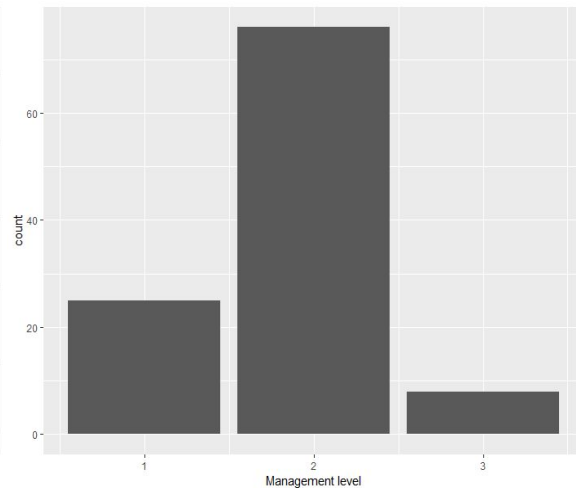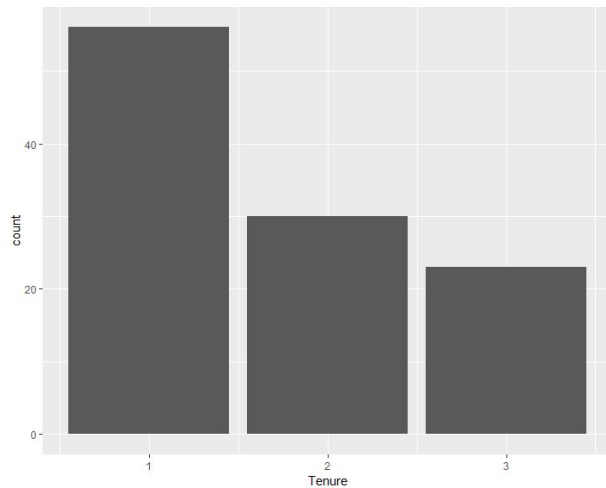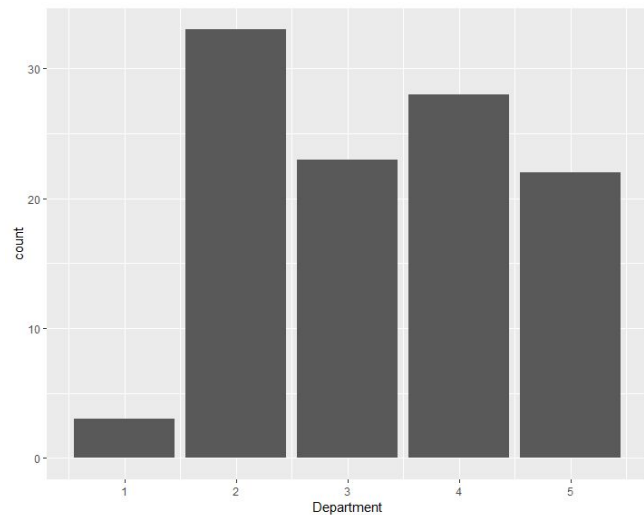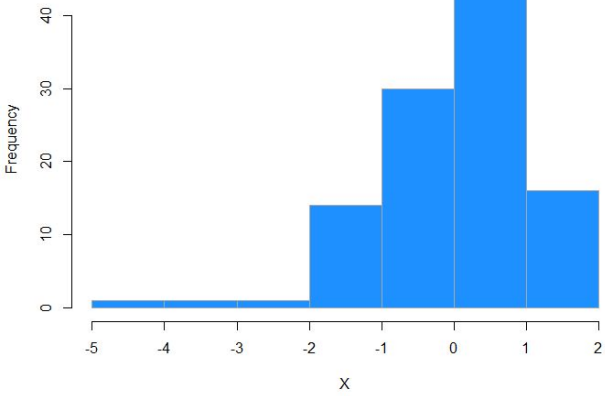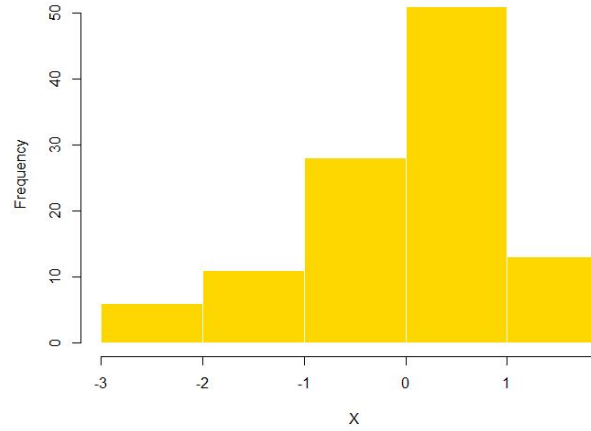# Social Network Final Project

Group 3

Individual Attribute Data

satisfaction with individual productivity — satisfaction with group productivity — satisfaction with organizational productivity
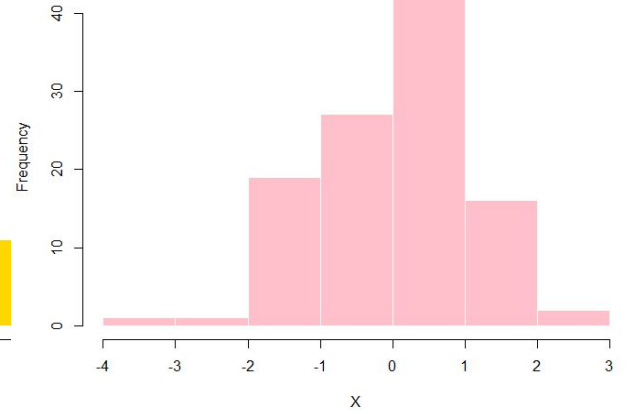
Network Datasets
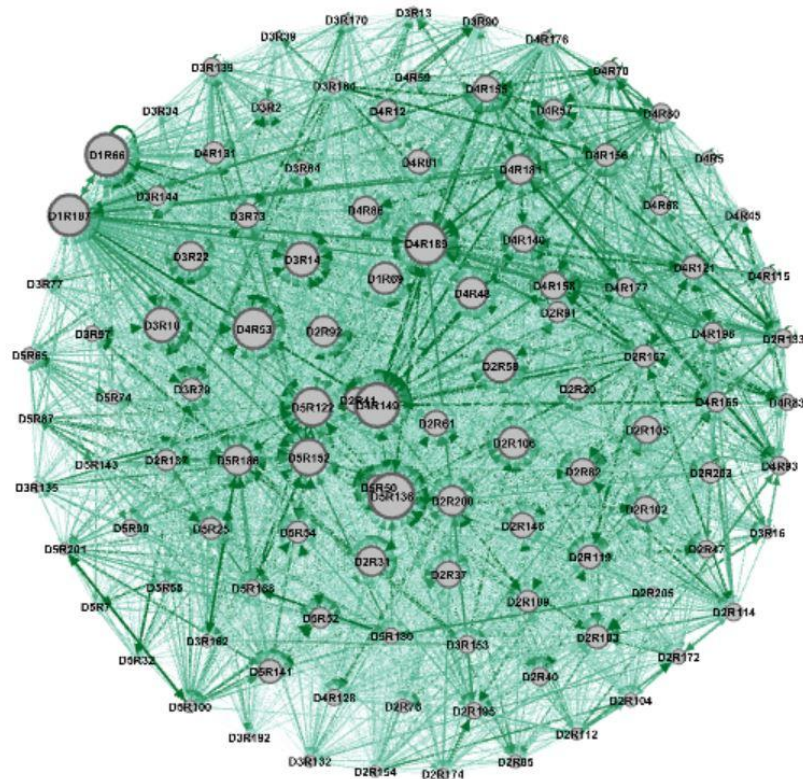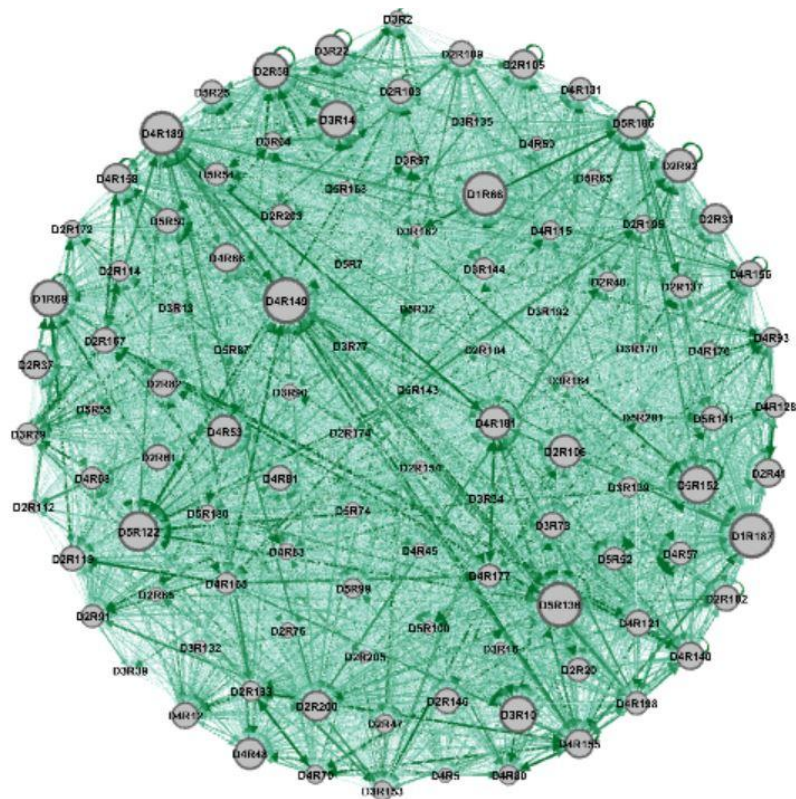
Research Questions

1. What types of employee in the organization are more likely to become the center in the network?
2. What is the structure of our network? What are some similarities or differences between collaboration network and information seeking network?
3. Is there any connection between collaboration and seeking information?
4. What specific attributes will have an influence on forming collaboration or seeking information ties.

2.Descriptive analysis

○Network level analysis

○Node level analysis

Network level analysis

Name of Network	Information Seeking Network	Collaboration Network
Number of Vertex	109	109
Number of Edge	1040	2029
Edge Density	0.3406388	0.3447163
Mean Shortest Path Length	1.672103	1.669215
Network Diameter	3	3

The mean of global transitivity of information seeking network is 0.5903442 while the average of that of Collaboration is 0.5504041.

Degree Distribution of Information Seeking Net

In-degree for Information Seeking Network

Cumulative Frequency vs In-Degree
The verage in-degree is 36.78899

Out-degree for Information Seeking Network

Out-Degree
The verage in-degree is 36.78899
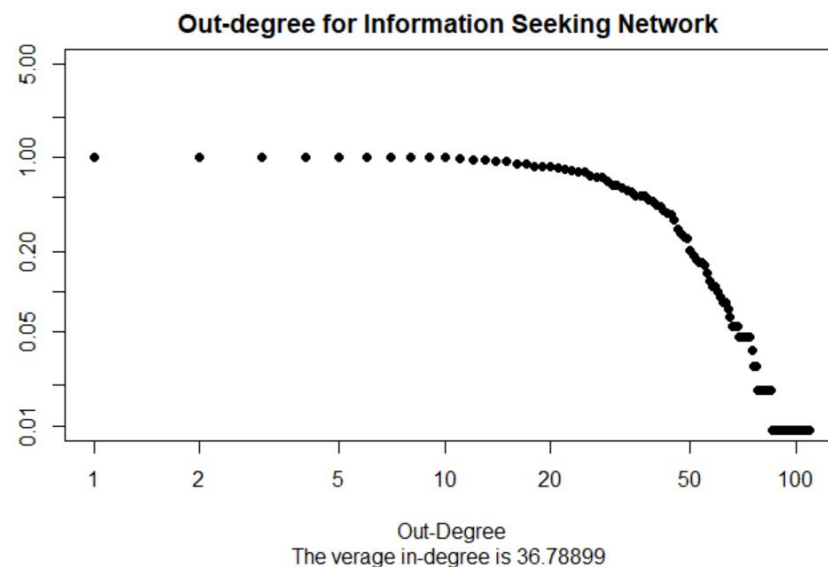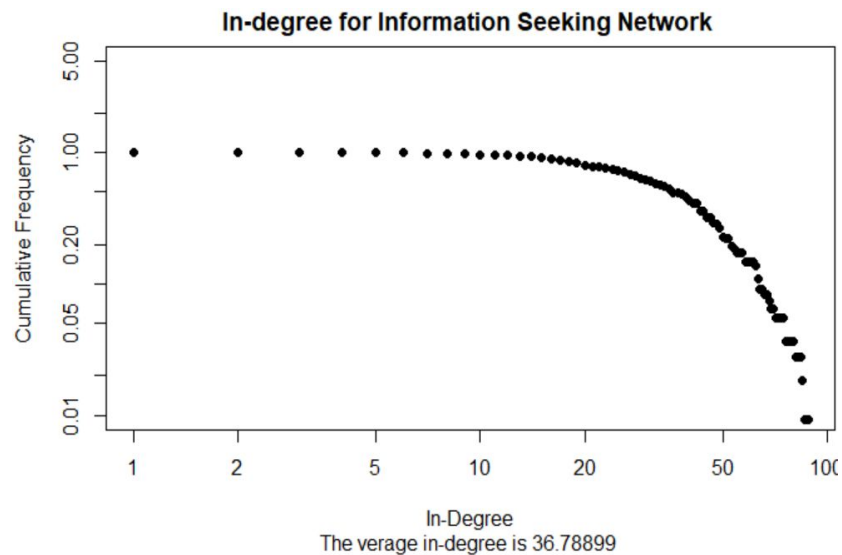
Degree Distribution of Collaboration Network

Degree for Collaboration Network

Degree
The average degree is 37.22936
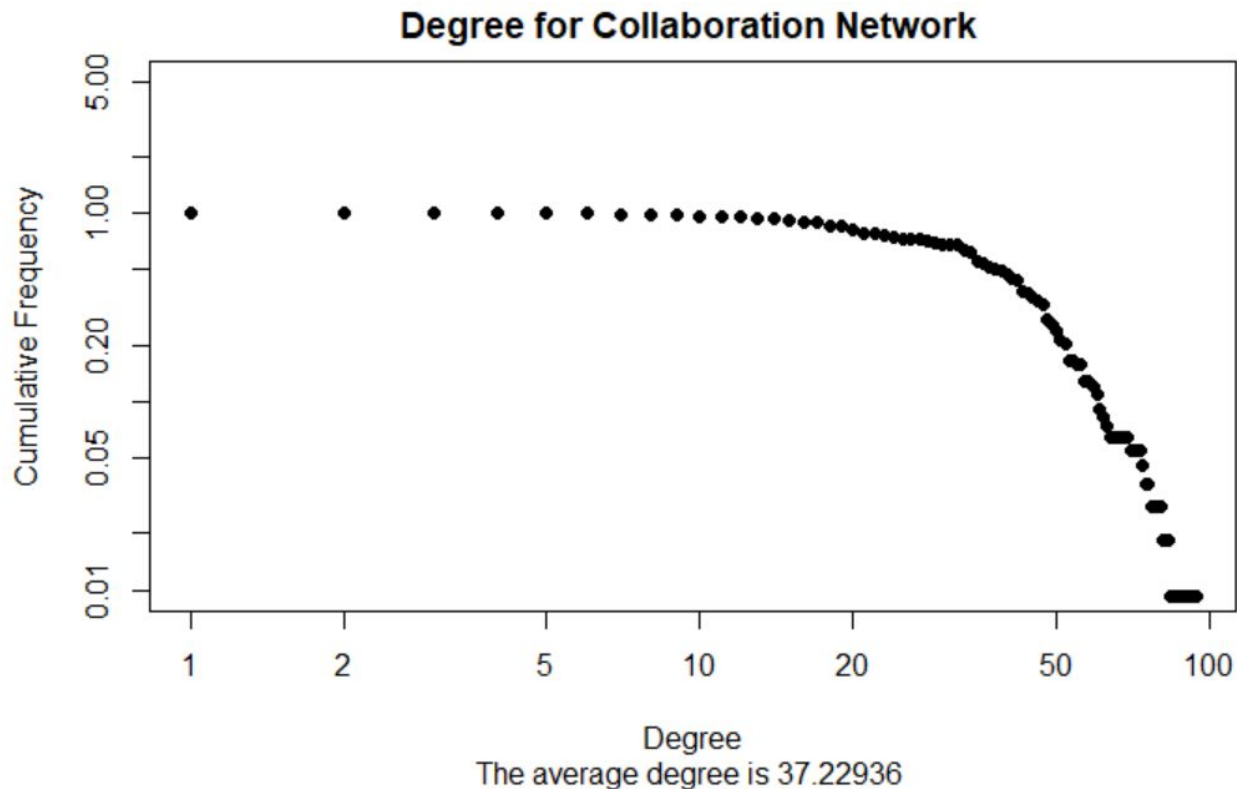
Node Level Analysis:

Name	Information seeking	Collaberation
Degree	36.78899	37.22936
Closeness	0.005607663	0.0056173
betweenness	72.58716	36.13761

In fact, according to the parameters of closeness, betweenness and degree, two networks are highly centrality and there are 10 important nodes existing with high weights and values.

ID	Department	Man-level	Tenure	Gender	Individual	Group	Organization
D1R187	1	1	2	2	-1.164	0.027	-1.742
D1R66	1	1	3	2	0.46	0.195	0.41
D2R200	2	1	2	1	-0.214	0.03	0.289
D2R61	2	1	2	2	0.123	0.325	0.136
D2R92	2	2	2	1	1.009	1.449	-0.38
D4R149	4	1	3	2	0.231	-0.369	0.144
D4R189	4	1	3	2	1.043	0.128	0.724
D4R53	4	2	1	2	1.564	0.219	0.995
D5R122	5	1	3	2	0.703	0.857	0.603
D5R136	5	1	3	2	1.265	0.599	0.231

- means the distribution of the center nodes in each department is even
- Lower management and long tenures would be found to collaborate and being seek information from within large probity.
- People with gender=2 are more popular and likely to be an important node.
- Most of these people with central nodes have high evaluation on the individual, Group and Organization.

- The relationships between the degree and between, the degree and closeness, the betweenness and closeness are all positive correlated.

- the node that has many connections with other nodes will be regarded as a significant node with large possibility and other nodes are more likely to connect with this node, which means this node will have higher betweenness centrality.
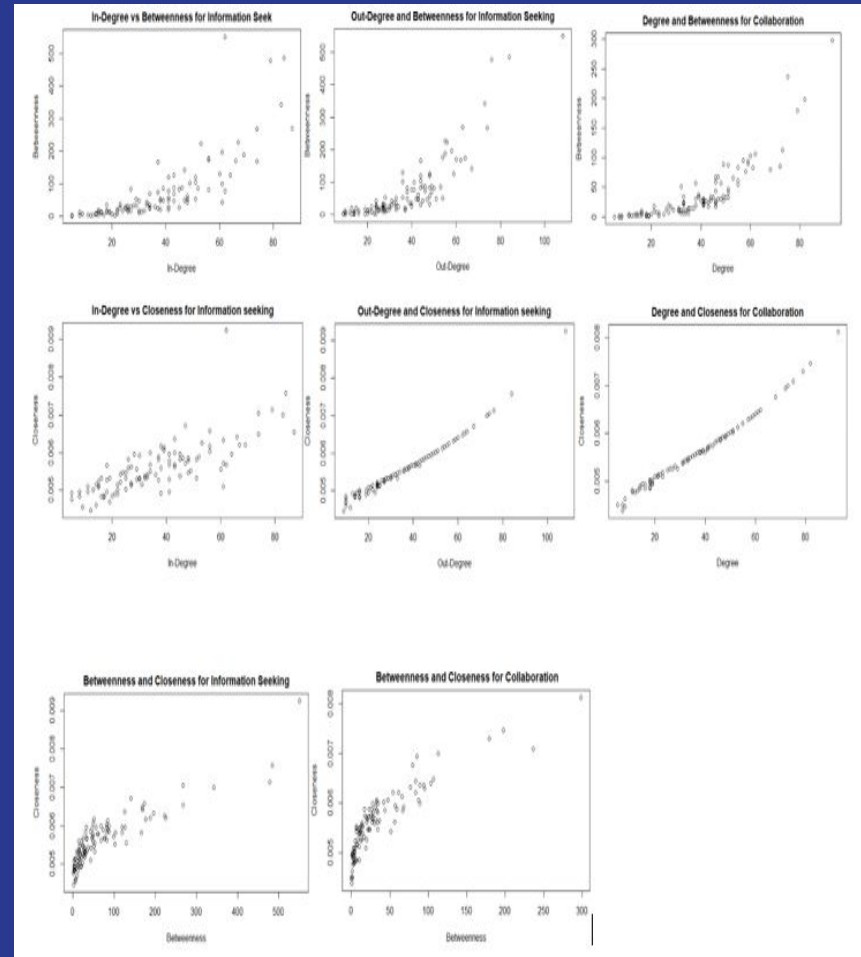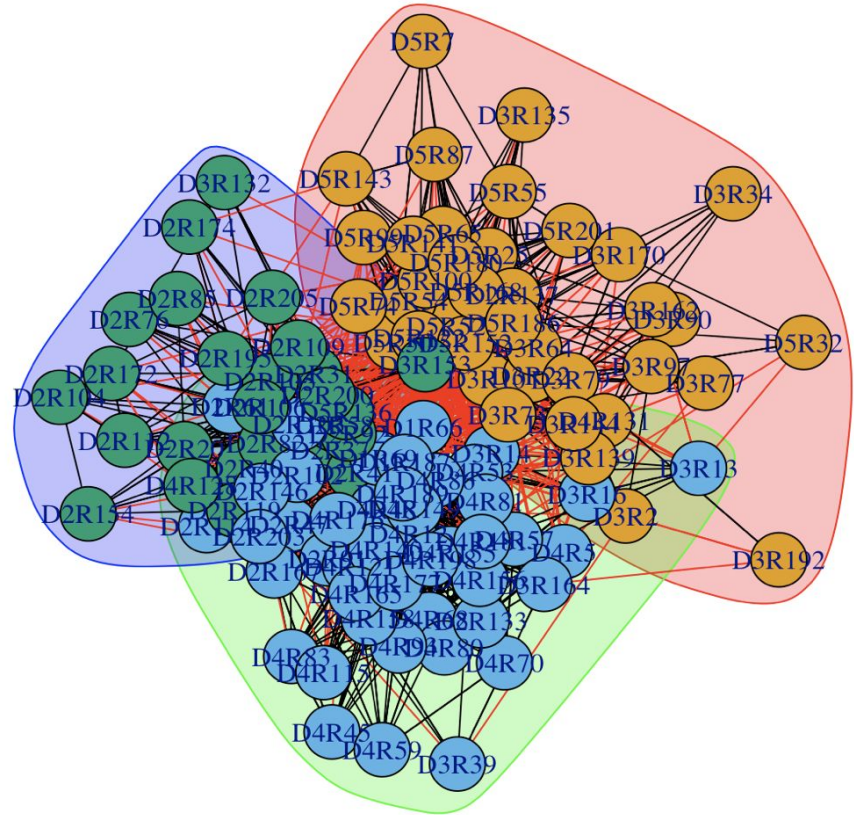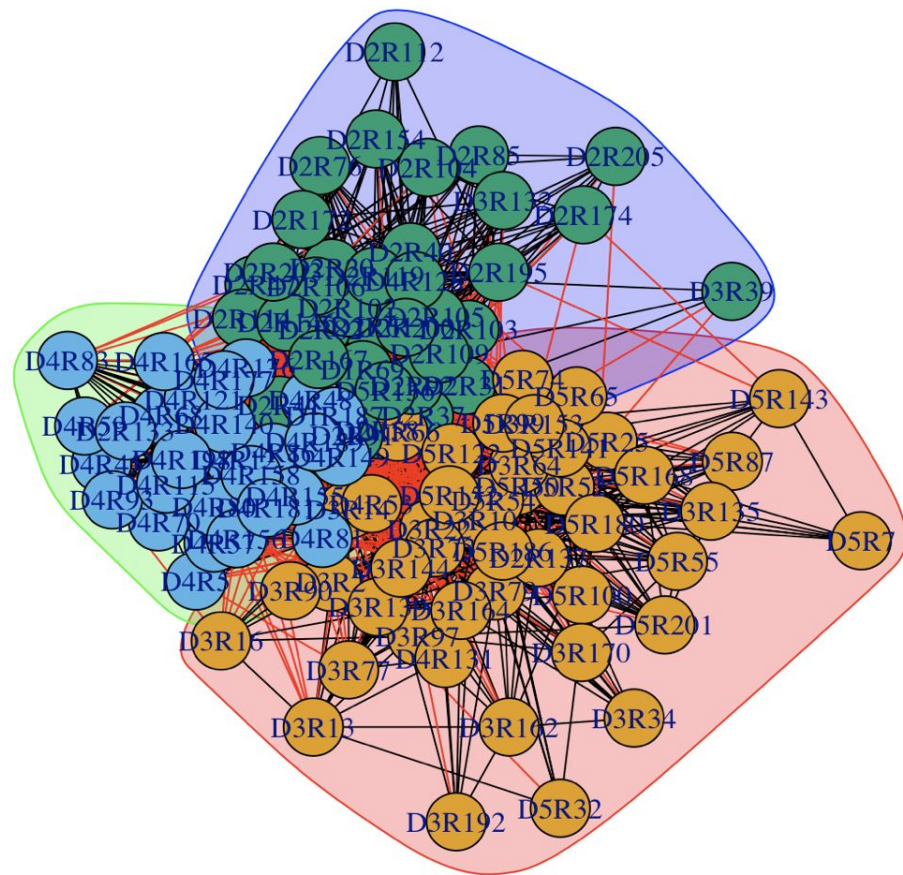
3.Other analysis

○Subgroup analysis
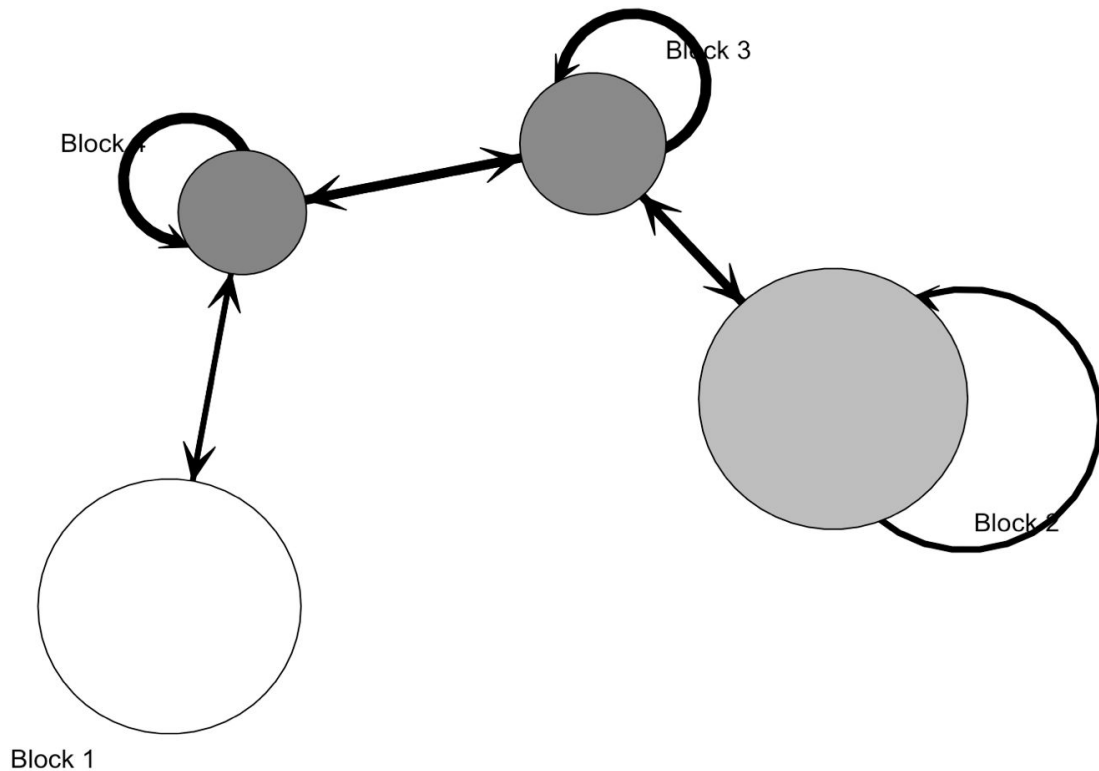
○Role analysis

Community For Information Seeking

Community For Collboration

Role Analysis

Block Model

4.Statistical analysis

○QAP

○ERGM

QAP - Relationship between Two Networks

```{r}
# fit a netlm model
nl.col.info <- netlogit(col.nw, info.nw, reps=100)
summary(nl.col.info)
```

```
Network Logit Model

Coefficients:
            Estimate   Exp(b)       Pr(<=b)  Pr(>=b)  Pr(>=|b|)
(intercept) -3.690598  0.02495708   0.2      0.8      0.2
x1           5.053675  156.59684736 1.0      0.0      0.0

Goodness of Fit Statistics:

Null deviance: 16319.46 on 11772 degrees of freedom
Residual deviance: 5832.191 on 11770 degrees of freedom
Chi-Squared test of fit improvement:
        10487.27 on 2 degrees of freedom, p-value 0
AIC: 5836.191   BIC: 5850.938
Pseudo-R^2 Measures:
        (Dn-Dr)/(Dn-Dr+dfn): 0.4711416
        (Dn-Dr)/Dn: 0.6426235
```

```{r}
# fit a netlm model
nl.info.col <- netlogit(info.nw, col.nw, reps=100)
summary(nl.info.col)
```

```
Network Logit Model

Coefficients:
            Estimate   Exp(b)      Pr(<=b)  Pr(>=b)  Pr(>=|b|)
(intercept) -2.226705  0.1078833   0        1        0
x1           5.053675  156.5968473 1        0        0

Goodness of Fit Statistics:

Null deviance: 16319.46 on 11772 degrees of freedom
Residual deviance: 6815.136 on 11770 degrees of freedom
Chi-Squared test of fit improvement:
        9504.322 on 2 degrees of freedom, p-value 0
AIC: 6819.136   BIC: 6833.883
Pseudo-R^2 Measures:
        (Dn-Dr)/(Dn-Dr+dfn): 0.4467089
        (Dn-Dr)/Dn: 0.582392
```

ERGM - Relationship b/w Attributes & Networks

Positive Significance:
- Having Mutual Ties
- Working at Dept. 2
- Having Tenture of 2 yr
- High Ind. Satisfaction

Negative Significance:
- Working at Dept.3
- Being at Mng. Level 3
- High Group Satisfaction

```
Formula:   col.nw ~ edges + mutual + isolates + nodematch("Department",
    diff = T) + nodefactor("Management.level") + nodematch("Gender",
    diff = T) + nodefactor("Tenure") + nodecov("Individual") +
    nodecov("Group") + nodecov("Organization")

Iterations:  2 out of 20

Monte Carlo MLE Results:
                                Estimate Std. Error MCMC % z value Pr(>|z|)
edges                           -2.131958   0.075862      0 -28.103  < 1e-04 ***
mutual                           2.937609   0.073988      0  39.704  < 1e-04 ***
isolates                             -Inf   0.000000      0    -Inf  < 1e-04 ***
nodematch.Department.1               -Inf   0.000000      0    -Inf  < 1e-04 ***
nodematch.Department.2           0.191924   0.057448      0   3.341 0.000835 ***
nodematch.Department.3          -0.234305   0.091912      0  -2.549 0.010796 *
nodematch.Department.4           0.004079   0.084680      0   0.048 0.961577
nodematch.Department.5          -0.009156   0.089857      0  -0.102 0.918837
nodefactor.Management.level.2   -0.040630   0.032148      0  -1.264 0.206298
nodefactor.Management.level.3   -0.153086   0.051727      0  -2.959 0.003082 **
nodematch.Gender.1               0.019650   0.046067      0   0.427 0.669714
nodematch.Gender.2              -0.039126   0.046248      0  -0.846 0.397544
nodefactor.Tenure.2              0.297972   0.034392      0   8.664  < 1e-04 ***
nodefactor.Tenure.3             -0.035538   0.038642      0  -0.920 0.357745
nodecov.Individual               0.108488   0.021563      0   5.031  < 1e-04 ***
nodecov.Group                   -0.115454   0.019963      0  -5.783  < 1e-04 ***
nodecov.Organization            -0.012654   0.019610      0  -0.645 0.518747
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
edges                               mutual
3382                                  1219
isolates         nodematch.Department.1
0                                        0
```

Thanks