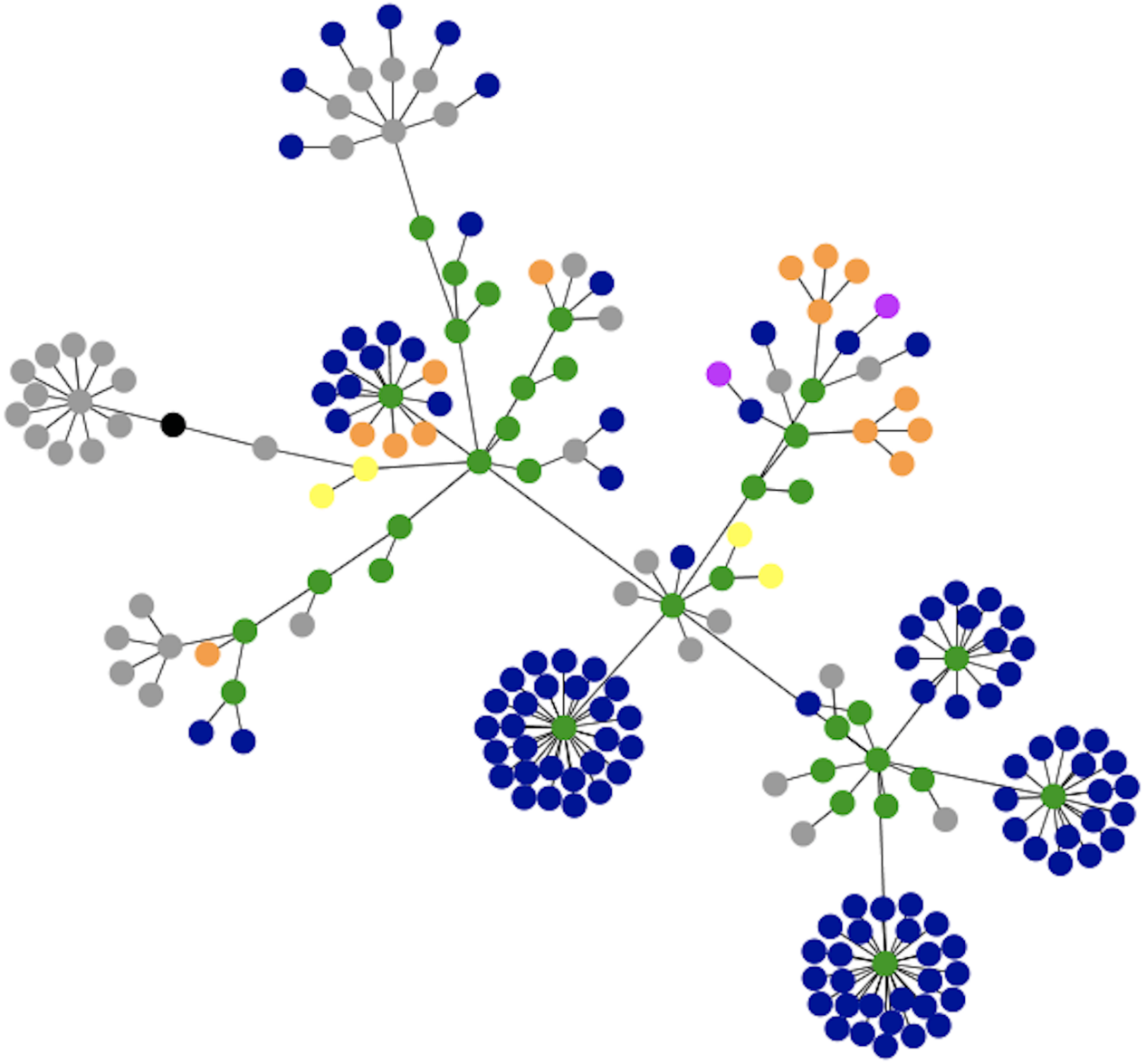
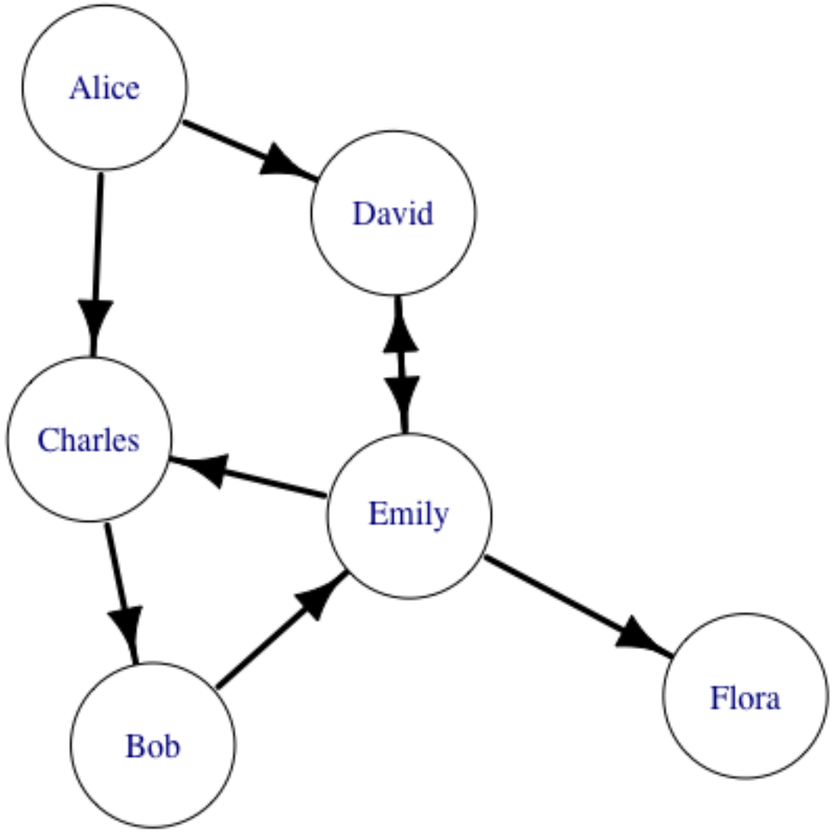
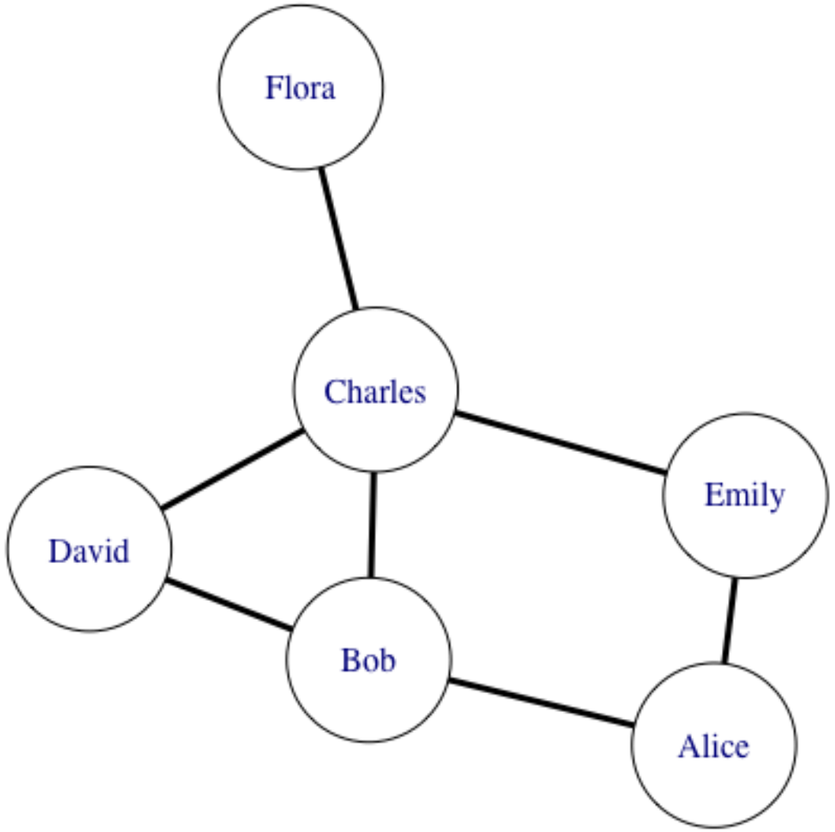
NETWORK ANALYSIS IN THE TIDYVERSE

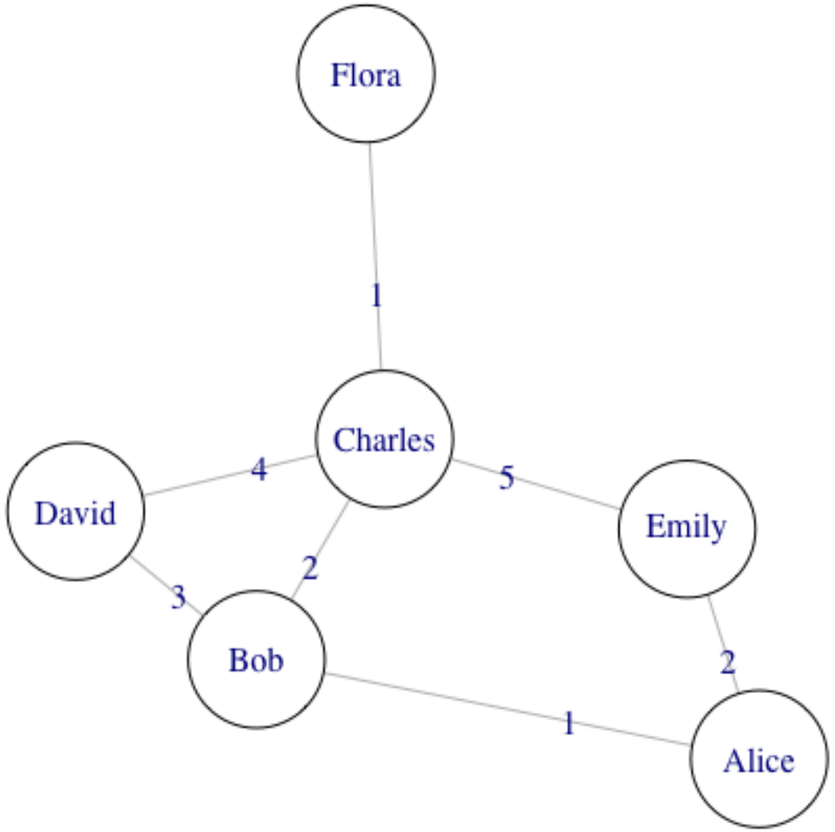
# Network analysis in R: A tidy approach

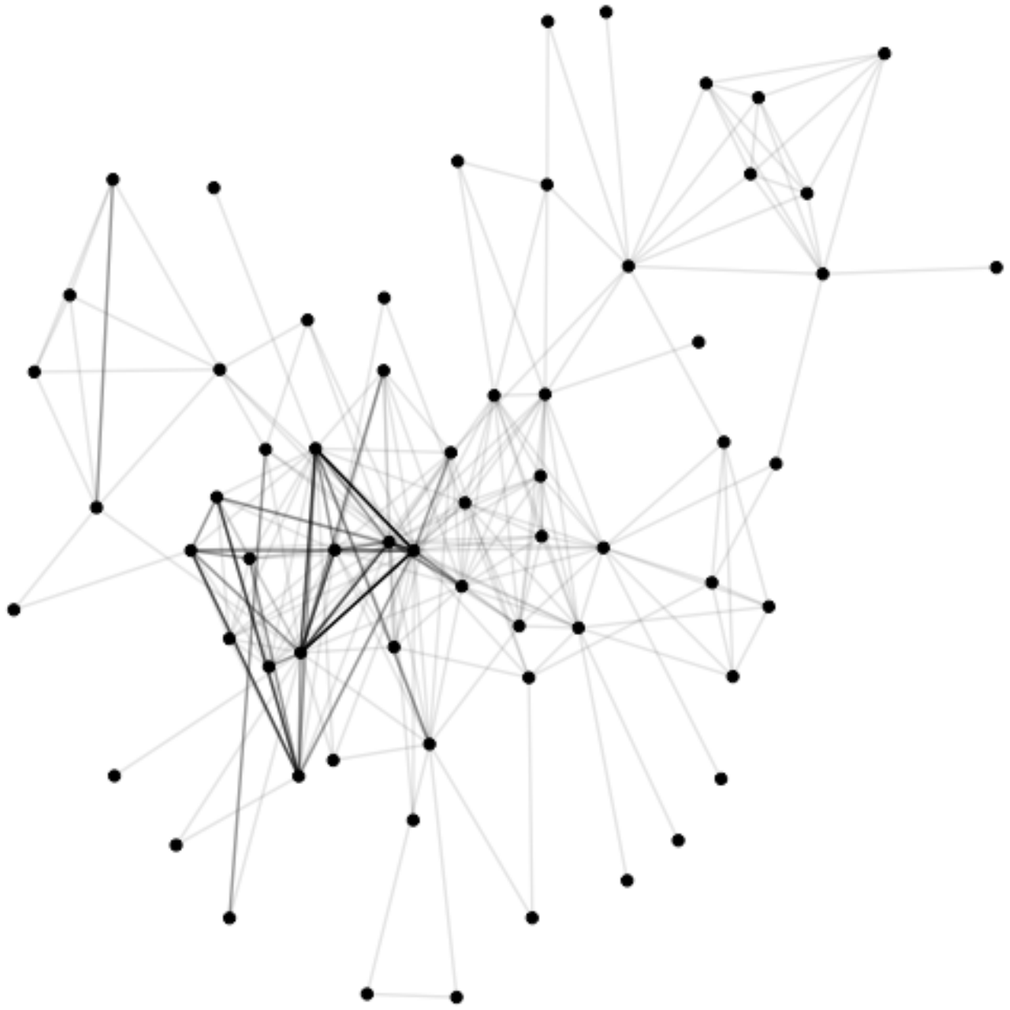
Massimo Franceschet
Prof. of Data Science, University of Udine (Italy)




Alice
David
Charles
Emily
Bob
Flora


Flora
Charles
Emily
David
Bob
Alice


Flora
1
Charles
4
5
David
Emily
2
3
2
Bob
1
Alice



# Building the network

```
# load packages for network exploration
library(readr)
library(igraph)
```

```
# read nodes and ties data into variables
nodes <- read_csv("nodes.csv")
ties <- read_csv("ties.csv")
```

```
# build a network from data frames
g <- graph_from_data_frame(d = ties,
                           directed = FALSE,
                           vertices = nodes)
```

# Exploring the network

```
# explore the set of nodes and print the number of nodes
V(g)
vcount(g)

# explore the set of ties and print the number of ties
E(g)
ecount(g)
```

```
# add the name attribute "Madrid network" to the network and print it
g$name <- "Madrid network"
g$name

# add node attribute id and print the node `id` attribute
V(g)$id <- 1:vcount(g)

# print the tie `weight` attribute
E(g)$weight
```

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# Let's start the investigation!

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# Visualizing networks

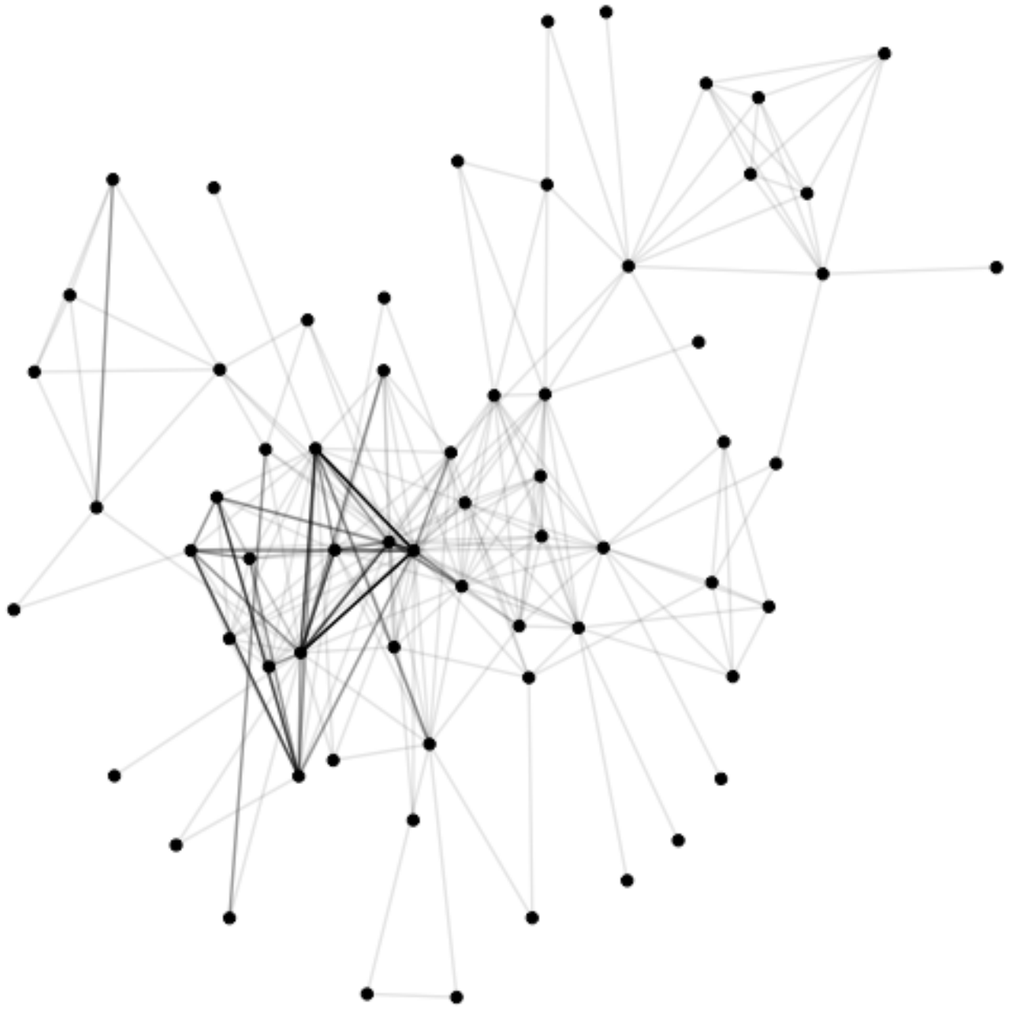
# ggraph()

```
# load packages for data manipulation and visualization
library{igraph)

library(dplyr)
library(ggplot2)

library(ggraph)
```

```
# visualize the network
ggraph(g, layout = "with_kk") +
    geom_edge_link(aes(alpha = weight)) +
    geom_node_point()
```



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# Let's practice!

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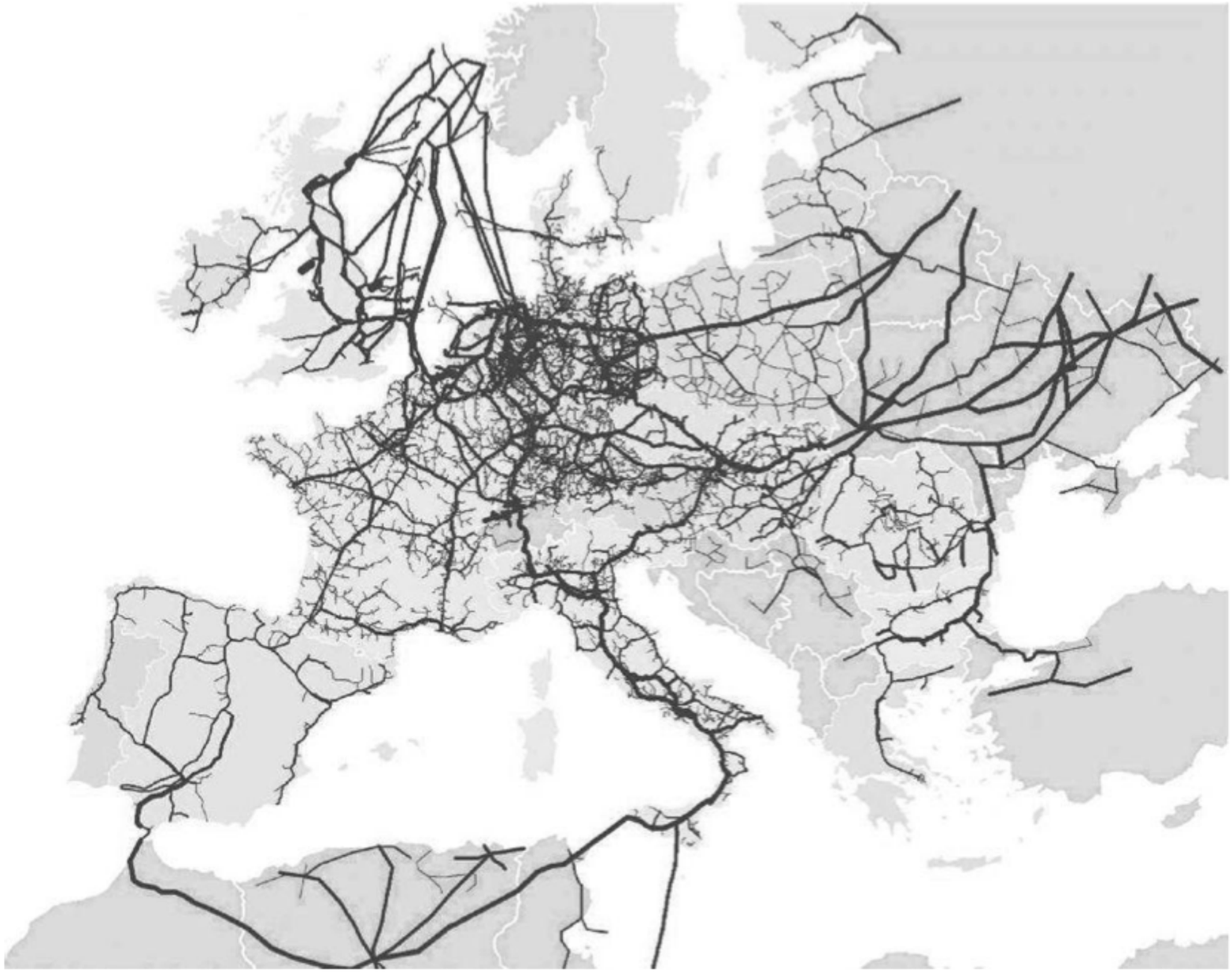
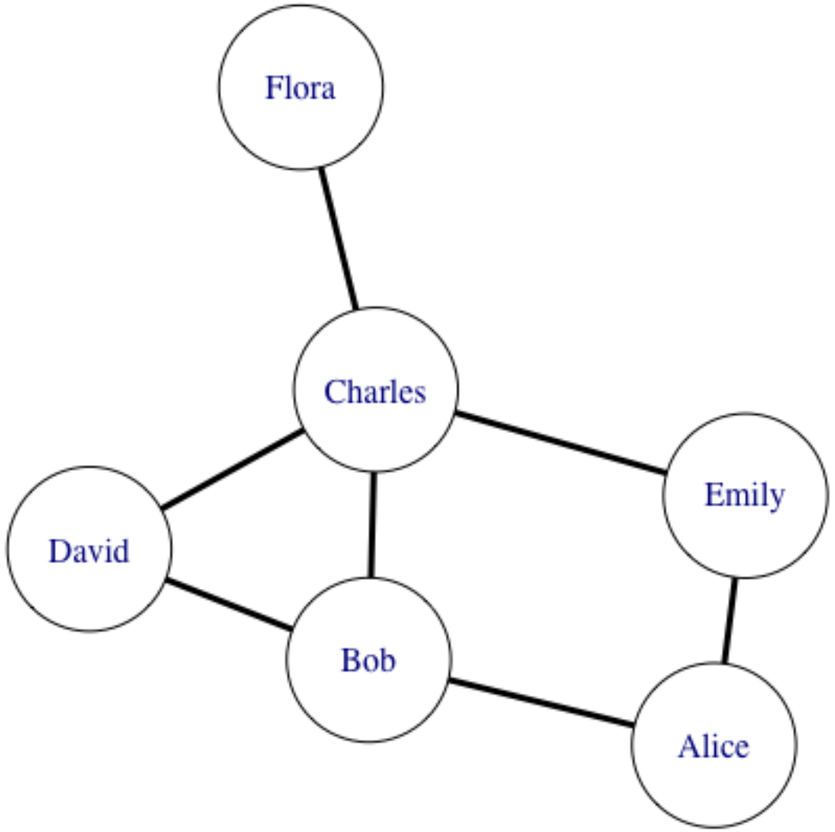
# Centrality measures



# Node centrality

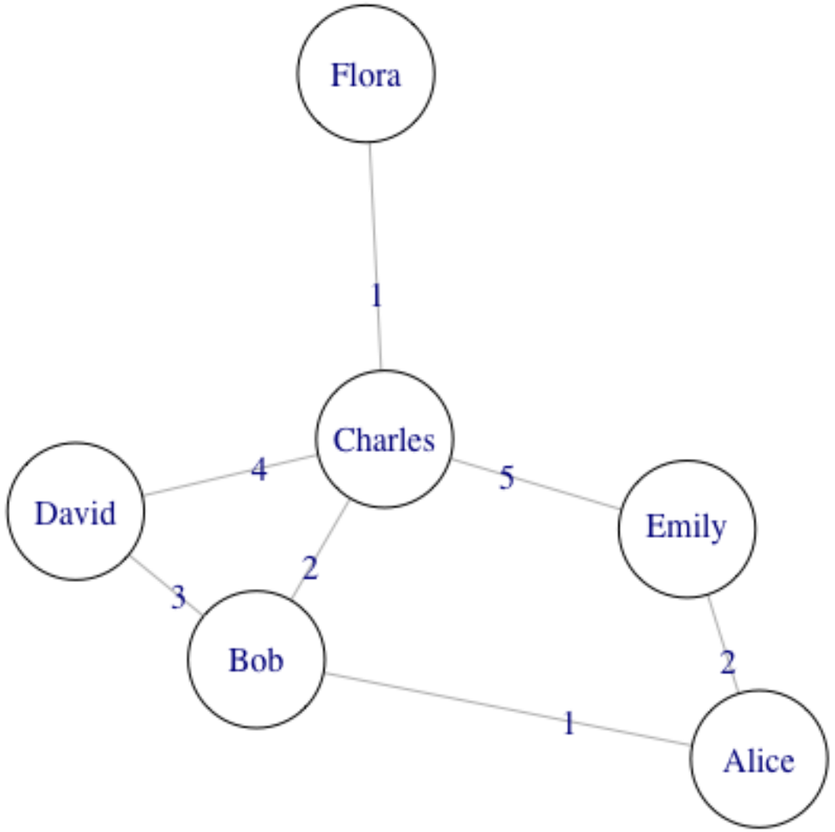
- Which are the most important nodes in a network?
  - Important web pages about a certain topic
  - Influential academic papers covering a given issue
  - Internet routers whose failure would greatly affect network connectivity


Flora
Charles
Emily
David
Bob
Alice

# Computing degree

```
# compute node degrees
degree(g)
```

```
          Jamal Zougam       Mohamed Bekkali        Mohamed Chaoui
                    29                     2                    27
           Vinay Kholy         Suresh Kumar       Mohamed Chedadi
                    10                    10                     7
   Imad Eddin Barakat    Abdelaziz Benyaich       Abu Abderrahame
                    22                     6                     4
        Omar Dhegayes           Amer Azizi   Abu Musad Alsakaoui
                     2                    18                    10
         Mohamed Atta      Ramzi Binalshibh      Mohamed Belfatmi
                    10                    10                    11
          Said Bahaji         Galeb Kalaje      Abderrahim Zbakh
                    11                    16                    15
```


Flora
1
Charles
4
5
David
Emily
2
3
2
Bob
1
Alice

# Computing strength

```
# compute node strengths
strength(g)
```

```
          Jamal Zougam         Mohamed Bekkali          Mohamed Chaoui
                    43                       2                      34
           Vinay Kholy          Suresh Kumar         Mohamed Chedadi
                    10                      10                       7
    Imad Eddin Barakat    Abdelaziz Benyaich         Abu Abderrahame
                    35                       7                       4
         Omar Dhegayes           Amer Azizi    Abu Musad Alsakaoui
                     3                      27                      10
          Mohamed Atta       Ramzi Binalshibh       Mohamed Belfatmi
                    12                      14                      19
           Said Bahaji          Galeb Kalaje       Abderrahim Zbakh
                    17                      21                      15
```

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# Let's find the most central terrorists in the network!