Exercise_2

2023-03-21

1. Create a dataset where edges are based on seat adjacency

```
# Load the igraph package
library(igraph)
```

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

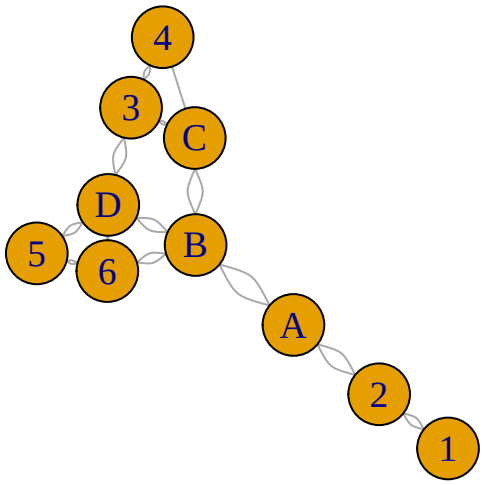
```
##
## Attaching package: 'igraph'
```

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

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

```
# Create the nodes
seat_nodes <- c(1:6, LETTERS[1:4])

# Create an empty graph with the seat nodes
seat_adjacency_graph <- graph.empty(n = length(seat_nodes), directed = FALSE)
V(seat_adjacency_graph)$name <- seat_nodes

# Create the adjacency list
adj_list <- list(
  "1" = c("2"),
  "2" = c("1", "A"),
  "3" = c("4", "D", "C"),
  "4" = c("3", "C"),
  "5" = c("D", "6"),
  "6" = c("5", "D", "B"),
  "A" = c("B", "2"),
  "B" = c("6", "D", "C", "A"),
  "C" = c("3", "B"),
  "D" = c("3", "5", "6", "B")
)

# Add edges based on adjacency rules
for (seat in names(adj_list)) {
```

```
  for (neighbor in adj_list[[seat]]) {
    seat_adjacency_graph <- add.edges(seat_adjacency_graph, c(seat, neighbor))
  }
}

# Plot the seat adjacency graph
plot(seat_adjacency_graph, vertex.size = 30, vertex.label.cex = 1.2)
```



2. Calculate Degree centrality, Closeness centrality, Betweenness centrality

Calculate degree centrality, closeness centrality, betweenness centrality for each seat choice (A-D), assuming the other open seats are filled.

```
# Define the seat choices
seat_choices <- LETTERS[1:4]

# Calculate centralities for the seat choices
degree_centralities <- degree(seat_adjacency_graph, v = seat_choices)
closeness_centralities <- closeness(seat_adjacency_graph, v = seat_choices)
betweenness_centralities <- betweenness(seat_adjacency_graph, v = seat_choices)

# Combine the centralities into a data frame
centralities <- data.frame(
  Seat = seat_choices,
```

```
  Degree = degree_centralities / 2,  # divide degree centralities by 2
  Closeness = closeness_centralities,
  Betweenness = betweenness_centralities
)

# Print the centralities data frame
print(centralities)
```

```
##   Seat Degree  Closeness Betweenness
## A    A    2.0 0.05263158   14.000000
## B    B    4.0 0.06666667   20.500000
## C    C    2.5 0.05263158    6.333333
## D    D    4.0 0.05882353    8.333333
```

Note: Degree centrality measures the number of connections a node has in a graph, counting both incoming and outgoing connections. In an undirected graph like the "Fakebook bus", each seat has connections to its adjacent seats, which results in degree centrality values that are twice the actual number of adjacent seats. To correct for this, we divide the degree centrality values by 2.

3. Discuss possible consequences of your choice of a seat.

When would this choice be beneficial? When would it be not so beneficial?

Conversations on the "Fakebook bus" can lead to unexpected opportunities for career advancement, new projects, and possibilities. For example, striking up a conversation with a colleague sitting next to you could lead to the discovery of shared interests or professional goals, which could spark collaborations or new projects. Additionally, having conversations with colleagues from other departments or more senior colleagues with more power in an organization can allow for the opportunity to pitch your ideas or get valuable feedback.

By taking advantage of the social opportunities provided by the "Fakebook bus," passengers may be able to expand their professional networks, gain new insights into their work, and advance their careers in unexpected ways.

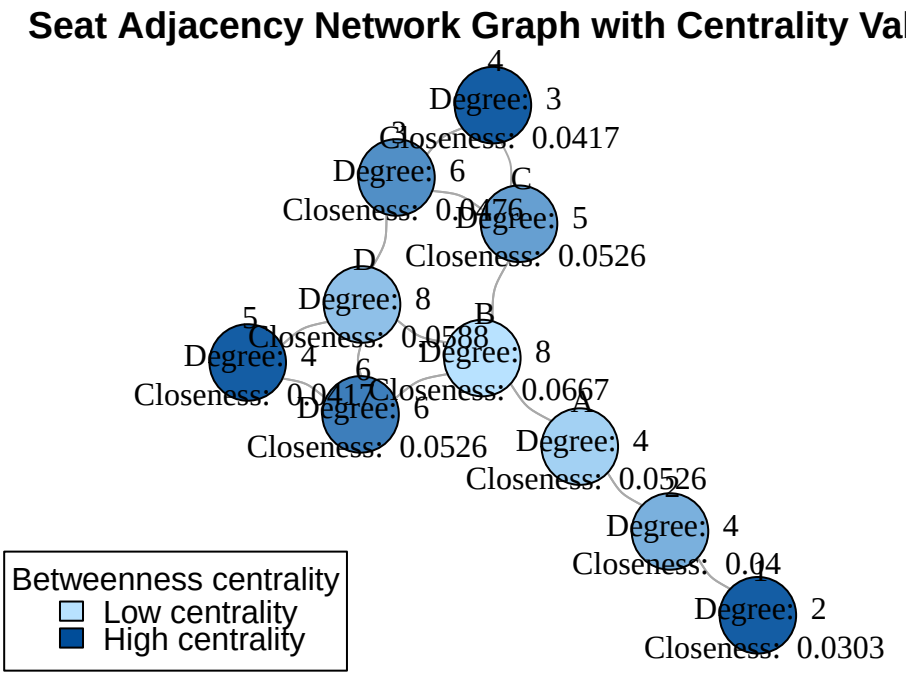
While the choice of seating on the "Fakebook bus" can have numerous benefits, there are also potential downsides to consider. One possible scenario is that someone might end up sitting next to a person who is unfriendly, unpleasant, or even hostile. In such cases, attempting to engage in conversation may be met with resistance or even hostility, which could lead to a negative experience for both parties.

Another possible downside is that a person might end up sitting next to someone who is uninterested in the conversation. While this may not necessarily be a negative experience, it may mean that the potential benefits of socializing on the bus are not fully realized. Furthermore, seating choices may not always be available, and a person may end up sitting in a less-than-ideal location due to circumstances beyond their control.

Overall, while the choice of seating on the "Fakebook bus" can have positive social and professional consequences, it's important to be aware that not all interactions will be positive and that circumstances may not always allow for the optimal seating choice.

4. Plot the network graph with labels and centrality values

```r
# Generate a color palette with 10 colors
color_palette <- colorRampPalette(c("#B8E2FF", "#004D99"))(10)


# Add centrality values to the graph vertices
V(seat_adjacency_graph)$degree <- degree(seat_adjacency_graph)
V(seat_adjacency_graph)$closeness <- closeness(seat_adjacency_graph)
V(seat_adjacency_graph)$betweenness <- betweenness(seat_adjacency_graph)

# Customize vertex labels with centrality values
vertex_labels <- paste(V(seat_adjacency_graph)$name,
                       "\nDegree: ", V(seat_adjacency_graph)$degree,
                       "\nCloseness: ", round(V(seat_adjacency_graph)$closeness, 4))

# Normalize betweenness centrality values
scaled_betweenness <- scale(V(seat_adjacency_graph)$betweenness)

# Assign colors based on normalized betweenness centrality
V(seat_adjacency_graph)$color <- color_palette[rank(-scaled_betweenness)][V(seat_adjacency_graph)]

# Set plot margins
par(mar = c(5, 5, 1, 1))

# Plot graph
plot(seat_adjacency_graph, vertex.size = 30, vertex.label = vertex_labels,
     vertex.label.cex = 1, vertex.label.color = "black", vertex.label.dist = 0.5,
     edge.arrow.size = 0.2, edge.curved = 0.3, layout = layout_with_kk,
     main = "Seat Adjacency Network Graph with Centrality Values")

# Add color legend
legend("bottomleft", legend = c("Low centrality", "High centrality"),
       fill = c(color_palette[1], color_palette[10]), title = "Betweenness centrality",
       x.intersp = 0.7, y.intersp = 0.7, inset = 0.01)
```


Seat Adjacency Network Graph with Centrality Values
4
Degree: 3
Closeness: 0.0417
3
Degree: 6
Closeness: 0.0476
C
Degree: 5
Closeness: 0.0526
D
Degree: 8
Closeness: 0.0588
B
Degree: 8
Closeness: 0.0667
5
Degree: 4
Closeness: 0.0417
6
Degree: 6
Closeness: 0.0526
A
Degree: 4
Closeness: 0.0526
2
Degree: 4
Closeness: 0.04
1
Degree: 2
Closeness: 0.0303
Betweenness centrality
Low centrality
High centrality