Exercise_2

2023-03-21

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

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

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

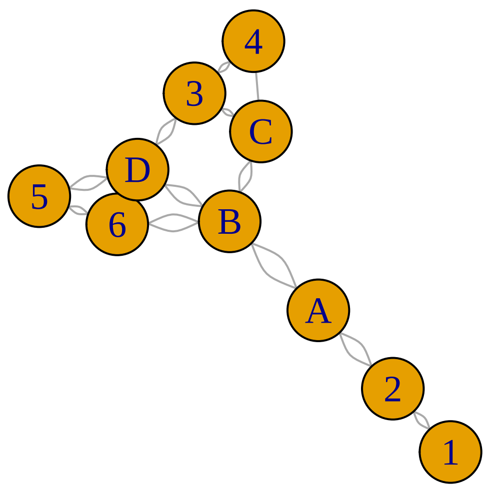
```
##
## Attaching package: 'igraph'
```

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

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

```r
# 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)) {
```

```r
  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.

```r
# 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,
```

```r
  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.

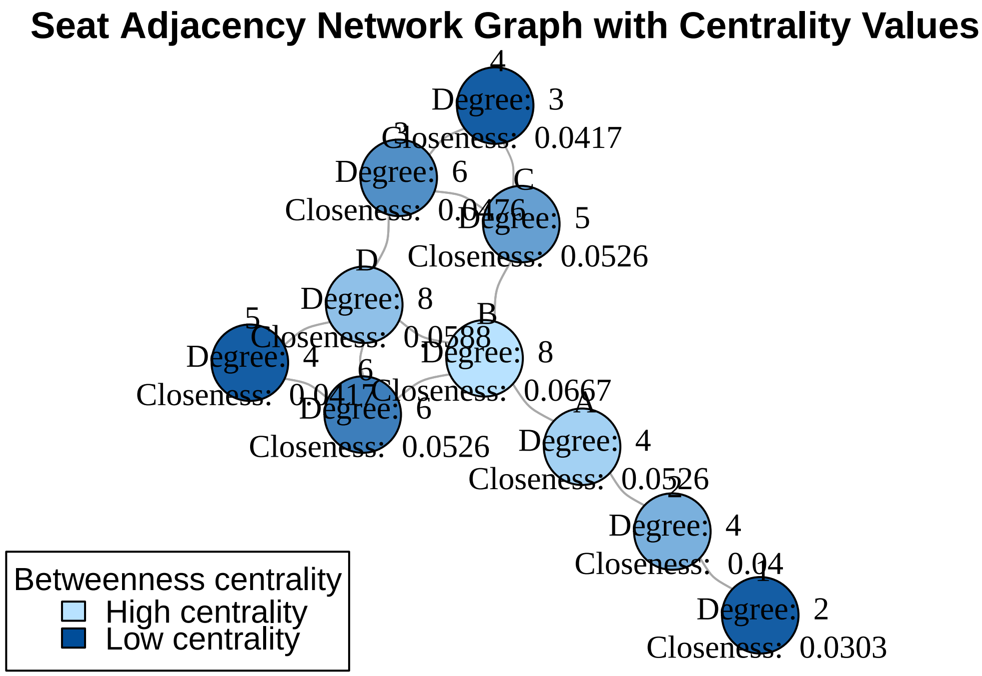
While the choice of seating on the "Fakebook bus" can have numerous benefits, there are also potential downsides to consider. One possible scenario is that someone might end up sitting next to a person who is unfriendly, unpleasant, or even hostile. In such cases, attempting to engage in conversation 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("High centrality", "Low centrality"),
       fill = c(color_palette[1], color_palette[10]), title = "Betweenness centrality",
       x.intersp = 0.7, y.intersp = 0.7, inset = 0.01)
```



Conclusion and Insights

This exercise involves a practical application of network analysis to determine the most socially beneficial seat on a bus based on adjacency rules. The analysis shows that the most central seat in the graph, which has the highest degree, closeness, and betweenness centralities, is seat B. This means that individuals sitting in seat B are likely to have the greatest social benefit in terms of communicating with adjacent seats.

Degree centrality is a measure of the number of edges that are connected to a node, and in this case, seat B has the highest degree centrality, indicating that it has the most connections with other seats in the graph. This means that individuals sitting in seat B can easily communicate with other passengers in the adjacent seats, thereby increasing their social benefit.

Closeness centrality is a measure of how close a node is to other nodes in the graph. In this case, seat B has a relatively high closeness centrality, meaning that it is well connected to other seats in the graph. Therefore, individuals sitting in seat B are likely to be in close proximity to other passengers and can communicate with them more efficiently.

Finally, betweenness centrality measures the number of shortest paths that pass through a node. Seat B has the highest betweenness centrality in the graph, indicating that it is a hub for communication between other seats. Therefore, individuals sitting in seat B can serve as a bridge between other passengers, increasing their social benefit.

In conclusion, the insights derived from this exercise show that seat B is the most socially beneficial seat on the bus based on the adjacency rules. This is because seat B has the highest degree, closeness, and betweenness centralities. Therefore, sitting in seat B increases the likelihood of having meaningful social interactions with adjacent passengers, leading to a greater sense of social connectedness and possibly enhancing the overall travel experience. This exercise also highlights the practical applications of network analysis and can be applied to other situations where social networks are involved. For example, in a workplace, identifying the most central employees can help improve collaboration and communication within the organization. Similarly, in a social setting, identifying central individuals can help individuals build stronger connections and enhance their social capital.