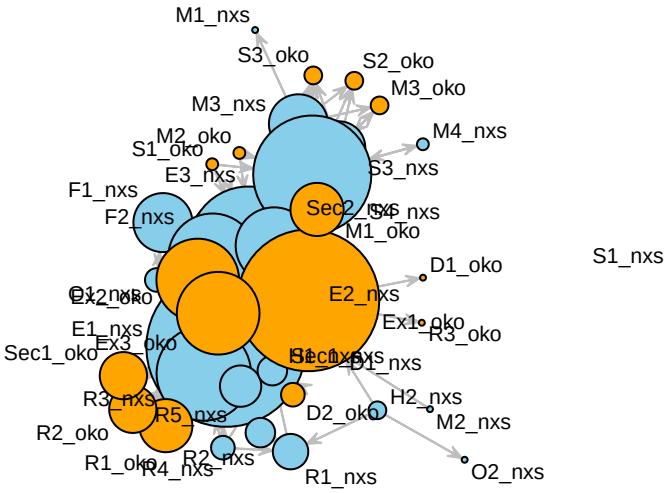
MAT1

```
# Convert the combined adjacency matrix to a network object for sna
network <- as.network(combinedAdjMxt_dir, directed = TRUE)

# Set colors based on the group (Nexus or Oko)
vertex_colors <- ifelse(grepl("_nxs$", V(combined_graph_dir)$name), "skyblue", "orange")

# Set vertex sizes based on degree
vertex_sizes <- igraph::degree(combined_graph_dir) * 2
```

```
# Define a color palette for the edges
edge_colors <- rep("gray", ecount(combined_graph_dir))
```

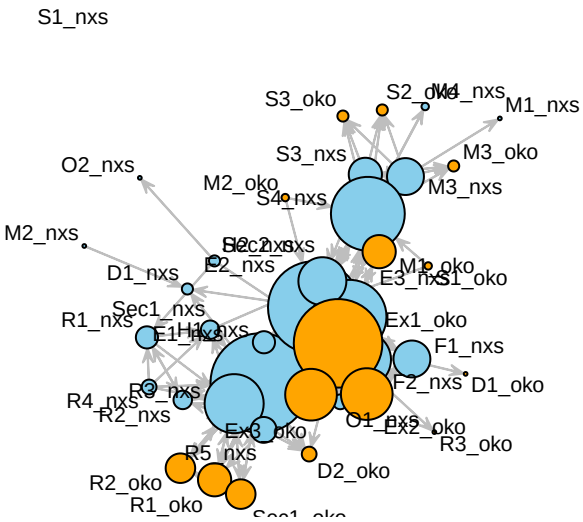
```
# Kamada-Kawai Layout
gplot(network, displaylabels = TRUE, label.cex = 0.7,
      vertex.col = vertex_colors, vertex.cex = vertex_sizes / 5,
      edge.col = edge_colors, edge.lwd = 0.5,
      main = "Kamada-Kawai Layout")
```

Kamada−Kawai Layout



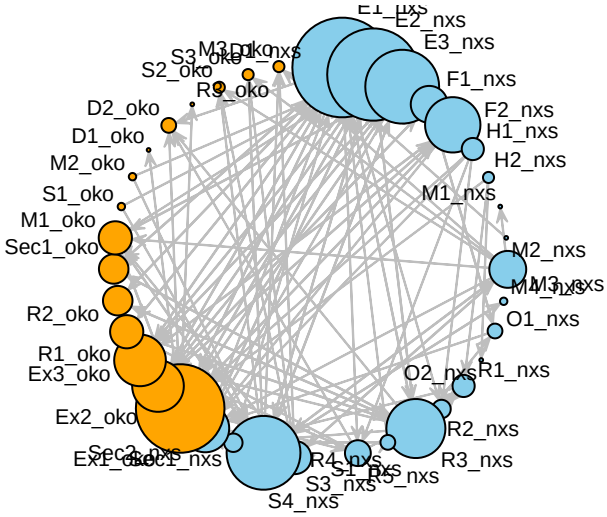

```
# Fruchterman-Reingold Layout
gplot(network, displaylabels = TRUE, label.cex = 0.7,
      vertex.col = vertex_colors, vertex.cex = vertex_sizes / 8,
      edge.col = edge_colors, edge.lwd = 0.5,
      mode = "fruchtermanreingold",
      main = "Fruchterman-Reingold Layout")
```

Fruchterman−Reingold Layout



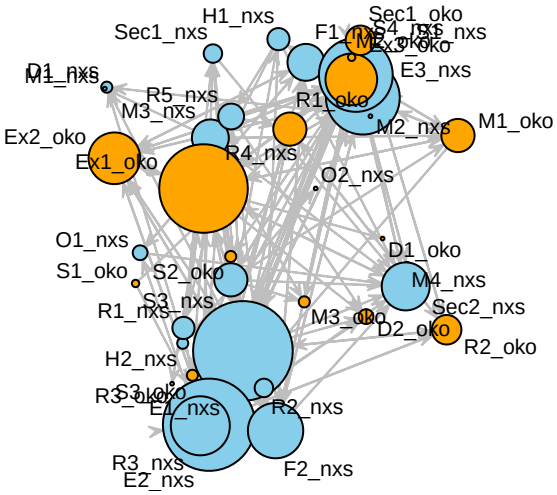
```
# Circle Layout
gplot(network, displaylabels = TRUE, label.cex = 0.7,
      vertex.col = vertex_colors, vertex.cex = vertex_sizes / 8,
      edge.col = edge_colors, edge.lwd = 0.5,
      mode = "circle",
      main = "Circle Layout")
```

Circle Layout



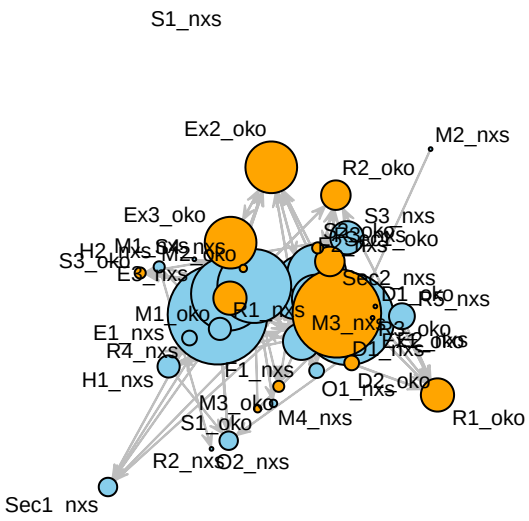

```
# Random Layout
gplot(network, displaylabels = TRUE, label.cex = 0.7,
      vertex.col = vertex_colors, vertex.cex = vertex_sizes / 8,
      edge.col = edge_colors, edge.lwd = 0.5,
      mode = "random",
      main = "Random Layout")
```

Random Layout



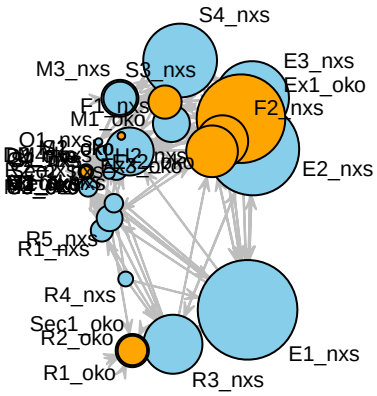
```
# Spring Layout
gplot(network, displaylabels = TRUE, label.cex = 0.7,
      vertex.col = vertex_colors, vertex.cex = vertex_sizes / 8,
      edge.col = edge_colors, edge.lwd = 0.5,
      mode = "spring",
      main = "Spring Layout")
```

Spring Layout




```
# Eigen Layout
gplot(network, displaylabels = TRUE, label.cex = 0.7,
      vertex.col = vertex_colors, vertex.cex = vertex_sizes / 8,
      edge.col = edge_colors, edge.lwd = 0.5,
      mode = "eigen",
      main = "Eigen Layout")
```

Eigen Layout



Discussion

##lets first briefly analyze the symmetrized network of both pre-acquisition and post-acquisition company state:

before merger

```
## [1] "Dyadic Census :"
```

```
##      Mut Asym Null
## [1,]  46    0  230
```

```
## [1] "Triadic Census :"
```

```
##       003 012 102 021D 021U 021C 111D 111U 030T 030C 201 120D 120U 120C 210 300
## [1,] 1184   0 689    0    0    0    0    0    0    0 130    0    0    0   0  21
```

after merger

```
## [1] "Dyadic Census:"
```

```
##      Mut Asym Null
## [1,] 132    0  609
```

```
## [1] "Triadic Census:"
```

```
##       003 012  102 021D 021U 021C 111D 111U 030T 030C 201 120D 120U 120C 210
## [1,] 5202   0 3176    0    0    0    0    0    0    0 575    0    0    0   0
##      300
## [1,] 186
```

Mutual dyads increased significantly from 46 to 132 after the merger. Triads with three edges (300) increased from 21 to 186 after the merger which tells us that there are more close-knit groups where each member is connected to the other two. This is likely driven by the 6 executives of the company working extremely close together as most of the scenarios include at least 2 executived from either of the company. Null dyads also increased a lot, but that is likely because of the significant amount of communication overall as seen by the x6 increase in edge count. the 201 tried where a node has bidirectional communication with two other nodes increased from 130-575 so is evident that there are certain individuals which are now in a more managerial like role. A great example is Wynona L (Ex1_oko) who interacts bidirectionaly with some of her team and the Nexus execs but the Nexus execs do not interacts birectionally with Oko employees. As expected from the merger and most evident from significant interaction amount between the execs of two companies and increase in employees that don't interact with them or nexus employees, the 102 triad type increased drastically as well.

##Now lets focus on directed network analysis

before merger

```
## [1] "Total Degree:"
```

```
##   D1   E1   E2   E3   F1   F2   H1   H2   M1   M2   M3   M4   O1   O2   R1   R2
##    3    8    7    6    3    4    5    2    1    1    6    2    4    1    6    5
##   R3   R4   R5   S1   S3   S4 Sec1 Sec2
##    5    4    3    0    5    9    5    9
```

```
## [1] "Indegree:"
```

```
##   D1   E1   E2   E3   F1   F2   H1   H2   M1   M2   M3   M4   O1   O2   R1   R2
##    3    4    0    1    2    2    2    0    1    0    2    1    2    1    3    4
##   R3   R4   R5   S1   S3   S4 Sec1 Sec2
##    3    0    2    0    2    5    3    9
```

```
## [1] "Outdegree:"
```

```
##   D1   E1   E2   E3   F1   F2   H1   H2   M1   M2   M3   M4   O1   O2   R1   R2
##    0    4    7    5    1    2    3    2    0    1    4    1    2    0    3    1
##   R3   R4   R5   S1   S3   S4 Sec1 Sec2
##    2    4    1    0    3    4    2    0
```

```
## [1] "Dyad Count:"
```

```
## $mut
## [1] 6
##
## $asym
## [1] 40
##
## $null
## [1] 230
```

```
## [1] "Triad count:"
```

```
##  [1] 1184  586  103   35   39   35   13    6   17    0    2    0    3    0    0
## [16]    1
```

```
## [1] "Edge Count:"
```

```
## [1] 52
```

```
## [1] "Density:"
```

```
## [1] 0.0942029
```

```
## [1] "Reciprocity:"
```

```
## [1] 0.2307692
```

after merger

```
## [1] "Combined Directed Network - Total Degree:"
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
##        3       27       25       20       10       15        6        3
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
##        1        1       10        2        4        1        6        5
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##       16        4        7        0        9       20        5       13
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       24       14       14        9        8        8        9        2
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        2        1        4        1        3        3        3
```

```
## [1] "Combined Directed Network - Indegree:"
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
##        3       12       13        9        5        7        2        0
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
##        1        0        2        1        2        1        3        4
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##        7        0        3        0        2        9        3       11
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       11        7        8        5        4        4        5        0
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        0        1        4        1        3        3        3
```

```
## [1] "Combined Directed Network - Outdegree:"
```

```
##   D1_nxs   E1_nxs   E2_nxs   E3_nxs   F1_nxs   F2_nxs   H1_nxs   H2_nxs
##        0       15       12       11        5        8        4        3
##   M1_nxs   M2_nxs   M3_nxs   M4_nxs   O1_nxs   O2_nxs   R1_nxs   R2_nxs
##        0        1        8        1        2        0        3        1
##   R3_nxs   R4_nxs   R5_nxs   S1_nxs   S3_nxs   S4_nxs Sec1_nxs Sec2_nxs
##        9        4        4        0        7       11        2        2
##  Ex1_oko  Ex2_oko  Ex3_oko   R1_oko   R2_oko Sec1_oko   M1_oko   S1_oko
##       13        7        6        4        4        4        4        2
##   M2_oko   D1_oko   D2_oko   R3_oko   S2_oko   S3_oko   M3_oko
##        2        0        0        0        0        0        0
```

```
## [1] "Combined Directed Network - Dyad Count:"
```

```
## $mut
## [1] 50
##
## $asym
## [1] 59
##
## $null
## [1] 632
```

```
## [1] "Combined Directed Network - Triad Count:"
```

```
##  [1] 5842 1501 1180   64   40   54  108  141   12    0   89    4   22    7   15
## [16]   60
```

```
## [1] "Combined Directed Network - Edge Count:"
```

```
## [1] 159
```

```
## [1] "Combined Directed Network - Density:"
```

```
## [1] 0.1072874
```

```
## [1] "Combined Directed Network - Transitivity (Global Clustering Coefficient):"
```

```
## [1] 0.4205607
```

```
## [1] "Combined Directed Network - Reciprocity:"
```

```
## [1] 0.6289308
```

We can clearly see that the density (and edge count) has increased signficantly after the merger which means that interactions increased in frequency and the network is denser. from the plots we saw earlier it is easily observable how much denser it is especially when you use the interactive tool and select any one of the executives from NexusOko. The very first scenario where Art Y, Briley H, Chris T, Wyndham R from Nexus, and Dave G, Wynona L, and Hiroshi T of Oko.AI met essentially made them the centers of the network since every interaction after included at least one of them making the network very dense.

Transitivity also increased which tells us that the network is more clustered. so if two nodes are connected to a third one those two nodes are probably also connected. Thats kind of what i was hoping to happen with these scenarios, showcasing what a good startup acquision should be, instead of being divisive it should be tight knit within and among groups. a simple example of increase in transitivity is when Briley H (E3_nxs) and Casey S (S4_nxs) meet with Wynona L (Ex1_oko) and Mark P (M1_oko) where the Nexus and Oko marketing teams connect Or when Wynona L (Ex1_oko) meets with Raghav C (D1_oko), Sarah H (D2_oko), Robin K (R5_nxs), and Lex L (R3_oko) to recruit them making them a separate cluster group. The goal of all these scenarios is to facilitate efficient flow of information within groups and so increased transitivity was expected.

Reciprocity increase by .39 which is quiet a bit. this means that a lot more interactions are now bidirectional. This is in part because Management is essentially communicating bidirectionally. Also because members of Oko teams had bidirectional relationships between themselved and when they interacted with management.An example of the latter would when, in scenario 10, Robin K (R5_nxs), Kim K (R3_nxs), Chris T (E1_nxs) of Nexus, and Hiroshi T (Ex3_oko), Adam S (R1_oko), and Sarah H (D2_oko) met and everyone interacted with each other making a highly reciprocal network where Chris T ad Kim K also have a high overall degree as well as reciprocity with management. If reciprocity is high after an acquision, I would presume the management is doing something very correctly to maximize the synergy.

If we look at the dyad census its interesting to see that before merger there were a significant about of asymmetrical dyads when compared to mutual ones, but after the merger mutual dyads number increased a lot more than assymetrical ones. This shows that the post merger interactions were focused within a cluster of member. This is confirmed since interactions were primarily focused on executives and group leaders and the regular employees from nexus didn't interact much with Oko's regular employees nor did many nexus' employeed interact much with any of the executives. In the triadic census we see similar things noted in the undirected network analysis. 102 and 201 increase shows emergence of key individuals, 300 shows increased of stronger clustering. But there is also an increase in empty triads which is explained by regular oko and nexus employees lacking interaction.

Lets lastly analyze the individuals with most changes and the oko company members with highest social impact: Chris T(E1 / E1_nxs) had an increase of: Total Degree: +19, Indegree: +8, Outdegree: +11. Art Y (E2, E2_nxs) connectivity changed in a slightly different but still significant way: Total Degree: +18 Indegree: +13 Outdegree: +5 From this we can see that Art Y had a lot more people connect with him rather than his reach out wherea Chris T had the highest outdegree among anyone post merger. This outdegree for Chris T is explainable by the fact that hes present in scenarios 1, 2 and 10 where all of them were of him establishing his governance. What's interesting is that Art Y and Wynona L (ex-Ceo of OKO / Ex1_oko) have very comparable degree statistics. Wynona's degree numbers are Total Degree- 24, Indegree- 11, and Outdegree-13 compared to Art's 25 , 13 , 12. Through out the scenarios Wynona was very engaged everywhere and and is also leading the innovations team so her significance post-merger is explainable.