Excercise 2

2024-03-25

```
# Load necessary libraries
library(igraph)
```

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

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

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

```
library(readxl)
library(knitr)
library(ggraph)
```

```
## Loading required package: ggplot2
```

```
library(ggplot2)
library(ggrepel)
library(kableExtra)
```

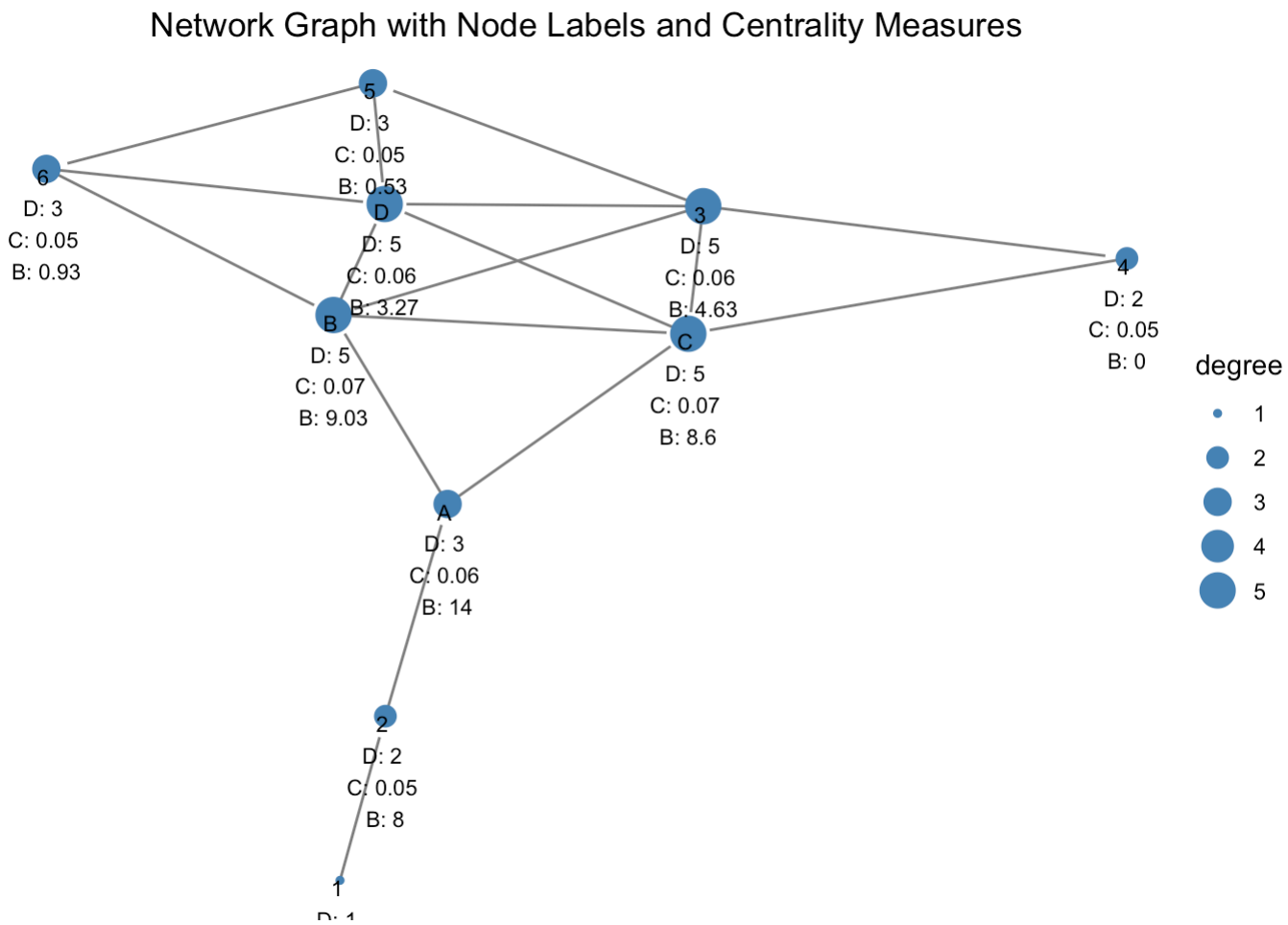
```
data <- read_excel("/Users/rohankumar/Desktop/McGill/Winter 2/Org Network Analysis/Ex
cerise 2.xlsx")
```

```
# Create the graph
g <- graph_from_data_frame(data, directed = FALSE)

# Calculate centrality measures (not normalized)
degree_centrality <- degree(g, v=c("A", "B", "C", "D"), mode="all", normalized=FALSE)
closeness_centrality <- closeness(g, vids=c("A", "B", "C", "D"), mode="all", normaliz
ed=FALSE)
betweenness_centrality <- betweenness(g, v=c("A", "B", "C", "D"), directed=FALSE, nor
malized=FALSE)

# Combine the centrality measures into a data frame
centralities_df <- data.frame(
  Seat = c("A", "B", "C", "D"),
  Degree = degree_centrality,
  Closeness = closeness_centrality,
  Betweenness = betweenness_centrality
)

# Print the table with reduced whitespace
kable(centralities_df, caption = "Centrality Measures for Empty Seats", align = 'c')
%>%
  kable_styling(full_width = FALSE, position = "left")
```

Centrality Measures for Empty Seats

	Seat	Degree	Closeness	Betweenness
A	A	3	0.0625000	14.000000
B	B	5	0.0714286	9.033333
C	C	5	0.0714286	8.600000
D	D	5	0.0625000	3.266667

```
# Ensure node names are set correctly (if they aren't already)
node_names <- union(data$`First person`, data$`Second person`)
V(g)$name <- as.character(node_names)

# Recalculate centralities with updated node names
degree_centrality_all <- degree(g, mode="all", normalized=FALSE)
closeness_centrality_all <- closeness(g, mode="all", normalized=FALSE)
betweenness_centrality_all <- betweenness(g, directed=FALSE, normalized=FALSE)

# Update centrality measures as attributes to the nodes
V(g)$degree <- degree_centrality_all
V(g)$closeness <- closeness_centrality_all
V(g)$betweenness <- betweenness_centrality_all

# Combine the name and centrality measures into a single label for each node
V(g)$label <- paste(V(g)$name, "\nD:", round(V(g)$degree, 2),
                    "\nC:", round(V(g)$closeness, 2),
                    "\nB:", round(V(g)$betweenness, 2))

# Define the layout
layout <- create_layout(g, layout = 'fr')

# Plot the network without arrows using ggraph
ggraph(layout) +
  geom_edge_link(color = "gray50", end_cap = circle(3, 'mm')) +  # Remove the arrow a
rgument
  geom_node_point(aes(size = degree), color = "steelblue") +
  geom_node_text(
    aes(label = label),
    vjust = 1,
    hjust = 0.5,
    check_overlap = TRUE,
    size = 3
  ) +
  theme_void() +
  labs(title = "Network Graph with Node Labels and Centrality Measures") +
  theme(plot.title = element_text(hjust = 0.5)) # Center the title
```



Seat A: Has the lowest degree centrality but the highest betweenness centrality. This seat may not have the most connections, but it has a strategic position in terms of control over the network's flow. Seats B and C: Both have the highest degree and closeness centrality, suggesting they are well-connected and close to all other nodes. Seat B has slightly more betweenness centrality than Seat C. Seat D: Has a high degree centrality but the lowest betweenness centrality, indicating it has fewer control points in the network flow

By considering the numbers Seat B is the optimal seat because it has the highest degree, closeness and betweeness centrality.