

NETWORK SCIENCE

# Assignment 5

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## 1 Loading Data

As stated in the assignment guide file, these commands are used to load the data from the CSV files to the programming environment.

```
1 nodes <- read.csv("Lawyers.csv", header=T) # Attributes Data
2 cowork <- matrix(scan("Cowork.txt"), ncol=71, nrow=71, byrow=T)
```

Then, a graph object is created from the loaded data using the command below:

```
1 graph <- graph_from_adjacency_matrix(cowork, mode = "directed")
2 graph <- as.undirected(graph, mode="collapse")
```

## 2 Question 1

I first clustered the network using Louvain algorithm. Then I added this data to the nodes and the graph. lastly I plotted the graph. The plot is shown in Figure 1

```
1 CL <- cluster_louvain(graph)
2
3 nodes$community <- membership(CL)
4 V(graph)$community <- nodes$community
5 plot(graph, vertex.color=V(graph)$community, vertex.size=7)
```

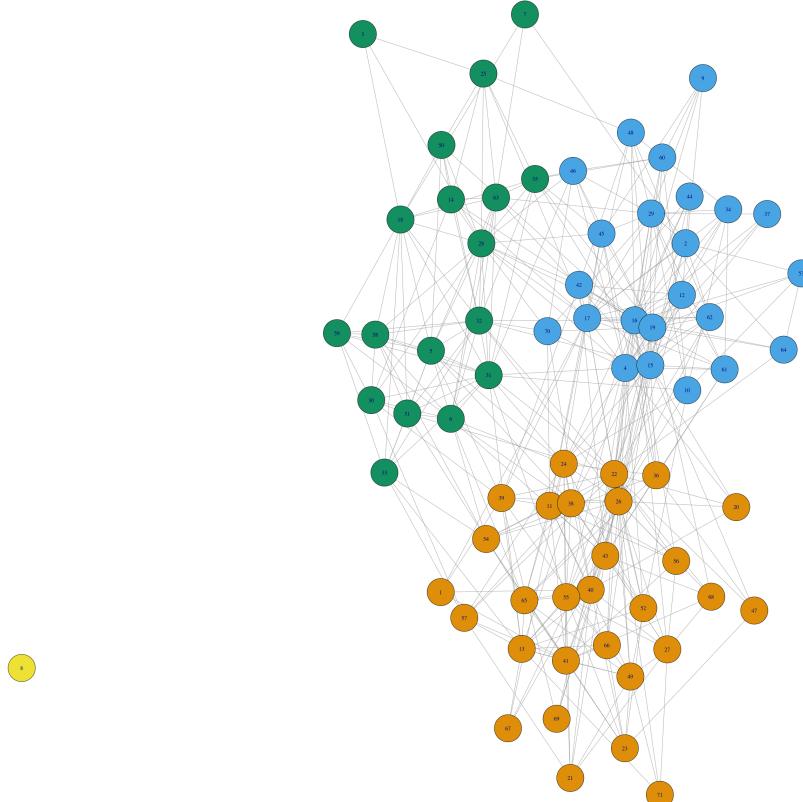


Figure 1: Network plot of Question 1

### 3 Question 2

I attached the community group index to the nodes dataframe in question 1 and used it to color the graph.

#### 3.1 Q2 a: Display the top 5 rows of the new nodes data frame

The output is shown in Figure 2

```
1 head(nodes, 5)
```

	Name	Seniority	Status	Gender	City	Years	Age	Practice	LawSchool	community
1	V1	1	1	1	1	31	64	1	1	1
2	V2	2	1	1	1	32	62	2	1	2
3	V3	3	1	1	2	13	67	1	1	3
4	V4	4	1	1	1	31	59	2	3	2
5	V5	5	1	1	2	31	59	1	2	3

Figure 2: Question 2a: top rows of the new nodes data frame

#### 3.2 Q2 b: How many communities did the algorithm detect? Report the modularity value for the communities partitioning.

The code and the output is shown below:

```
1 length(CL)
2 # output: 4
3
4 modularity(CL)
5 # output: 0.395
```

#### 3.3 Q2 c: What are the sizes of these communities? Show in the following table

The answer is in Table 1

Community	Community 1	Community 2	Community 3	Community 4
#Lawyers	27	25	18	1

Table 1: Question 2c: sizes of communities

#### 3.4 Q2 d: Show the community membership by the lawyers' status in the following table

Community	Community 1	Community 2	Community 3	Community 4
Status 1	10	12	13	1
Status 2	17	13	5	0

Table 2: Question 2d: community membership by the lawyers' status



## 4 Question 3

The tables are shown as Table 3, 4, and 5 below. Practice table shows that the communities 1, and 2 match very good with the lawyers' practice and community 3 matches perfectly with the layers' cities. Because there is only one member in community 4, we can not conclude any matching with any of the attributes. The interesting thing about the these communities is that each of communities are somehow related to one of the attributes.

Community	Community 1	Community 2	Community 3	Community 4
Status 1	10	12	13	1
Status 2	17	13	5	0

Table 3: Question 3: community membership by the lawyers' status

Community	Community 1	Community 2	Community 3	Community 4
Practice 1	27	2	11	1
Practice 2	0	23	7	0

Table 4: Question 3: community membership by the lawyers' practice

Community	Community 1	Community 2	Community 3	Community 4
City 1	27	20	0	1
City 2	0	1	18	0
City 3	0	4	0	0

Table 5: Question 3: community membership by the lawyers' city