# Tutorial on igraph

CS552: Network Science

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# About igraph
## Introduction

- Network analysis library, written mostly in C/C++.
- Interface to R and Python
- https://github.com/igraph
- http://igraph.org
- Open GitHub issues for bugs

# What can be represented with networks?

- Anything with nodes and edges
- Interactions on social networking applications (Facebook, Twitter, Instagram, etc.)
- Biology and ecology (ecosystems)
- Transportation: roads, railroad tracks, available flights
- Finance: stock markets, donors for campaigns, etc.
- The internet, as links and webpages.

# Terminologies

- Node/Vertex
- Edge
- Subgraph
- Degree
- Walk
- Path
- Shortest Path

# Creating a Graph

- adding/deleting Nodes
- adding/deleting edges
- summary of its nodes and edges

## Generating graphs

- igraph includes both deterministic and stochastic graph generators
- **Deterministic generators** produce the same graph every time you call the fuction
- **Stochastic generators** produce a different graph each time

# Overview

- Vertex and edges can have attributes such as a name, coordinates for plotting, metadata, and weights
- `Graph.vs` and `Graph.es` are the standard way to obtain a sequence of all vertices and edges, respectively

# Structural properties of graphs

- indegree
- outdegree
- edge betweeness
- Pagerank

# Querying vertices and edges based on attributes

- Selecting vertices and edges.
- Finding a single vertex or edge with some properties.
- Looking up vertices by names.
- Get an adjacency matrix for a graph

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# Graph generation

- From nodes and edges
- From matrices
- API calls
- From files
- From external libraries
- From pandas DataFrame
- From a formula

# Graph analysis

- Vertices and edges
- Incidence
- Neighborhood
- Degrees
- Graph operators
- Topological sorting
- Pathfinding and cuts
- Graph properties
- Clustering
- Centrality measures

Thank You for Your Attention!