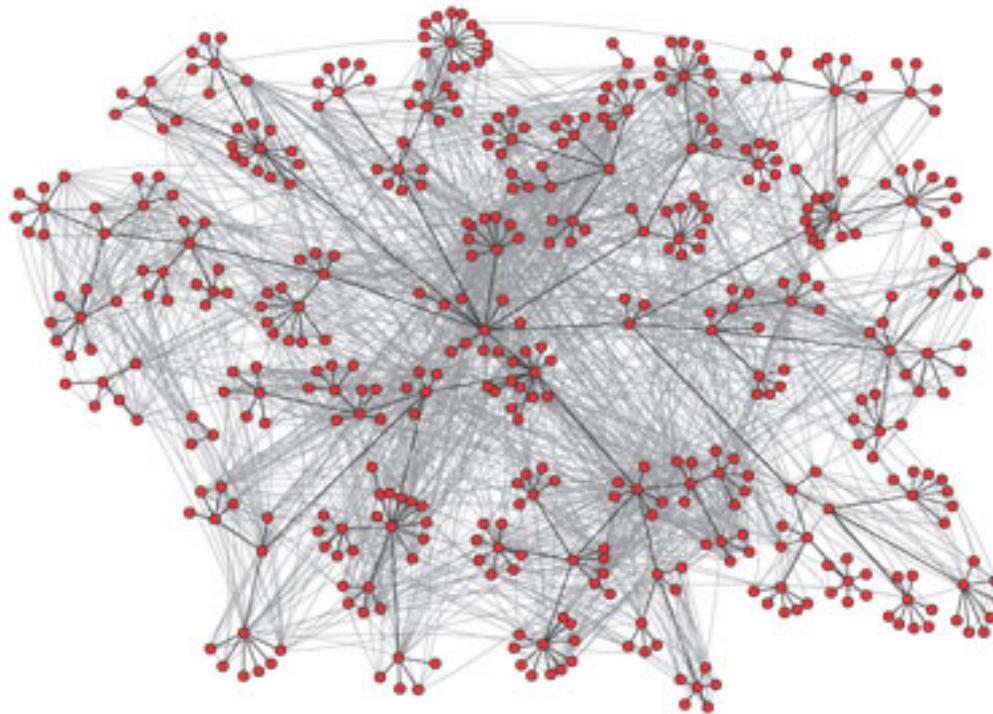


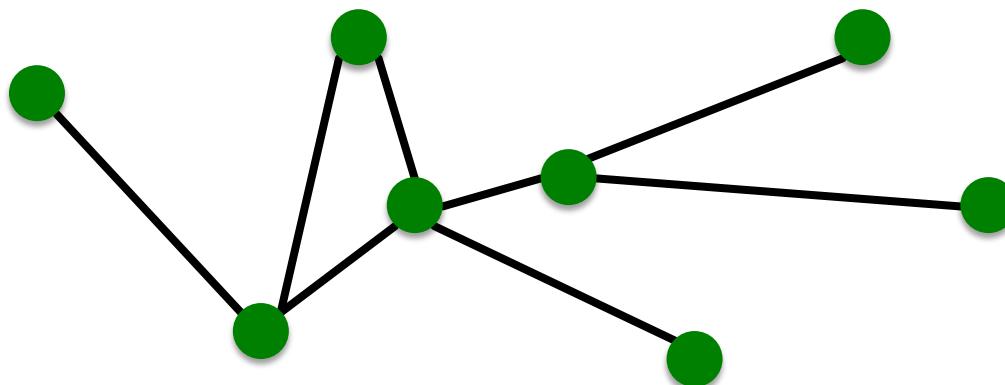
# **Starter Topic: Structure of Graphs**

# Structure of Networks?



A network is a collection of objects where some pairs of objects are connected by links  
**What is the structure of the network?**

# Components of a Network



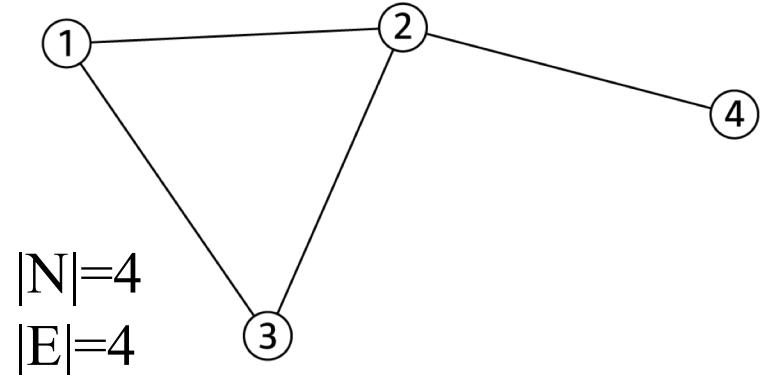
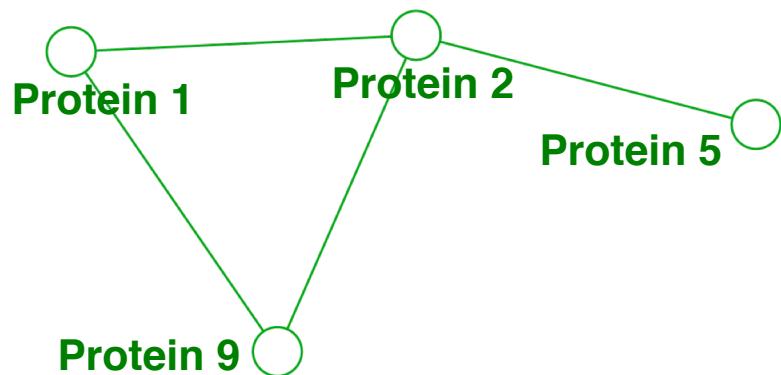
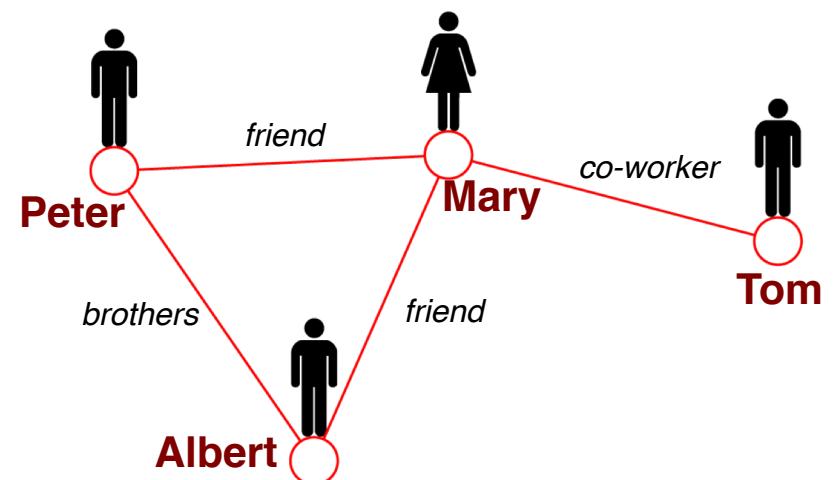
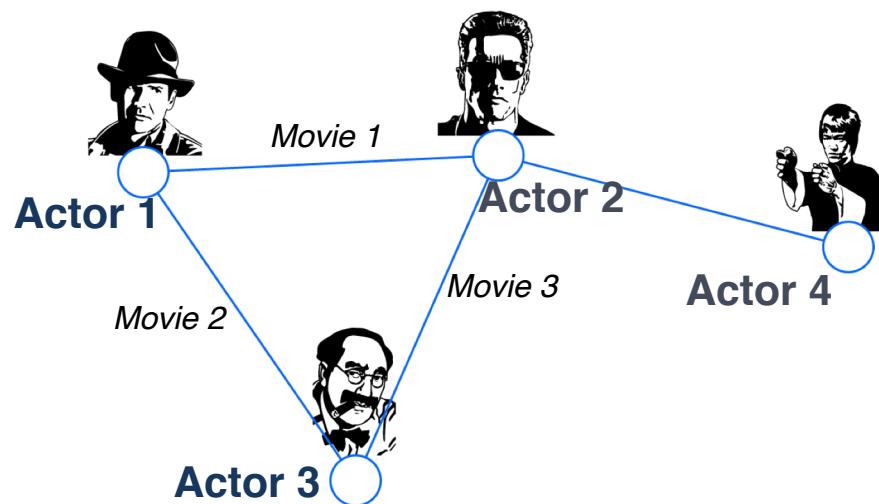
- **Objects:** nodes, vertices  $N$
- **Interactions:** links, edges  $E$
- **System:** network, graph  $G(N,E)$

# Networks or Graphs?

- **Network** often refers to real systems
  - Web, Social network, Metabolic network
- **Language:** Network, node, link
- **Graph** is a mathematical representation of a network
  - Web graph, Social graph (a Facebook term)
- **Language:** Graph, vertex, edge

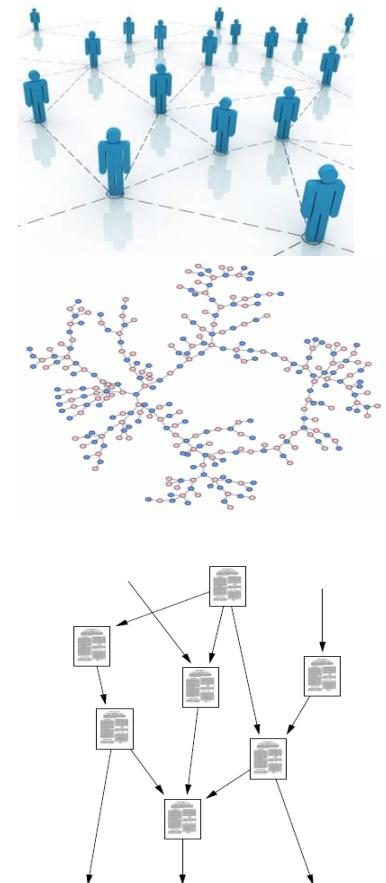
We will try to make this distinction whenever it is appropriate, but in most cases we will use the two terms interchangeably

# Networks: Common Language



# Choosing Proper Representations

- If you connect individuals that work with each other, you will explore a **professional network**
- If you connect those that have a sexual relationship, you will be exploring **sexual networks**
- If you connect scientific papers that cite each other, you will be studying the **citation network**
- **If you connect all papers with the same word in the title, what will you be exploring?** It is a network, nevertheless



# How do you define a network?

- How to build a graph:
  - What are nodes?
  - What are edges?
- Choice of the proper network representation of a given domain/problem determines our ability to use networks successfully:
  - In some cases there is a unique, unambiguous representation
  - In other cases, the representation is by no means unique
  - The way you assign links will determine the nature of the question you can study