# 1. Introduction to Network Analysis

Introduction to Social Network Analysis in R

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1. Introduction to Network Analysis

2. Basics of Networks

Basic Network Elements

WA: Work Along! And Your Turn Activity!

# Introduction to Social Network Analysis(SNA) in R

1. Introduction to basic concepts in SNA
2. Visualization of networks.
3. Metrics - Individual nodes.
4. Metrics - Whole network.
5. Project.

# 1. Introduction to Network Analysis

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# Network Analysis

- Map and understand complex structures & systems
- Relational methods
- Connections, structures & positions

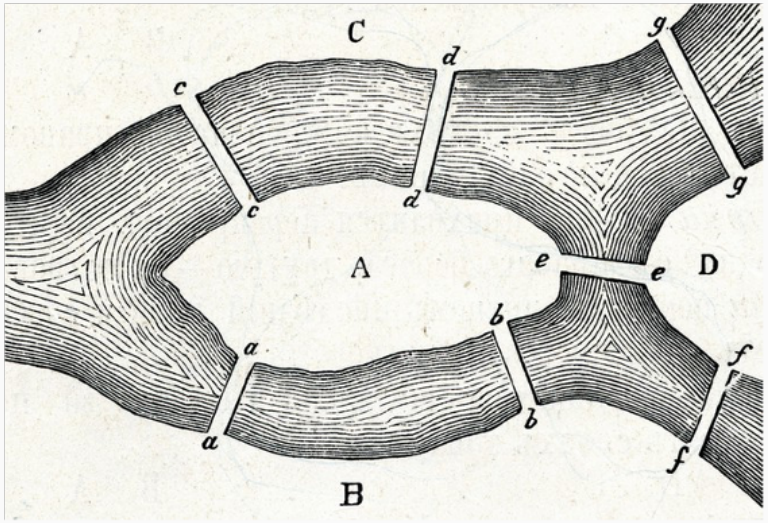
Data with ***Entities*** and their ***relations***

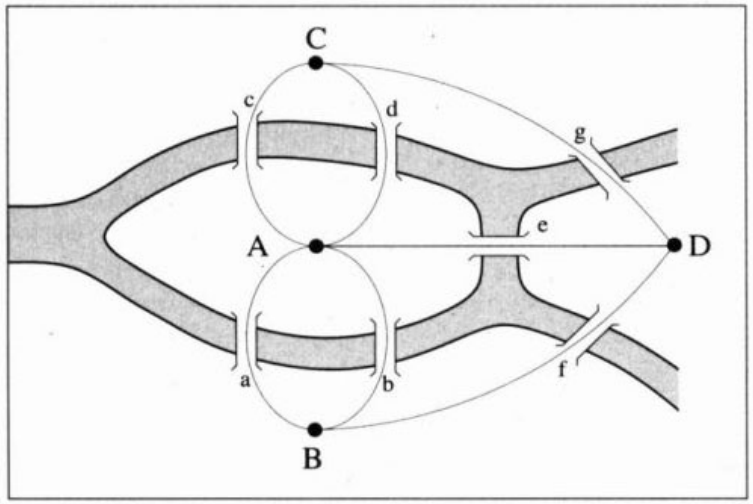
# Origins

- Network Analysis rooted in graph theory in 1735
  - Euler
  - Bridges of Königsberg problem
- Social Network Analysis rooted in Social Dynamic Analysis
  - Jacob L. Moreno, a psychiatrist (1889 - 1974)
  - dynamics of social interactions within groups of people
- Modern-day Network Science rooted in the beginnings of the Internet
  - Facebook

# Network science has a long history (almost 300 years! (1735))

Beginnings in Graph Theory begins with solution to the "Bridges of Königsberg" question in 1735.




**Question**: Can one walk across all seven bridges and never cross the same one twice?

Euler diagram: land areas by letters(vertices), bridges between land represented as edges.

**Simple observation:** if there is a path crossing all bridges, but never the same bridge twice, then nodes with odd number of links must be either the starting or the end point of this path

# The birth of social network analysis

Moreno in 1930's, in his 1934 book "Who Shall Survive", describes the First Social Network depicting friendship patterns between the boys (triangles) and girls (circles) in a class of schoolchildren in the 1930s.

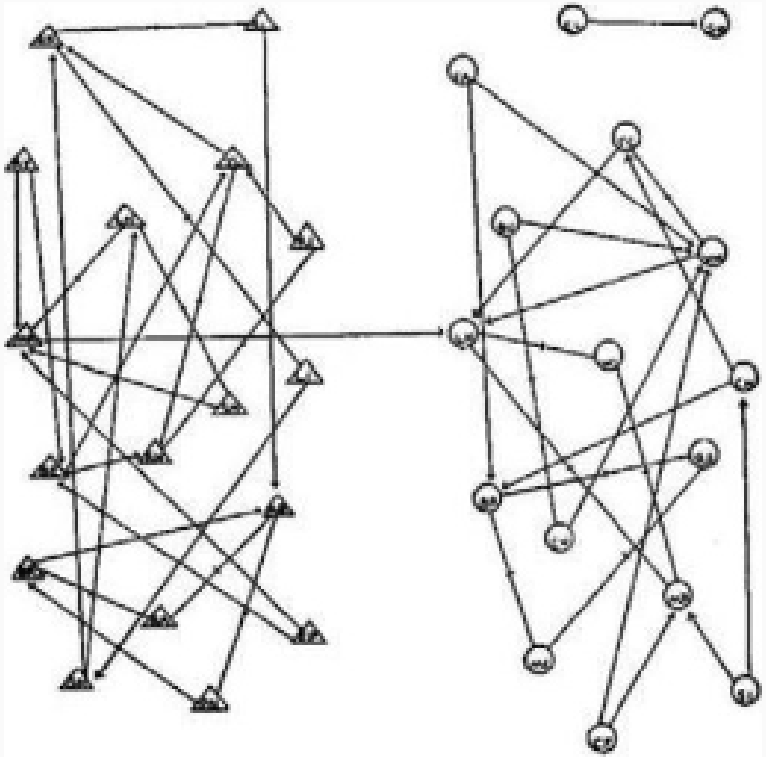


Diagram was hand-drawn and is called a Sociogram - a new model for human interactions

# In Contrast: Modern Social Networks

# Modern Social Networks

- Many possible definitions of an edge!
  - friends (sociology)
  - professional relationships (mobility, influence)
  - romantic relationships (psychology, sociology)
  - exchange of goods or money (economics)
  - communication (internet, neuroscience)
  - virus and diseases (biology, health)
- Applications
  - Power grid networks
  - Transportation (air, subway, road systems)
  - Migration networks
  - Textual networks
  - Citation networks
  - Recommendation networks
- can be used to understand a wide array social and economic dynamics

# To summarise

- Network science has a long history (1735!)
- Inherently interdisciplinary! (biology, physics, mathematics, sociology, statistics, economics, psychology. . . )
- Modern Network Analysis provides a framework to extract information from a relational system.
- Tools borrow from
  - Graph Theory for mathematical framework
  - Computer Science for software algorithms for large networks
  - Statistics for framework for modeling
  - Computational Statistics for analysis, prediction, inference

# 2. Basics of Networks

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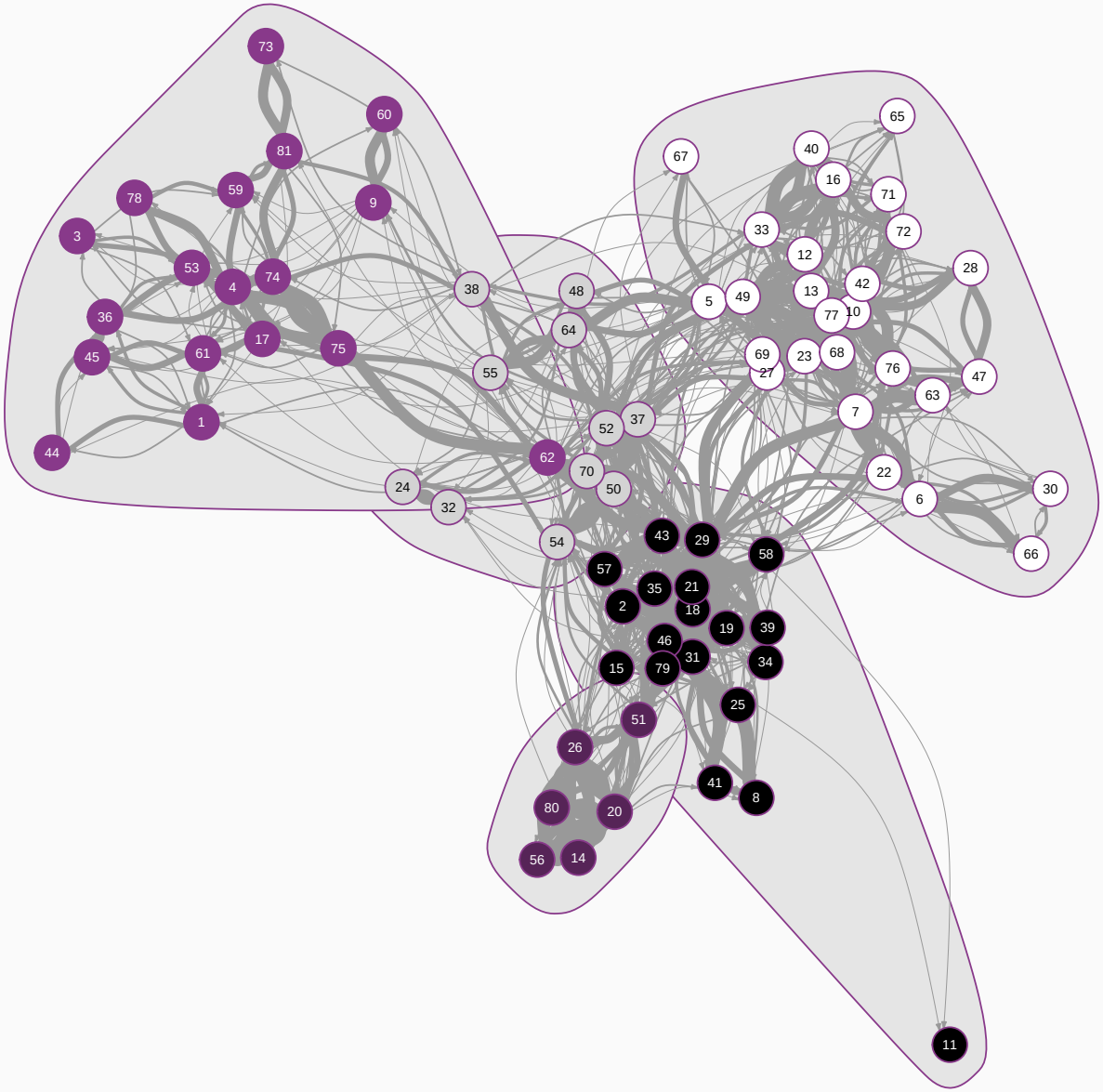
# UKFaculty network




The personal friendship network of a faculty from four UK universities.

# Basic Network Elements

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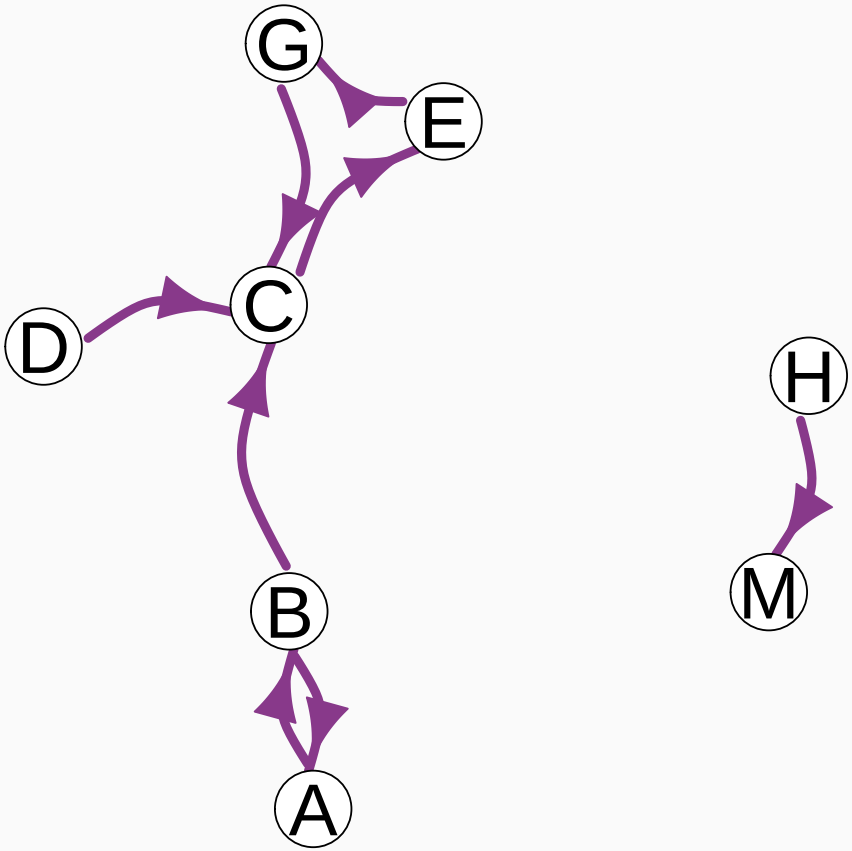
- Vertices (nodes, actors)
- Edges (links, ties)

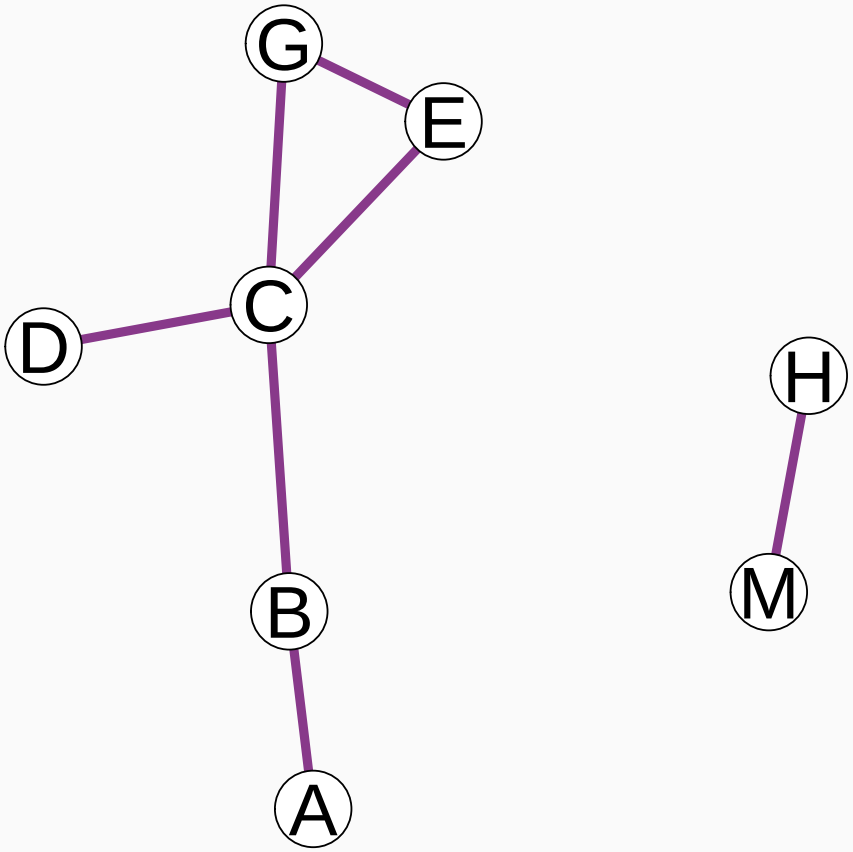
# Basic Network Elements: Direction

- Directed



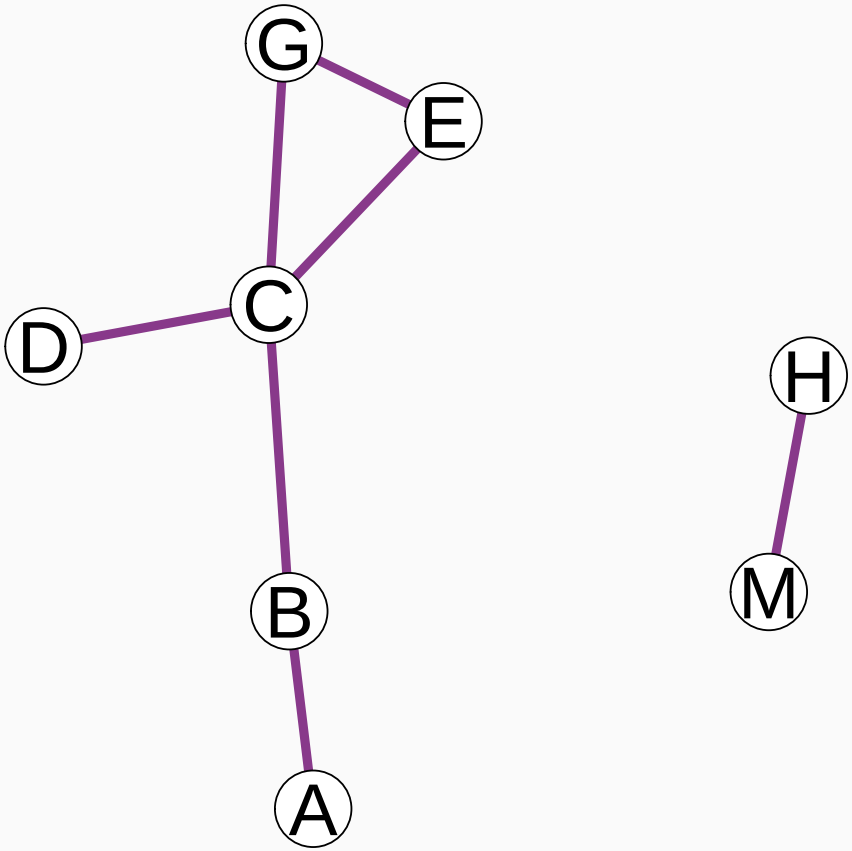
# Basic Network Elements: Direction

- Undirected



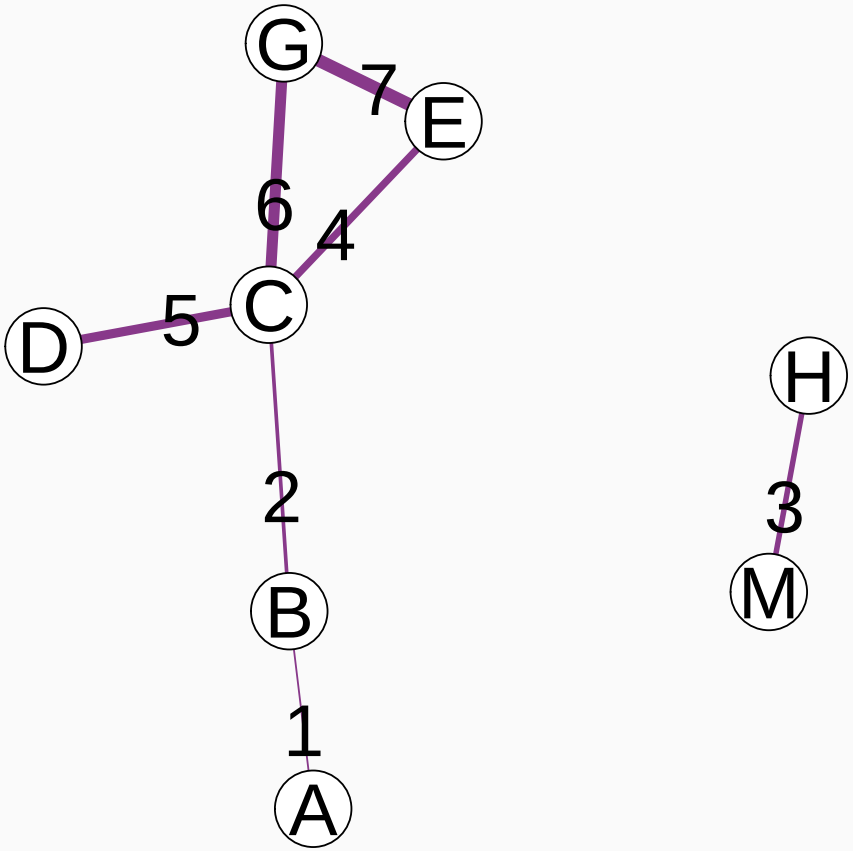
# Basic Network Elements: Weights

- Unweighted



# Basic Network Elements: Weights

- Weighted



# WA: Work Along! And Your Turn Activity!

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Let's explore our network!

**Before we start**

Make sure you have installed the following packages:

```
# for network analysis
install.packages("igraph")

# for accessing the data
install.packages("igraphdata")
```

# Work Along to explore the UKFaculty dataset

`WA_IntroSNA.Rmd`

# Summary:

Today we looked at

1. Introduction and Origins of Network Analysis
2. Basic Elements of Networks
3. Explored the basic elements in `UKFaculty` and `karate` networks availabe in `igraphdata` package

# Next session:

3. Visualization of networks
4. Metrics - Individual nodes